EFFECTIVENESS OF BRAIN COMPATIBLE LEARNING STRATEGY ON PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND MATHEMATICS ANXIETY AMONG STUDENTS IN SECONDARY SCHOOLS OF COASTAL AREA

Thesis
Submitted for the degree of

DOCTOR OF PHILOSOPHY IN EDUCATION

By

LISHEETHA. P.V.

Prof. (Dr.) P. K. Aruna (Rtd.)
Research Supervisor

Dr. Vasumathi T.
Research Co-guide

DEPARTMENT OF EDUCATION
UNIVERSITY OF CALICUT

2024

DECLARATION

I hereby declare that the work presented in the thesis entitled "**EFFECTIVENESS OF BRAIN COMPATIBLE LEARNING STRATEGY ON PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND MATHEMATICS ANXIETY AMONG STUDENTS IN SECONDARY SCHOOLS OF COASTAL AREA**" is based on the original work done by me under the guidance of **Prof. (Dr.) P. K. Aruna** (Rtd.), Professor, Department of Education, University of Calicut and has not been included in any other thesis submitted previously for the award of any Degree, Diploma, Title or Recognition before. The contents of the thesis are undergone plagiarism check using iThenticate software at C.H.M.K. Library, University of Calicut, and the similarity index found within the permissible limit. I also declare that the thesis is free from AI generated contents.

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(Research Scholar)

Aruna PK

Prof. (Dr.) P. K. ARUNA (Rtd.)
(Supervising Teacher)

Place: C.U. Campus
Date: 30.11.2024

Prof. (Dr.) P. K. ARUNA
Professor (Rtd.)
Department of Education
University of Calicut

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30.11.2024

Prof. (Dr.) P. K. Aruna (Rtd.)
(Supervising Teacher)

Prof. (Dr.) P. K. ARUNA
Professor (Rtd.)
Department of Education
University of Calicut

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This is to certify that the thesis entitled **EFFECTIVENESS OF BRAIN COMPATIBLE LEARNING STRATEGY ON PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND MATHEMATICS ANXIETY AMONG STUDENTS IN SECONDARY SCHOOLS OF COASTAL AREA** is a record of bonafide study and research carried out by **LISHEETHA P.V.** under my guidance and supervision and is submitted to the Department of Education, University of Calicut for the degree of **Doctor of Philosophy in Education**. No changes have been made to this thesis as the adjudicators do not recommend any corrections/suggestions after evaluation.

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Calicut University
18 .06.2025

Prof. (Dr.) P. K. Aruna (Rtd.)
(Supervising Teacher)

Dr. VASUMATHI T.
Assistant Professor
Department of Education
University of Calicut

Certificate

I, **Dr. Vasumathi T.,** do hereby certify that this thesis entitled **EFFECTIVENESS OF BRAIN COMPATIBLE LEARNING STRATEGY ON PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND MATHEMATICS ANXIETY AMONG STUDENTS IN SECONDARY SCHOOLS OF COASTAL AREA** is a record of bonafide study and research carried out by **Lisheetha P.V.** under my co-guidance and that it has not been previously formed the basis for the award of any other Degree, Diploma, Title or Recognition.

Calicut University
30.11.2024

30/11/24
Dr. Vasumathi T.
(Research Co-guide)

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ABSTRACT

DEPARTMENT OF EDUCATION
UNIVERSITY OF CALICUT

EFFECTIVENESS OF BRAINCOMPATIBLE LEARNING STRATEGY ON PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND MATHEMATICS ANXIETY AMONG STUDENTS IN SECONDARY SCHOOLS OF COASTAL AREA

Lisheeta. PV	**Prof (Dr.) P.K. Aruna (Rtd.)**	**Dr. Vasumathi. T**
Research Scholar	Research Guide	Co- Guide

The National Council of Teachers of Mathematics (NCTM) supports and advocates for the highest-quality mathematics teaching and learning for every student.The 2020 revision of the Specialized Professional Association (SPA) Standards reflects current conversations in the mathematics and mathematics education communities regarding not just standards of content but also the deepening urgency to address the nature of effective mathematics teaching and the goals for mathematical learning for each student. The performance of students in mathematics in the coastal area is much below expectations even with the emphasis on mathematics in the secondary education system and the efforts of educators and curriculum reformers to improve the subject .Brain compatible learning strategy is the deliberate application of techniques founded on ideas that come from reliable scientific studies. The application of a significant collection of ideas that captures our knowledge of how the brain functions in real environments is also known as Brain compatible learning. It is essentially the application of brain learning methodologies in the context of education.

The present investigation aimed to compare the effectiveness of two methods of instruction in enhancing students' problemsolving ability, perceptual speed and reduction of mathematics anxiety. The current study examines the impact of Brain Compatible learning strategy on students' anxiety related to mathematics, perceptual speed and problem solving abilityin secondary schools located in coastal area.

The present study comprises mixed methods.It incorporates a preliminary survey on problemsolving ability, Perceptual speed and mathematics anxiety of secondary school students and preliminary survey of secondary school mathematics teachers and then the experimental study. The researcher employed the Quasi-experimental design with the Pre-test post-test nonequivalent group design.

In the preliminary survey of secondary school studentsthe investigator collected data from a sample of 400 Secondary school students, of which 149 were coastal area secondary school students and 251 were non-coastal areas secondary school students in the Kozhikode district with purposive sampling technique and in the preliminary survey of secondary school mathematics teachersby using purposive sampling technique the investigator collected data from 30 secondary school mathematics teachers from Kozhikode district. In the experimental study the two intact classes of Standard VIII with 54 students from two different coastal area secondary schoolswere selectedrandomly one experimental group and one control group for experimental and control treatments from the Kozhikode district. The statistical techniques used were Basic descriptive statistics,

Mean difference analysis, Percentage analysis, Single-factor ANCOVA, Effect size (Cohen's d and partial eta squared) and Bonferroni's Post Hoc analysis.

The findings of the comparisonof mean difference analysis of the performance of students in the coastal area and non-coastal area secondary schools From the preliminary survey on problemsolving ability, perceptual speed and mathematics anxiety of secondary school students the students from coastal area secondary school shows significantly low performance in problemsolving ability and perceptual speed in mathematics and shows significantly higher mathematics anxiety while comparing to the overall performance of students from non-coastal area secondary school.Hence the investigator decided to conduct the experimental study in the coastal area secondary schools.

The findings of the preliminary survey of teachers revealed that most of the secondary school teachers were aware of different teaching strategies used for teaching mathematics at the secondary school level but they face some constraints in adopting them successfully. Teachers suggested the measures to overcome the constrains they experienced for improving Teaching mathematics at Secondary school.From the survey,the investigator decided to select Brain Compatible learning strategy as an instructional strategy because it is not used much by secondary school mathematics teachers.

The major findings of the experimental study were problem solving ability and perceptual speed of students taught through the instructional strategy based on Brain Compatible learning strategy is significantly higher than that of those taught through the Existing method of teaching for the Total sample and Subsamples based on gender.The mathematics anxietyof students taught through the instructional strategy based on Brain Compatible learning strategy is significantly lower than that of those taught through the Existing method of teaching for the Total sample, boys and girls.The conclusion that can be derived from both qualitative and quantitative analysis of the present study is that the Brain Compatible learning strategy is effective in enhancing problem solving ability, perceptual speed and in reducing the mathematics anxiety for Total sample and Subsamples based on the gender of thecoastal area secondary school students.

The study also revealed that Brain compatible learning strategy has a significant advantage over the Existing method of teaching irrespective of gender in teaching mathematics to coastal area secondary school students. As we all know mathematics is a very difficult subject for most students. So, it can be said that by implementing Brain Compatible learning strategy we can enhance the mathematical abilities and reduce mathematics anxiety of coastal area secondary school students.

Key terms. Effectiveness, Brain Compatible learning strategy, Problem solving ability, Perceptual speed, Mathematics anxiety, Coastal area secondary school students.

തീരപ്രദേശത്തെ സെക്കണ്ടറി സ്കൂൾ വിദ്യാർത്ഥികളുടെ ഗണിതശാസ്ത്രപ്രകടനത്തിൽ ബ്രെയിൻ കോംപാറ്റബിൾ പഠനതന്ത്രത്തിന്റെ സ്വാധീനം

ലിഷിത പി.വി. ഗവേഷക വിദ്യാർത്ഥിനി

പ്രൊഫ. (ഡോ.) അരുണ പി.കെ. (Rtd.) മാർഗദർശക

ഡോ. വസുമതി ടി. ഉപ-മാർഗദർശക

നാഷണൽ കൌൺസിൽ ഓഫ് മാത്തമാറ്റിക്സ് ടീച്ചേർസ് 1920 മുതൽ എല്ലാ സ്കൂളുകളിലും ഗണിതശാസ്ത്രപഠനനിലവാരം ഉയർത്താൻ പ്രതിജ്ഞാബദ്ധമാണ്. കുട്ടികളുടെ വ്യക്തിപരമായ സാഹചര്യങ്ങളോ, ശാരീരിക ബുദ്ധിമുട്ടുകളോ പരിഗണിക്കാതെ തന്നെ എല്ലാ കുട്ടികൾക്കും ഉയർന്ന നിലവാരമുള്ള ഗണിതശാസ്ത്ര വിദ്യാഭ്യാസം ലഭ്യമാക്കുന്നതോടെ കുട്ടികളിലെ ഗണിതശാസ്ത്ര പഠനം മെച്ചപ്പെടുത്താൻ സാധിക്കും. സെക്കന്ററി വിദ്യാഭ്യാസ സമ്പ്രദായത്തിൽ ഗണിതശാസ്ത്രത്തിന് ഊന്നൽ നൽകിയിട്ടും, വിഷയം മെച്ചപ്പെടുത്താനുള്ള അധ്യാപകരുടേയും, പാഠ്യപദ്ധതി പരിഷ്കർത്താക്കളുടേയും ശ്രമങ്ങൾക്കിടയിലും തീരദേശവിദ്യാലയങ്ങളിലെ വിദ്യാർത്ഥികളുടെ ഗണിതശാസ്ത്രത്തിലെ പ്രകടനം പ്രതീക്ഷിച്ചതിലും താഴെയാണ്. മസ്തിഷ്കം സ്വാഭാവികമായി പഠിക്കുന്നുവെന്ന് സൂചിപ്പിക്കുന്ന ന്യൂറോ സയൻസിലെ നിലവിലെ ഗവേഷണത്തെ അടിസ്ഥാനമാക്കിയുള്ള നിർദ്ദേശങ്ങളോടുള്ള സമഗ്രമായ സമീപനമാണ് ബ്രെയിൻ കോംപാറ്റിബിൾ പഠനതന്ത്രം. ഇത് മസ്തിഷ്കത്തിന്റെ ഘടനയേയും, പ്രവർത്തനത്തേയും അടിസ്ഥാനമാക്കിയുള്ളതാണ്. വിവിധ സങ്കേതങ്ങളുടെ സങ്കലനം ഉൾകൊള്ളുന്ന ഒരു മെറ്റാ കൺസെപ്റ്റ് ആണ് ഇത്.

തീരപ്രദേശത്ത് സ്ഥിതിചെയ്യുന്ന സെക്കന്ററി സ്കൂളുകളിലെ വിദ്യാർത്ഥികളുടെ പ്രശ്നപരിഹാരശേഷി, ഗ്രഹണവേഗത എന്നിവ വർദ്ധിപ്പിക്കാനും ഗണിതശാസ്ത്ര ഉത്കണ്ഠ കുറക്കുവാനും വേണ്ടി രണ്ട് പ്രബോധനരീതികളുടെ ഫലപ്രാപ്തി താരതമ്യം ചെയ്യാനാണ് ഇപ്പോഴത്തെ അന്വേഷണം ലക്ഷ്യമിടുന്നത്. ഈ ഗവേഷണം സമ്മിശ്രരീതികൾ ഉൾക്കൊള്ളുന്നു. സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികളുടെ പ്രാഥമിക സർവ്വേയും ഗണിത അധ്യാപകരുടെ പ്രാഥമിക സർവ്വേയും തുടർന്ന് പരീക്ഷണാത്മകപഠനവും ഇതിൽ ഉൾപ്പെടുത്തിയിട്ടുണ്ട്. ഗവേഷക ക്വാസി പരീക്ഷണാത്മക ഡിസൈൻ ആണ് ഉപയോഗിച്ചിരിക്കുന്നത്.

സെക്കന്ററി സ്കൂൾവിദ്യാർത്ഥികളുടെ പ്രാഥമിക സർവ്വേയിൽ 400 വിദ്യാർത്ഥികളുടെ ദത്തങ്ങൾ ശേഖരിച്ചതിൽ 149 തീരദേശ സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികളും 251 തീരദേശ ഇതര സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികളുമാണ്. 30 സെക്കന്ററി സ്കൂൾ അധ്യാപകരിൽ നിന്നും സാങ്കേതിക വിദ്യ ഉപയോഗിച്ച് വിവരങ്ങൾ ശേഖരിച്ചു. പരീക്ഷണാത്മക പഠനത്തിന് രണ്ട് വ്യത്യസ്ത തീരദേശ സെക്കന്ററി സ്കൂളുകളിൽനിന്ന് 54 വിദ്യാർത്ഥികളുള്ള എട്ടാം ക്ലാസുകൾ തിരഞ്ഞെടുത്തു. ഗവേഷക ഡാറ്റകൾ ശേഖരിച്ചത് കോഴിക്കോട് ജില്ലിയിൽനിന്നാണ്. അടിസ്ഥാന വിവരണാത്മക സ്ഥിതി വിവരകണക്കുകൾ, ശരാശരി, വ്യത്യാസ വിശകലനം, ശതമാനവിശകലനം, സിങ്കിൾ ഫാക്ടർ അൻകോവ, ഇഫക്ട്സൈസ് (കോഹൻസ് ഡി, ഭാഗിക ഈറ്റാ സ്ക്വയർ), ബേൺഫെറോണിയുടെ പോസ്റ്റ്ഹോക്ക് വിശകലനം എന്നീ സ്റ്റാറ്റിസ്റ്റിക്കൽ ടെക്ക്നിക്കുകളാണ് ദത്തവിശകലനത്തിന് ഉപയോഗിച്ചത്.

നിവലിലെ പഠനത്തിന്റെ ഗുണപരവും അളവുപരവുമായ വിശകലനത്തിൽ നിന്ന് ഉരുത്തിരിഞ്ഞ നിഗമനങ്ങൾ. തീരദേശ സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികളുടെയും, തീരദേശ ഇതര സ്കൂൾ വിദ്യാർത്ഥികളുടെയും താരതമ്യപഠനത്തിൽ തീരദേശഇതര സ്കൂളുകളിലെ വിദ്യാർത്ഥികൾക്കാണ് പ്രശ്നപരിഹാരശേഷിയും, ഗ്രഹണവേഗതയും കൂടുതലും ഗണിതശാസ്ത്ര ഉത്കണ്ഠ കുറവായും കാണപ്പെടുന്നത്. അതിനാലാണ് ഗവേഷക പരീക്ഷണാത്മക പഠനം തീരദേശ സെക്കന്ററി സ്കൂളിൽ നടത്തിയത്. പരീക്ഷണാത്മക പഠനത്തിന്റെ അടിസ്ഥാനത്തിൽ ലഭിച്ച കണ്ടെത്തലുകൾ ബ്രെയിൻ കോംപാറ്റിബിൾ ലേണിംഗ് സ്ട്രാറ്റജിയെ അടിസ്ഥാനമാക്കിയുള്ള പ്രബോധനരീതിയിലൂടെ പഠിപ്പിക്കുന്ന തീരദേശ സെക്കന്ററി സ്കൂളിലെ വിദ്യാർത്ഥികളുടെ പ്രശ്നപരിഹാരശേഷിയും, ഗ്രഹണവേഗതയും നലവിലുള്ള അധ്യാപന രീതിയിലൂടെ പഠിപ്പിച്ചതിനേക്കാൾ വർദ്ധിപ്പിക്കാനും ഗണിതശാസ്ത്ര ഉത്കണ്ഠ കുറക്കുവാനും സാധിച്ചിട്ടുണ്ട്. തീരപ്രദേശത്തെ സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികൾക്ക് ഗണിതശാസ്ത്രം പഠിപ്പിക്കുന്നതിൽ ലിംഗഭേദമില്ലാതെ നിലവിലത്തെ പഠിപ്പിക്കൽ രീതിയേക്കാൾ ബ്രെയിൻ കോംപാറ്റിബിൾ ലേണിംഗ് സ്ട്രാറ്റജിക്ക് കാര്യമായ നേട്ടമുണ്ടെന്നും പഠനം വെളിപ്പെടുത്തുന്നു.

നമുക്കെല്ലാവർക്കും അറിയാവുന്നതുപോലെ മിക്ക വിദ്യാർത്ഥികൾക്കും ഗണിതം വളരെ പ്രയാസകരമായ വിഷയമാണ്. അതിനാൽ ബ്രെയിൻ കോംപാറ്റിബിൾ ലേണിംഗ് സ്ട്രാറ്റജി നടപ്പാക്കുന്നതിലൂടെ തീരദേശ സെക്കന്ററി സ്കൂൾ വിദ്യാർത്ഥികളുടെ ഗണിതശാസ്ത്ര പരമായ കഴിവുകൾ വർദ്ധിപ്പിക്കാനും ഗണിത ശാസ്ത്ര ഉത്കണ്ഠ കുറക്കുവാനും സാധിക്കും എന്ന് പറയാം.

Chapter -1

INTRODUCTION

- Need and significance of the study.
- Statement of the problem.
- Definition of key terms.
- Variables of the study.
- Objectives of the study.
- Hypothesis of the study.
- Methodology in brief.
- Scope of the study.
- Limitation of the study.
- Organization of the report.

INTRODUCTION

Education significantly influences a child's development of uniqueness in all physical, mental, emotional and social domains. The education of the next generation is receiving crucial attention in light of how globalization is evolving and how competition is intensifying. Improving the overall quality of education is our nation's greatest educational issue today, in addition to its growth and universalization. The maintenance of student engagement throughout the teaching-learning process is essential for ensuring high-quality education. To accomplish this we need to implement novel methods of instruction that align with the interests of our students. It implies that instructors should provide a productive learning environment in the classroom and that the process of instruction and learning should be the needs of the students.

The optimum way for the brain to learn is found in physiological research where Brain compatible learning originates. Applying the brain's learning mechanism to education is known as Brain compatible learning. This method encompasses several disciplines including education, neuroscience and knowledge theory from other fields such as chemistry, neurology, psychology, sociology, genetics, biology, computational neurobiology, etc. There are connections between the nature of cognition and how the brain works and how knowledge is formed. This idea describes how common sense, life experiences and brain science combine to create practical resources and educational guidelines. The brain is designated as the organ of learning by Hart (1978). Twelve concepts that apply our understanding of brain function to teaching and learning were established by Caine and Caine (1991). Caine & Caine (1991) have identified three requirements for complex learning – an attitude of ease, active processing and orchestrated immersion.

Brain compatible learning is the deliberate application of techniques founded on ideas that come from reliable scientific studies. The application of a significant collection of ideas that captures our knowledge of how the brain functions in real

environments is also known as Brain compatible learning. It is essentially the application of brain learning methodologies in the context of education. Jensen (2008) argues that there are three key concepts to understanding brain compatible education: engagement, methods, and principles. Using techniques based on ideas obtained from a comprehension of the brain is known as Brain Compatible Education.

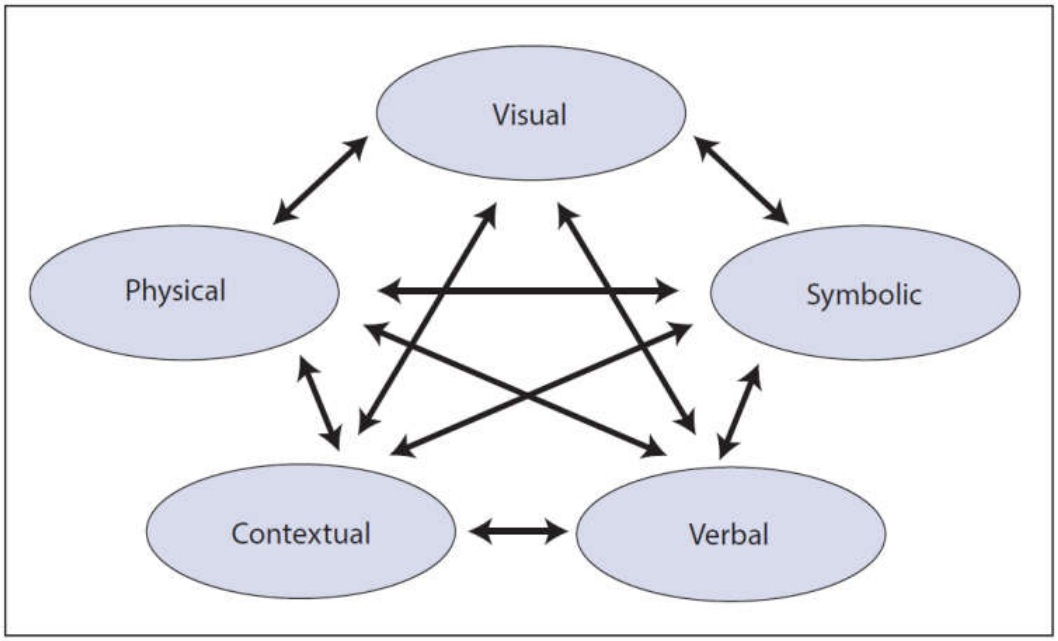
Mathematics is the gateway and key to all Sciences, asserts Bacon. A subject with connections to practically every academic subject is mathematics. It encompasses language as well as a subject. Mathematical language provides a useful symbolism for the concise and accurate representation of concepts. Consequently, a major portion of the educational curriculum is devoted to mathematics.

Mathematical Representations

Essential characteristics of mathematical acts and structures are embodied in mathematical representations (NCTM, 2014, p. 25). Symbolic, physical, verbal, visual, and contextual representations are all included in the generic classification of mathematical representations:

Figure 1

Mathematical Representation



(Source: NCTM, 2014, p.25)

It is possible to build links between different mathematical subject domains or to comprehend, acquire and apply mathematical concepts in one field of mathematics by using mathematical representations. "Viewing a concept through a variety of lenses, with each lens providing a different perspective that makes the concept richer and deeper" is how Tripathi (2008) described the process of approaching problem solving through the use of multiple representations (p. 439). Mathematical models are one type of representation that may be chosen and used to assist students in applying mathematics. Representations of a certain real-world issue are employed in mathematical models to characterize, investigate or comprehend the issue (NCTM 2018).

Mathematical Proficiency

The National Research Council (NRC, 2001) states that efficacious teacher preparation programs help aspiring educators comprehend the subjects they teach, how their students will learn those subjects and how to promote their learning. The mathematical proficiencies are identified by the National Research Council. Since no one term can adequately express one's skill, competence, understanding and facility in mathematics, we have selected mathematical proficiency to include the essential elements that we feel are required for every student to acquire mathematics properly.

Kilpatrick et al. (2001) delineate five interconnected components of mathematical proficiency:

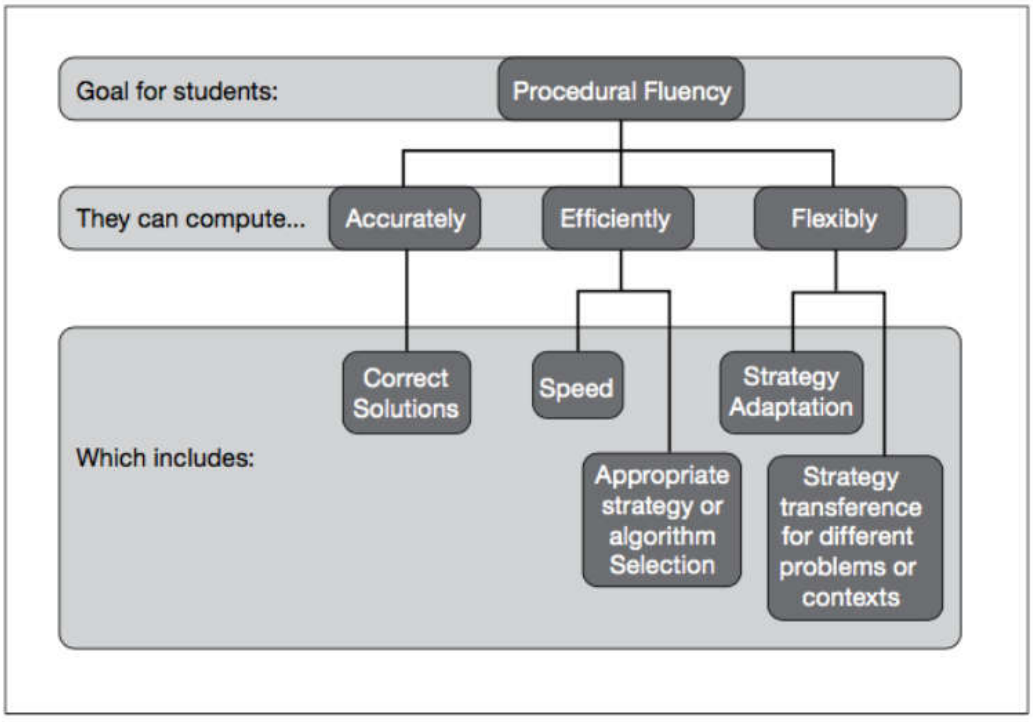
- Conceptual understanding is the ability to understand concepts, laws and connections. Students frequently comprehend the connections and similarities between related facts as a consequence.
- Procedural fluency refers to the adaptability, precision and effectiveness of executing suitable processes. Knowing when and how to apply processes is a skill in competence. This includes fundamental computations that are accurate and efficient.

- The capacity to develop, portray and resolve mathematical issues is known as strategic competence. This is comparable to addressing problems. Procedural fluency and conceptual comprehension go hand in hand with strategic competency.
- The ability to reason about ideas and their relationships is known as adaptive reasoning. To get answers one must use reasoning to sort through a variety of steps, concepts and facts.

Positive attitudes toward mathematics are part of the Productive Disposition. As pupils grow more proficient in mathematics and have a deeper comprehension of the subject develops. Procedural fluency is not just about understanding how to use an algorithm or method; procedural skills might be used to describe such attempts. Procedural fluency involves choosing strategies with flexibility in mind illustrated in Figure 2.

Figure 2

The Procedural Fluency Illustrated in the Graphic



(Source: Bay-Williams & Levine, 2017)

Guidelines for Training Secondary Mathematics Teachers: The National Council of Teachers of Mathematics (NCTM - 2020)

The goal of the National Council of Teachers of Mathematics (NCTM) is to ensure that every student receives the best possible instruction in mathematics. The Specialized Professional Association (SPA, 2020) Standards for the Preparation of Secondary Teachers have been revised to take into account the most recent findings and developments in the field of mathematics education. This update takes into account the ongoing discussions in the fields of mathematics and mathematics education about the need to address the nature of successful mathematics instruction as well as the objectives of mathematical learning for every single student in addition to subject requirements.

Mathematical Knowledge and Understanding

In the mathematical domains of numbers, algebra and functions, calculus, statistics and probability, geometry, trigonometry, and measurement, secondary mathematics teacher education candidates (henceforth referred to as candidates) exhibit and apply understandings of key mathematical concepts, procedures, knowledge and applications.

Understanding and Applying Mathematical Processes

Candidates exhibit their understanding and proficiency with the mathematical processes of problem solving, mathematical reasoning and communication and mathematical modeling within or beyond mathematical disciplines. As part of these mathematical procedures correctly use technology.

Getting to Know Students and Making Plans for Mathematical Education

Using their understanding of individuals as well as mathematics, candidates design demanding and interesting mathematics lessons that enhance students' access

to learning. All students are given equal opportunity to acquire and apply mathematical ideas, abilities and practices through the established mathematics curriculum that considers cultural sensitivity.

Teaching Mathematics with Meaning

Candidates enhance rigorous mathematics learning for a wide range of students by using equitable and effective teaching techniques. Candidates set high standards for mathematics education, involve students in learning with high cognitive demand, employ tools and representations specific to mathematics, gather and utilize student input, foster conceptual understanding and procedural fluency and ask thoughtful questions to encourage student discussion.

Evaluating the Influence on Students' Learning

To improve instruction and subsequently student learning, candidates assess and utilize data that shows students' proficiency in challenging mathematics. Candidates review learning outcomes from formal and informal assessments for each student, the class as a whole and student subgroups broken down by demographic characteristics to inform their planning and instruction.

Teaching and Learning Mathematics in a Social and Professional Context

The ideal candidates are thoughtful math teachers who work together with peers and other stakeholders to further their careers, enhance student's learning and establish more equal math classrooms. To enhance student learning promote professional development and provide more equitable mathematical learning environments, candidates are reflective math educators who work with peers and other stakeholders.

Clinical Practice and Secondary Field Experiences

Secondary mathematics educators who are effective follow a predetermined path of fieldwork and clinical practice in various environments, all under the guidance

of more seasoned and highly skilled math educators. They acquire a wide range of practical knowledge, abilities, efficient methods for teaching and studying mathematics and professional behavior in middle and secondary settings involving a variety of student groups. Applicants work as full-time student teachers or interns in secondary mathematics under the supervision of college or university instructors who have experience teaching secondary mathematics or who possess comparable competence.

Applicants work as full-time student teachers or interns in secondary mathematics under the supervision of college or university instructors who have experience teaching secondary mathematics or who possess comparable competence.

Six Guidelines for Teaching Mathematics in Schools (NCTM-2000)

Equity. Raising standards and providing solid support for every student are necessary for excellence in mathematics instruction.

Curriculum. A curriculum is more than a list of exercises; it has to be well-organized, centered on significant mathematics and consistent throughout the grades.

Teaching. The third principle is that good math instruction starts with identifying what pupils already know and what they still need to learn.

Learning. Students need to approach mathematics with comprehension, actively constructing new information from prior knowledge and experience.

Assessment. Which should help students understand key mathematical concepts and provide instructors and students with relevant information.

Technology. Technology significantly impacts the mathematics that is taught and improves student learning. It is therefore vital to the teaching and learning of mathematics.

The NCTM's 2000 publication, Principles and Standards for School Mathematics lists the fundamental elements of a top-notch mathematics curriculum in

schools. It demands and lays forth a basic mathematical basis that all students must acquire. The assertions that make up the principles are core ideas that are essential to a top-notch mathematical education. The Standards outline the knowledge and skills students should acquire via mathematical teaching. The Principles and Standards taken together provide a vision for teachers to follow as they work to enhance mathematics instruction in classrooms, schools and educational systems.

Need and Significance of the Study

The National Council of Teachers of Mathematics has been committed to raising the standard of mathematics instruction in schools across the board since 1920. Regardless of their personal qualities, circumstances or physical difficulties, all children may learn mathematics when they have access to high-quality mathematics education. All students don't need to get the same teaching to achieve equity. Instead, it requires that to support access and achievement for all students, reasonable and suitable accommodations be offered as well as the inclusion of suitably demanding content. The instruction that students get in school shapes their knowledge of mathematics, their aptitude for using it to solve problems and their self-assurance in their mathematical abilities.

For an educator to be effective, they must have a deep understanding of the subject matter they are teaching and be able to draw from it, as well as flexibility in their approach to teaching. Additionally, they must be provided with ample opportunities and resources to further their professional development. Through the alignment of factual information and procedural skills, research has firmly demonstrated the role that conceptual understanding plays in the learning of mathematics as outlined in the learning principle. Students who possess conceptual understanding can study effectively. They will be able to see how crucial it is to take stock of their ideas and grow from their errors. When given demanding assignments,

students grow competent and self-assured in their abilities to solve them and they will be motivated to persevere.

To solve a problem, one must undertake an activity for which the approach to a solution is unknown before hand (NCTM 2000b, p. 52). Not only is problem solving an objective of mathematics education, but it is also a primary method of achieving it. Not a stand-alone component of the mathematics curriculum but an essential component of mathematics. When the problem solver is faced with an issue for which there isn't a clear-cut answer, problem solving is a cognitive processing that aims to turn the circumstance into a desired scenario. One uses mathematical problem solving techniques continuously throughout their life.

One of the most important aspects of teaching mathematics is problem solving. Students learn about the value and strength of mathematics in the real world by solving problems. Students must use what they already know to come up with a solution and in the process, they frequently pick up new mathematical concepts. Not only is problem solving an objective of mathematics education but it's also a key component of accomplishing it. Students should be given regular chances to develop, consider and work through difficult issues that call for a lot of effort. After completing such tasks they should be encouraged to consider what they have thought through.

Being able to solve problems effectively can be very beneficial in everyday life and the workplace. Students who learn problem solving techniques in mathematics should develop ways of thinking, habits of persistence, curiosity and confidence in new situations. Since problem solving is essential to learning mathematics, it shouldn't be treated as a stand-alone component in math curricula. The challenges' contexts might range from well-known incidents affecting students their lives or the school day to uses from the fields of science and industry. Well-

crafted puzzles will incorporate several subjects with important mathematical concepts.

The process by which information received from the world through the senses is converted into an experience of things such as events, sounds, tastes and objects is referred to as perception. Even though perception may be investigated in all sensory modalities, the majority of theory and research has concentrated on auditory and visual perception. Although it would seem reasonable to think that conscious awareness is necessary for perception, there is mounting evidence that significant perceptual processing may take place even in the absence of conscious knowledge. In tests of perceptual speed, perceptual speed is defined as the capacity to compare letters, numbers, objects or patterns with accuracy and rapidity The items that need to be compared might be shown all at once or in order. Comparisons between an item in the present and an object from memory may also be required of the students.

For instance, a candidate's perceptual quickness is measured by several aptitude and IQ tests, such as the Thomas International General Intelligence Assessment. Perceptual quickness is one of the key mental skills in visual thinking that has been frequently found. The rate at which something is seen is referred to as its perceived speed. It displays the rate of comprehension. Among the many extremely ill-defined and abstract factors that go into making us human beings capable of succeeding, conquering and exceeding in the challenges we face daily are the nature of cognition, perception and learning. The unique features of our mental faculties and the diversity of human ideas that define our intellectual standing.

Mathematics anxiety is the term used to describe anxiety related to studying and doing mathematical tasks. It may be defined as a tense sensation that makes it difficult to work with numbers and solve mathematical issues in a classroom setting

or everyday life. Pupils who struggle with math anxiety have a poor comprehension of mathematical ideas. Panic sets so quickly because they can primarily rely on memorization of processes, regulations and routines with little intellectual comprehension. Their main requirement for assistance is to replace the memory of failure with the potential for success. Anxiety related to mathematics is quite common among learners. It is among the things that prevent students from studying mathematics in the classroom. It is a tense, uneasy sensation that makes it difficult to work with numbers and solve mathematical issues in both academic and real-world contexts. It might be anything from a slight tightness to a deep dread of maths. It applies to every circumstance requiring mathematics, not only tests or classroom environments.

A significant avoidance is developed by the afflicted. It has been noted that even math-proficient students experience anxiety when solving math problems and that anxiety deters them from pursuing professions in advanced math and science. Rather than being an academic issue mathematics anxiety is an emotional one that has several detrimental effects, such as poor attitudes toward mathematics, avoiding mathematics and having a poor comprehension of mathematical ideas. They do not have much conceptual knowledge and instead rely mostly on memorization of processes, rules and routines. They might also have low self-esteem and self-efficacy and perform poorly in mathematics. It occurs when math related tension and anxiety become too much to handle. This can be caused by problems with fundamental arithmetic facts, computational difficulties, applying math concepts or difficulties with unique relationships and visualizations. Their main requirement is assistance in substituting the memory of failure with the potential for success.

Since they have never succeeded in their mathematics lessons, students may suffer from math anxiety. Bad instructions may be to blame for this. The "explain-

practice-memorize" method of teaching mathematics is a significant contributor to math anxiety (Steele and Alfred, 1998). Therefore, in order to keep students' interest, a mathematics instructor must be innovative in his teaching strategies. Additionally, learners must have access to a mathematical assistance system. The majority of children in coastal regions have little interest in studying mathematics. There might be a number of causes for their fear of learning mathematics including the teachers' varying pedagogical approaches, the students' intellectual aptitude, or their potential for problem solving given that it is a crucial subject covered in the educational curriculum. Numerous research supports the finding that the teaching-learning process may be improved by using a brain compatible learning technique. Thus, we may help students in secondary schools in the coastal area to develop problem solving abilities, perceptual speed, and minimize mathematics anxiety by implementing brain compatible learning strategies.

Education can no longer serve as a vehicle for the dissemination of knowledge in the current educational environment because a greater focus has to be placed on positive habits and interests. The learning process is seen to have undergone a fundamental change from teacher-centered to student-centered education. It is important to provide students the chance to learn via idea exploration, prediction, reflection, problem solving and investigation. The current approach offers lots of chances for process-oriented learning incorporating the previously listed processes which has proven to be effective in delivering high-quality instruction. We must guarantee that all students have access to high-quality instruction that satisfies their fundamental learning requirements and enhances their lives if the goal of "education for all" is to become a reality.

A quality education involves more than just granting students access to the classroom; it also entails being proactive in recognizing and removing obstacles that

students face along the way. Long-term memory has limitless storage capacity. The data that is kept is updated continuously and cross-linked to one another. The stored data is retrieved, analyzed and processed to move on to higher-order cognitive processes including application, synthesis, understanding and analysis. Instructors should understand how the brain learns because they may utilize this knowledge to enhance their teaching methods. To release the neurotransmitters that facilitate learning, educators should provide a calm, enjoyable, stimulating, and demanding atmosphere. Students should be allowed enough time to debate to help them organize and understand the material, which improves both short- and long-term memory.

Studies on Brain compatible learning techniques have shown encouraging findings for the teaching of mathematics. El-sayed (2015) administered an experimental research to determine how using a Brain compatible learning theory-based method affected the development of numerical scientific abilities in Oman's basic education standard pupils. Salim (2022) identified the effects of a Brain compatible instructional learning design on the systematic thinking of female first-intermediate math students. The impact of Brain compatible methods on the problem solving abilities of grade four and grade five Lebanese pupils was examined by Balaa and Hassan (2018). The effect of brain based education methodologies on the academic performance of deaf or hard-of-hearing pupils in mathematics was examined by Olaoluwa and Ayantoye (2016). To achieve the NCTM 2020 Standards and guiding principles for mathematics education. To raise the standard of mathematics instruction as well as students' active involvement and engagement in the learning process we must employ a variety of instructional methodologies. Only then can they develop a useful plan for resolving both everyday difficulties and complex mathematical problems.

Since as we all know mathematics is a highly tough topic for the majority of students worldwide. Research on abilities to solve problems, perceptual speed and mathematical anxiety have been undertaken in the field of mathematics education. Kumar and Dilip (2023) examined secondary school students' ability to solve complex mathematical problems in relation to their mathematical aptitude and self-concept. A literature review on the impact of students' mathematical problem solving abilities on higher-order thinking skills (HOTS) was carried out by Siska and Fauzi (2023). A study on the investigation of metacognitive skills in math problem solving SMA pupils at Nyemplak Boyolai was carried out by Safitri and Suryani (2022). In 2023, Fimansyah and Syarifah carried out research on the value of problem solving abilities in mathematics education and how learning and other variables affect them. Surur et al. (2020) looked at the problem solving skills of students who received instruction using group discussion and problem solving learning models in various ways.

Fang and Zhou (2022) Form perception speed was studied because it is important for understanding how nonverbal numbers relate to arithmetic fluency. Clark et al. (2021) In those with neurodevelopmental conditions, the association between math performance and attention is mediated by their perceptual reasoning ability. Foulds et al. (2020) researched the constraints, difficulties and suggestions associated with reflecting on perceptual speed assessments in information retrieval. Taneja (2016) examined the impact of spatial aptitude and perceptual quickness on secondary school students' mathematical success. Li and Cai (2014) carried out research on how a digit's perceptual processing speed is affected by its numerical magnitude.

Brewster and Miller (2023.) carried out research on thoughts on arithmetic prowess, anxiety and intervention. The research on mathematics anxiety is included in the article, along with its contributing components and potential interventions,

such as expressive writing and mindfulness exercises. A resting state FMRI was used to gather data for CUI et al. (2023) investigation on the brain mechanism behind the influence of arithmetic anxiety on math conceptual understanding. The research talks about the Effect of Math Anxiety on Conceptual Knowledge in Mathematics. Drudu and Pramod (2020) examined how well Standard XI pupils in higher secondary schools performed in mathematics about IQ, creativity, attitude toward mathematics, mathematics anxiety and socioeconomic level.

After examining earlier studies in the area of mathematics education research, the teaching technique and variables were selected. According to recent research, secondary school children in the coastal area do poorly in mathematics. Numerous efforts were undertaken to determine the precise cause of the low arithmetic performance of secondary school pupils in the coastal area. The performance of students in mathematics in the coastal area is much below expectations, even with the emphasis on mathematics in the secondary education system and the efforts of educators and curriculum reformers to improve the subject. Instructors employ several tactics that they believe work well to meet each student's unique needs. Even in this decade, a lot of teachers still stick to tried-and-true methods while ignoring more innovative and effective ones. It is the teacher's responsibility to find teaching strategies that meet both the needs of the students and the requirements of the subject. The rate of literacy and education in coastal communities is quite low. The curricula and pedagogy of coastal secondary schools may shed light on more successful teaching strategies. Countable research has shown that learning techniques that are compatible with the brain provide insight into the beneficial impact on goal achievement. Nevertheless, very little acknowledged research has tried to implement a Brain compatible learning technique in secondary schools in coastal areas. Studies specifically linking Brain compatible learning strategies to secondary school pupils in coastal regions' problem

solving abilities, perceptual speed and mathematics anxiety were particularly hard to come by. Therefore, the current study examines the impact of Brain compatible learning strategies on students' anxiety related to mathematics, perceptual speed and problem solving abilities in secondary schools located in coastal locations.

Statement of the Problem

The statement of the problem outlines the research purpose, the variable selected and the problem to be addressed. The present study aimed to find out the effectiveness of Brain compatible learning strategy over the existing method of teaching in terms of Problem solving ability, Perceptual speed and Mathematics anxiety of standard VIII students of coastal area secondary schools in Kerala state. Hence the present study is entitled as "**Effectiveness of Brain Compatible Learning Strategy on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety among Students in Secondary Schools of Coastal Area".**

Definition of Key Terms

The key terms used in the statement of problems in the study are defined in the present context as follows,

Effectiveness

Effectiveness is the ability to achieve desired results with economy of time and effort, in relation to the amount of work accomplished (Good, 1959).

Effectiveness means, the use of a plan for instruction or presentation which causes a desired change in the Learner's Behaviour (Charters & Good, 1945).

In the present study, effectiveness means the capacity to produce empirically demonstrated results approved by those in the academic environment up to the learner. Here effectiveness implies the significant difference in problem solving

ability, perceptual speed and mathematics anxiety through Brain compatible learning strategies and existing methods of teaching and learning and is measured in terms of the difference between pre-test and post–test scores of experimental and control group of Standard VIII coastal area secondary school students.

Brain Compatible Learning Strategy

Brain compatible learning is an active process where students are actively engaged in constructing their own knowledge in a variety of learning situations and contexts. (Caine & Caine, 1997)

In the present study Brain compatible learning strategy is an instructional strategy with a mix of multiple strategies that focuses on measuring the attainment and retention of Mathematics concepts effectively for everyone involved in learning.

The investigator used seven staged brain-based planning outlined by Jensen (2008) for framing lesson transcript of Brain compatible learning strategy.

Problem Solving Ability

Problem solving is a cognitive process directed at transforming a given situation into a goal situation when no obvious method of solution is available to the problem solver (Mayer, 1992).

In the present study, problem solving ability refers to the problem solving ability in mathematics. Problem solving ability in mathematics is a mental process that involves discovering, analyzing, and solving problems. The ultimate goal of problem solving in mathematics is to overcome obstacles and find a solution that best resolves the issue by using mathematical ideas and concepts.

Perceptual Speed

Perception is the way we notice things, especially with senses and the ability to understand things quickly. (The Oxford Advanced Learner’s Dictionary, 2010)

The term perception refers to the means by which information acquired from the environment via the sense organs is transformed into an experience of objects, events, sounds and taste etc. Roth (1986, p.81).

In the present study, Perceptual speed refers to the perceptual speed in mathematics. Perceptual speed in mathematics can be operationally defined as the ability to quickly and accurately compare; numbers, symbols, geometric figures and basic arithmetic operations. The perceptual speed in mathematics concentrates particularly on visual perception.

Mathematics Anxiety

Mathematics anxiety is defined by feelings of tension, helplessness, mental disorganization, and associated bodily symptoms that are evoked in mathematical problem solving situations (Ashcraft, 2002).

In the present study, Mathematics anxiety is defined as an intrinsic fear of a learner at a secondary level experiencing mathematics related situations that interfere with performance in mathematics related academic and daily life activities.

Coastal Area Secondary School Students

Coastal Area

Coastal areas are commonly defined as the interface or transition areas between land and sea, including large inland lakes. Coastal area generally means any land area that lies close to the sea.

Secondary School Students

Secondary School students refer to the pupils who are studying in Standard VIII in any of the schools recognized by the Government of Kerala.

In the present study coastal area secondary school students refer to the pupils who are studying in Standard VIII in any of the schools recognized by the

Government of Kerala, which is situated with in one km from the coastal line of Kozhikode district.

Variables of Study

The main intention of the study was to find out the effectiveness of Brain compatible learning strategy over the Existing method of teaching in terms of Problem solving ability, perceptual speed and mathematics anxiety among Coastal area Secondary School standard VIII students of Kerala state. The independent, dependent and control variables are described as follows.

Independent Variable

The independent variable of the study is two levels of instructional method. They are Brain Compatible Learning strategy and Existing Method of teaching.

Dependent Variables

The dependent variables that were measured are.

1. Problem solving ability.
2. Perceptual speed.
3. Mathematics Anxiety.

Control Variables

1. Pre-experimental status in terms of problem solving ability in mathematics.
2. Pre-experimental status in terms of perceptual speed in mathematics.
3. Pre-experimental status in terms of mathematics anxiety.
4. Nonverbal intelligence.
5. Socioeconomic status.
6. Classroom environment

Classificatory Variable

Gender

Objectives of the Study

1. To study whether there exist any significant differences in the mean scores of problem solving ability and its sub-components (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. To study whether there exist any significant differences in the mean scores of perceptual speed and its sub-components (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithmetic operation test.) between the coastal area and non-coastal area secondary school students.
3. To study whether there exist any significant differences in the mean scores of mathematics anxiety and its sub-components (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Class room performance anxiety and Mathematics test anxiety.) between the coastal area and non-coastal area secondary school students.
4. To identify the prevailing strategies and methods in teaching mathematics and measure to overcome the constraints in implementing the strategies in teaching mathematics at the secondary level.
5. To compare the mean pre-test scores, post test scores and gain scores of the experimental group and control group in problem solving ability for the Total sample, Boys and Girls.
6. To compare the mean pre-test scores, post test scores and gain scores of the experimental group and control group in perceptual speed for the Total sample, Boys and Girls.

7. To compare the mean pre-test scores, post test scores and change scores of the experimental group and control group in mathematics anxiety for the Total sample, Boys and Girls.
8. To find out the effectiveness of Brain compatible learning strategy with that of Existing method of teaching on problem solving ability, perceptual speed, and mathematics anxiety among coastal area secondary school students.

Hypotheses of the study

1. There will be significant difference in the mean scores of problem solving ability and its subcomponents (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. There will be significant difference in the mean scores of Perceptual speed and its subcomponents (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithematic operation test) between the coastal area and non-coastal area secondary school students.
3. There will be significant difference in the mean scores of mathematics anxiety and its subcomponents (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Class room performance anxiety and Mathematics test anxiety) between the coastal area and non-coastal area secondary school students.
4. There will be no significant difference in the mean pretest scores of the Problem solving ability of the experimental group and control group for the Total sample, Boys and Girls.

5. There will be no significant difference in the mean pre -test scores of Perceptual Speed of the experimental group and control group for the Total sample, Boys and Girls.
6. There will be no significant difference in the mean pre-test scores of Mathematics anxiety of the experimental group and control group for the Total sample, Boys and Girls.
7. There will be significant difference in the mean pre-test and post-test scores of Problem Solving ability of the experimental group for the Total sample, Boys and Girls.
8. There will be significant difference in the mean pre-test and post-test scores of Perceptual Speed of the experimental group for the Total sample, Boys and Girls.
9. There will be significant difference in the mean pre-test and post-test scores of Mathematics anxiety of the experimental group for the Total sample, Boys and Girls.
10. There will be significant difference in the mean pre-test and post-test scores of Problem Solving ability of the control group for the Total sample, Boys and Girls.
11. There will be significant difference in the mean pre-test and post-test scores of Perceptual Speed of the control group for the Total sample, Boys and Girls.
12. There will be significant difference in the mean pre-test and post-test scores of Mathematics anxiety of the control group for the Total sample, Boys and Girls.
13. There will be significant difference in the mean post-test scores of Problem solving ability of the experimental group and control group for the Total sample, Boys and Girls.

14. There will be significant difference in the mean post-test scores of Perceptual Speed of the experimental group and control group for the Total sample, Boys and Girls.
15. There will be significant difference in the mean post-test scores of Mathematics anxiety of the experimental group and control group for the Total sample, Boys and Girls.
16. There will be significant difference in the mean gain scores of Problem solving ability of the experimental group and control group for the Total sample, Boys and Girls.
17. There will be significant difference in the mean gain scores of perceptual speed of the experimental group and control group for the Total sample, Boys and Girls.
18. There will be significant difference in the mean change scores of mathematics anxiety of the experimental group and control group for the Total sample, Boys and Girls.
19. There will be significant difference in the adjusted mean scores of Problem solving ability of Experimental and control groups by considering Pre-test Perceptual Speed, Pre-test Mathematics anxiety, Non-verbal Intelligence, Class Room Environment and Socio-Economic Status as covariates for the Total sample, Boys and Girls.
20. There will be significant difference in the adjusted mean scores of Perceptual Speed of the Experimental and control groups by considering Pre-test Problem solving ability, Pre-test Mathematics anxiety, Non-verbal Intelligence, Class Room Environment, and Socio-Economic Status as covariates for the Total sample, Boys and Girls.

21. There will be significant difference in the adjusted mean scores of Mathematics anxiety between the Experimental and control groups by considering Pre-test Problem solving ability, Pre-test Perceptual Speed, Non-verbal Intelligence, Class Room Environment, and Socio-Economic Status as covariates for the Total sample, Boys and Girls.

Methodology in Brief

The methodology adopted for the present study is briefly as follows. The design and sample are as follows.

Design of the Study

The present study comprises mixed methods. It incorporates a preliminary survey on problem solving ability, Perceptual speed and mathematics anxiety of secondary school students and preliminary survey of secondary school mathematics teachers and then the experimental study. The researcher employed the Quasi-experimental design with the Pre-test post-test nonequivalent group design. This design encompasses one experimental group and one control group.

The present investigation aimed to compare the effectiveness of two methods of instruction on the enhancement of student's problem solving ability, perceptual speed and reduction of mathematics anxiety. The investigator used the Quasi-experimental design with the Pre-test post-test nonequivalent group design. The two groups were equated by problem solving ability, perceptual speed, mathematics anxiety, Nonverbal intelligence, Classroom environment and Socioeconomic status. The experimental group is taught through Brain compatible learning strategy and the control group is taught through the existing method of teaching.

The layout of the design is as follows

The pretest-posttest Non-equivalent- Group design (Best & Kahn, 2006)

O1 X O2

O3 C O4

O1 O3 = pretests

O2 O4 = posttest

X exposure of the group to an experimental (treatment) variable

C exposure of a group to the control condition

O observation or test administered.

Samples Selected for the Study

In the preliminary survey of secondary school students, the investigator collected data from a sample of 400 Secondary school students, of which 149 were coastal area secondary school students and 251 were non-coastal areas secondary school students in the Kozhikode district with purposive sampling technique and in the preliminary survey of secondary school mathematics teachers; by using purposive sampling technique the investigator collected data from 30 secondary school mathematics teachers from Kozhikode district. In the experimental study, the two intact classes of Standard VIII were selected from two different coastal area secondary schools from the Kozhikode district. Two intact classes from Umbichy Hajee Higher Secondary School with 54 students from standard VIII were selected as the experimental group and two intact classes from Government Vocational Higher Secondary School from Payyanakkal with 54 students were selected as the control group respectively.

Tools used for the Study

The investigator used the following tools to accomplish the present study.

Questionnaire on Teacher's Perception towards Prevailing Strategies and Methods, Constraints and Suggestions in Teaching Mathematics (Aruna & Lisheetha, 2019)

The questionnaire was prepared for secondary school mathematics teachers to gather information on prevailing strategies and methods that they are using while doing Mathematics instruction in the class, the constraints faced by them while doing such innovative strategies in the classroom and their valuable suggestions for improvement of mathematics teaching in secondary school level. Teacher's opinions were collected through a questionnaire for validation.

Lesson Transcript for Brain Compatible Learning Strategy (Aruna & Lisheetha, 2020)

The investigator prepared a lesson transcript for a Brain compatible learning strategy with the help of a supervising teacher from the selected chapters of the standard VIII mathematics textbook of the Kerala syllabus. Brain compatible learning design is prepared based on seven staged Brain based planning outlined by (Jensen, 2008)). In the present study, the Brain compatible lesson transcript is presented in three phases. Phase one includes three stages, phase two includes one stage, and phase three includes three stages.

Lesson Transcript for the Existing Method of Teaching (Aruna & Lisheetha, 2020)

Existing method of teaching is the present strategy practiced in the Secondary schools in Kerala state. The lesson transcripts were prepared based on the existing method of teaching, which was validated by the experts in the field.

The Test of Problem Solving Ability (Aruna & Lisheetha, 2019)

The test of problem solving ability in mathematics was developed and standardized by Aruna and Lisheetha, (2019). It was administered in the preliminary survey of secondary school students and used as the pretest and post-test before and after the treatment, respectively.

Test of Perceptual Speed (Aruna & Lisheetha, 2019)

The test of perceptual speed was developed and standardized by Aruna and Lisheetha (2019). It was administered in the preliminary survey of secondary school students and used as the pretest and post-test before and after the treatment respectively.

Mathematics Anxiety Scale (Aruna & Lisheetha, 2019)

The Mathematics anxiety scale is a five-point Likert scale developed and standardized by Aruna and Lisheetha (2019). It was administered in the preliminary survey of secondary school students and used as the pretest and post-test before and after the treatment respectively.

Standard Progressive Matrices Test (Raven, 1958)

Nonverbal intelligence is one of the control variables of students. The Nonverbal intelligence of the control group and the experimental group was measured using the standard Progressive matrices test developed by Raven (1958.) The test consists of five subsets of 12 items, each including diagrammatic puzzles to solve.

Classroom Environment Inventory (Aruna, Sureshan &Unnikrishnan, 1998)

The main purpose of the tool was to get a fine picture of the classroom environment. The individual dimensions used for the construction of the classroom environment inventory were material Environment. Cohesiveness, Task orientation,

Innovation, participation, Teacher support, personalization, Independence, Order and organization, Teacher control, Friction, and competition.

Socio-Economic Status Scale (Aruna & Sumi, 2010)

The socioeconomic status scale was used to obtain the socioeconomic status of the students of the experimental group and control group, It is an expanded form of a general datasheet. The general data sheet is divided into five sections. The investigator depends on the education, occupation and income of the mother and father or guardian to fix the socioeconomic status score of the family.

Statistical Techniques used for the Study

Basic Descriptive Statistics

Basic descriptive statistics such as mean, median, mode, standard deviation, skewness, and kurtosis were used to calculate each variable in the study for the total sample, boys and girls separately.

Mean Difference Analysis

Mean difference analysis was used in the survey for analyzing the variables component and in the experimental study it was employed to check whether there exists any significant difference between the experimental group and control group.

Percentage Analysis

Percentage analysis was used to find out teacher's perceptions towards prevailing strategies, methods and constraints in teaching mathematics.

Single Factor ANCOVA

Single factor ANCOVA was employed to study the main effect of the independent variable and to avoid the unnecessary influence of the other uncontrolled independent variables.

Effect Size (Cohen's d and partial eta squared)

Effect size is a simple way of quantifying the effectiveness of a particular intervention relative to some comparison and may therefore said to be a true measure of the significance of the difference. It is an important tool for reporting and interpreting effectiveness, (Cohen's d, 2002)

Bonferroni's Post Hoc Analysis

Bonferroni's Post Hoc analysis was conducted to find out the statistical significance of the dependent variable by controlling the covariates.

Scope of the Study

As it is common knowledge, the majority of secondary school students find mathematics to be an extremely challenging subject. This is due to their perception that mastering mathematics is exceedingly challenging. This might be the result of the instructor's various teaching philosophies, the pupils' intellectual prowess, or their aptitude for solving problems. The literacy percentage among those living along the seaside is quite low when we take into account their educational circumstances. This might be the result of ineffective teaching methods in challenging areas like mathematics and a lack of motivation in learning. Teachers at coastal secondary schools have to find appropriate models, techniques and approaches to raise the Caliber of mathematics instruction and student performance. The purpose of the preliminary survey on secondary school students' problem solving ability, perceptual speed, and mathematics anxiety was to compare the problem solving ability, perceptual speed and mathematics anxiety components of students from coastal and non-coastal area secondary schools. Based on the survey data, we deduced that secondary school students in non-coastal locations had higher problem solving ability, perceptual speed, and lower mathematics anxiety than their

coastal counterparts. We thus decided to carry out experimental research at secondary schools near the seaside.

The primary goal of this study was to determine whether or not secondary school students in the coastal region could solve problems more quickly, perceive information more accurately, and experience less anxiety when using a Brain compatible learning strategy instead of the current teaching approach. The present study opted for a quasi-experimental methodology, specifically utilizing a pre-test-post-test non-equivalent group design. For the current experimental investigation, the proper tools, methods and resources were employed. Given that math teachers can apply the study's findings in the classroom, the researcher is happy with the outcome. This analysis focused on two strategies: the current teaching approach and the Brain compatible learning strategy. The teaching of mathematics is positively impacted by the Brain compatible learning approach. In the current educational environment, several tactics are used in response to various learning scenarios. It is clear from looking into the conditions in the coastal region schools that most of the advanced approaches to teaching and learning have not yet reached the secondary school pupils in the coastal area. For this reason, to raise the standards of mathematics education and instruction for students at Coastal area secondary school, greater emphasis must be paid to teaching and learning.

Research in the field of Brain compatible learning has shown that this method of instruction provide lower stress, encourage critical and creative thinking, improve motivation and give students an encouraging learning environment. It may provide an opportunity for a range of settings and learning methods. Engaging the appropriate brain networks is the key to keeping a student's attention. Ensuring that students participate in the classroom or other learning settings also activates the pleasure-related brain region. Instead of just remembering knowledge, we learn

better when we pay attention to what we see and hear and physically engage with it. Our neurons fire more vigorously when we are having trouble paying attention, trying to retain our focus on the material we are learning.

Brain compatible learning is mostly dependent on the processing mechanism of the brain. The brain's assumption that context will increase neuronal activity during pattern making learning is crucial to this. The brain groups relaxing occurrences into hierarchies and categories by using the information in the context of previously acquired and stored knowledge. The brain's ability to operate normally is essential for learning. Our chances of succeeding in our educational endeavors increase when we appropriately stimulate it. To put it briefly, our ability to learn improves with increasing brain knowledge. Therefore, Brain compatible learning may be regarded as beneficial for both teachers and students in improving students' capacity to solve problems, speed up their perception, and lessen their anxiety related to mathematics in secondary schools in the coastal area.

Limitations of the Study

The variables chosen for the current study have received enough consideration from the researcher. With sufficient care, a thorough examination of the literature and earlier research on the chosen factors were carried out. There could be certain limits even when the researcher has carefully planned every step of the experimental process, including choosing the variables, implementing strategies, administering tools, procedures, and materials, and carefully assessing the findings. Two coastal secondary schools in the Kozhikode district provided the sample. Two secondary schools in the Kozhikode district that are located near the coastal area made up the sample. One school's two intact classes were regarded as the experimental group and the other school's two intact classes were regarded as the

control group. One school is designated as the control group, and other school were designated as the experimental group.

However, using analysis of covariance, the study was able to statistically control for any initial differences in pre-experimental status regarding problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, socioeconomic status, and classroom environment, ensuring a valid result. Despite all efforts to reduce the impact of unrelated factors, the researcher still anticipates that the study's findings will be broadly applicable.

Only three chapters from the required mathematical textbooks made up the topic chosen due to time restrictions. The results may only apply to the state of Kerala because the curriculum was derived from the required texts for students studying under the Kerala syllabus. The representation of secondary school pupils in the coastal area is restricted to the VIII grades in this study. This research solely looks at the VIII standards as a representative of secondary school pupils in the coastal area.

The dependent variables of the study include the researcher's ability to solve mathematical problems, perceptual speed and mathematics anxiety; the independent factors are instructional tactics such as Brain compatible learning and current teaching methodologies. The variables that were chosen were thought to be more relevant to the researcher's time restrictions among the cognitive and emotional factors that influence learning. If properly handled, may have resulted in the gathering of additional information from larger samples, accounting for more complex factors and providing appropriate interpretation. Despite the limitations, the researcher made every reasonable attempt to ensure that the current study was as valid as feasible. The current study's goal is to positively impact trials on Brain compatible learning strategies in mathematics education, according to the researcher.

The Organization of the Report

Six chapters comprise the current study. The following is an explanation of each of these chapters.

Chapter 1: Introduction

This chapter goes into detail regarding the need and significance of the study. Statement of the Problem, definitions of key terms, variables. The study's objectives and hypotheses. The methodology was all adopted, study's scope and limitations. The report's structure is outlined in the latter portion of the chapter.

Chapter 2: Review of Related Literature

This chapter's first section describes the variables' theoretical foundation in depth. Brain compatible learning strategy, Problem solving ability, Perceptual speed, and mathematics anxiety. The review of relevant research on learning strategies brain compatible learning strategies, problem solving ability, perceptual speed and mathematics anxiety is covered in length in the second section.

Chapter 3: Methodology

The variables of the study, the description of the design, the tools utilized, the sample chosen for the study, the data collection procedure, the scoring and consolidation of the data and the statistical techniques used for the investigation were all covered in depth in the methodology of the study.

Chapter 4: Analysis

The results of the data collection and statistical analysis are presented in the analysis chapter. Preliminary and major analyses of the investigation are

included in the statistical analysis. Basic descriptive statistics, mean difference analysis and percentage analysis are all included in the study. ANCOVA with a single factor and Cohen's d test to determine the effect size and the Post Hoc analysis using Bonferroni post hoc analysis.

Chapter 5: Summary, Findings and Conclusion

The study was summarized in this chapter in retrospect. This chapter includes the study's main conclusions, tenability of the hypothesis, limitations and recommendations for further study.

Chapter 6: Recommendation

In this chapter, the study's recommendations are symmetrically documented with the educational implications of the research.

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Chapter -2

REVIEW OF RELATED LITERATURE

- Theoretical Framework of Variable
  - Braincompatible learning Strategy
  - Problem Solving Ability
  - Perceptual Speed
  - Mathematics Anxiety
- Review of Related Studies
  - Studies related to Braincompatible Learning Strategy
  - Studies related to Problem Solving Ability
  - Studies related to Perceptual Speed
  - Studies related to Mathematics Anxiety

REVIEW OF RELATED LITERATURE

A literature review often evaluates the current state of knowledge about a narrowly specified area of education. A reader may learn more about the goal and findings of the study by reading the literature review. Any literature that is pertinent to the issue at hand, such as earlier studies looking into the same variables or related problems, theory references, theory testing empirically and studies of related activities are considered related literature. Education themes that have been well-researched often have a sufficient number of studies pertinent to the area of study. In research, a review of the literature has several uses. The literature is consulted to establish the problem's importance, formulate the research strategy, connect the study's findings to prior understanding and recommend more research.

By conducting a review of the literature

- A researcher can define and restrict the topic
- Situate the study within a historical and associational framework
- Steer clear of accidental and pointless duplication.
- Relevant strategies and tactics.
- Connect the results to prior understanding and recommend more studies.

The current study sought to determine whether Braincompatible learning strategy was more effective than the current teaching approach and to investigate the impact of the learning strategy on the problem solving ability, perceptual speed and mathematics anxiety of Kerala State Standard VIII secondary school students in coastal areas. The investigator has endeavored to thoroughly examine the existing literature about the chosen variables. The following headings list the theoretical aspects and relevant studies.

- Theoretical Framework of the Variables
- Review of Related Studies

The Theoretical Framework of Variables

Braincompatible Learning

A holistic approach to education known as "braincompatible learning" is predicated on the idea that the brain learns naturally, according to recent neuroscience studies. This is predicated on our present understanding of the real composition and operation of the human brain. This kind of education helps to explain recurrent learning tendencies and offers a physiologically based foundation for instruction and learning. It's a meta-concept that incorporates a wide range of eclectic tactics. It's a common misconception that nobody can learn. However, everyone does learn. Every human being is born with a brain that is an incredibly potent processor. Braincompatible learning is important because it minimizes stress on children's learning capacities while optimizing learning. It creates an instant link to the outside world, which promotes learning and growth. It promotes the active processing required to maintain the relationship and strengthen memory (Konecki, et al., 2003).

Anatomy of the Brain

The portion of the central nervous system housed in the skull is known biologically as the brain. The most intricate organ in the body, the brain processes information incredibly quickly. Humans differ in terms of weight and brain size. A healthy adult's brain can weigh anywhere between two and four pounds, with an average weight of three pounds. The brain serves as a processing hub for incoming inputs, even though the entire body is involved in the learning process. As the brain processes sensory information, all of it is subconsciously stored, prioritized, analyzed, stored or discarded. A neuron can register and send 250–2500 impulses

per second. The hue of a typical live human brain is pinkish-beige. The cerebral cortex, which distinguishes the brain's exterior, resembles folds or wrinkles roughly the thickness of an orange peel. The human brain possesses the greatest area of uncommitted cortex of any animal on the planet, endowing humans with exceptional adaptability and learning potential.

Cells of the Central Nervous System

Glial Cells. Glial cells are thought to play a variety of roles, including producing myelin for axons, providing structural support for the blood-brain barrier, facilitating the movement of nutrients, and controlling the immune system. Glial cells are categorized into four main categories. Astrocytes. The following three cell types are important for learning: Schwann cells, microglial cells and oligodendrocytes. Compared to their neuronal counterparts, these cells are clustered in our brains around ten times greater. In terms of their capabilities, roles and significance, glial cells are comparable to neurons.

Neurons. The fundamental structural and functional unit of the nervous system is the neuron. The cell body's three main functional regions are as follows (Soma). The incoming feeder system (dendrites) and the outgoing projection (axon). It uses the electrical charge across its cell membrane, which is made possible by its structure and characteristics, to conduct messages. A regularly operating neuron links one cell to another by firing, integrating and producing information via tiny gaps known as synapses.

Dendrites. Branched-like projections are called dendrites. emerging from the cell's body. They are the ones that receive the information that is transmitted from neurons to individual cells. Neuronal networks or groups are involved in learning.

The cell must reach a certain threshold before it may fire, after which it will remain dormant and no memory will be triggered.

Axon. The eureka moment in learning happens when an axon connects with a dendrite from a nearby cell. The axon repeatedly multiplies and branches out to connect with hundreds of additional cells; neurons function to transmit information. It just has one direction of flow. After receiving inputs from other axons, the dendrites send the data to their cell body. The data then travels to the axon, which uses dendritic branches to transmit it to a different cell. The conductance of information by electrical stimulation and the transportation of chemicals are the two primary roles of an axon. Neurotransmitters are released into the synaptic gap by an electrical impulse that passes down the axon. The molecules pass through the opening and enter receptor sites on the receiving dendrite's surface in a microsecond. The thousands of rapid-fire impulses that are generated every second allow the neurotransmitters to be released, absorbed and reabsorbed. Neurotransmitters can either boost or have no impact on synaptic responses, which can lead to learning impairment or improvement.

Division and the Functions of the Brain

The brainstem, cerebellum, diencephalon and cerebrum are the four distinct sections that make up the brain. Together, they serve as the body's primary command center for movement, thought and response.

Brainstem. The area of the brain below the spinal cord that links to the brain is called the brainstem. It contains the middle oblongata and the ponds among other ill-defined regions. This crucial region controls the instinctive and unconscious actions necessary for survival. like respiration and heart rate.

Cerebellum. The cerebellum is the region of the brain most closely linked to motor control, posture and balance. Whether it's a cognitively rehearsed task

sequence or a gross motor task sequence, the cerebellum may perform predicted and corrective movements.

Diencephalon. The brain area known as the diencephalon is related to the pituitary gland, thalamus, hypothalamus and other minor midbrain structures. Except for smell, the thalamus functions as the main receiving, relaying and storing organ for all sensory data. The hypothalamus carries out several essential tasks. detecting inputs from the surroundings, including stress, noise, humidity and temperature.

Cerebrum. The four main regions of the cerebrum are referred to as lobes. Frontal, parietal, occipital, and temporal. The occipital lobe is principally in charge of vision, strong visual-auditory connection and connecting visual and language regions. The frontal lobe is engaged in intentional behaviors such as decision-making, imagination, planning and problem solving. Higher-order sensory and language processing are among the tasks performed by the parietal lobe. It is the temporal lobes that are in charge of meaning, language, hearing and memory. Although the functions of the lobes overlap.

Brain Physiology. The physiological research on the optimal ways for the brain to learn forms the basis of braincompatible learning. Neurones, which are billions of nerve cells, make up the brain. An electrochemical mechanism is used to transfer information between neurons. Neuronal connections are redundant, overlapping webs of flexibility. Excited neurons generate routes and patterns in response to both internal and external inputs. Neurons with more frequently utilized routes or patterns become more robust. The likelihood that the pattern will recur increases with its strength. New connections between neurons are formed when many routes and patterns are excited simultaneously. enhancing the brain's capacity for learning in the process.

Every brain is different. Individual experiences are what establish the link between cells and learning is influenced by both genetic and environmental variables. The brain's music is learning. The brain is wired to look for significance. When cognitive, emotional and psychomotor information are processed together in the brain learning occurs most effectively. Learning is improved when the brain is challenged or threatened. It goes back into fight-or-flight mode, which hinders learning. A key component of learning is paying attention with focus. The brain's inherent process is learning. The brain performs survival processes. Formal institutional standardized instructions are not inherently built into it. The best learning results come from introducing several instruction domains at once. The learners' new knowledge must apply to them. The brain either consciously or unintentionally considers education to be unnecessary If something is irrelevant, there is less opportunity for learning.

Learner motivation is significantly influenced by emotions. Learning comes from the brain's innate self-motivation. The neuronal pathways and patterns that are strengthened by internal self-motivation are more likely to be utilized again. Extrinsic motivation practice reinforces brain pathways and patterns that guarantee reusability. This suggests that a focus too much on techniques of external motivation may lead to a decline in self-motivation. The following are some of the most fascinating concepts that have emerged from the study. The brain is malleable from birth, which means that it may adapt its chemistry and structure to its surroundings. Genetics and environment have equal roles. Genes control how the environment is understood, while the environment influences how genes function. The brain looks for relationships. During several developmental stages, the brain is predisposed to acquire specific skills. Four to ten years old is known as the "wonder years of learning" since this is when the brain is most active. Early childhood education and parent education initiatives are supported by brain research.

History of Braincompatible Education

There have been crude models of the functioning of the brain for 2000 years. The brain was compared to a city switchboard until the middle of the 20th century. In the 1970s, right and left brains were mentioned in brain theory. Afterward, the idea of the "triune brain"—a word Paul Mc Clean used to describe how the human three-part brain evolved—was presented.

According to McLean's theory, survival learning occurs in the lower brain lies in the brain's base. Higher-order thought occurred in the upper brain, whereas emotions were located in the midbrain. Neuroscientists have been conducting research that might lead to better teaching practices for the past 20 years. Neuroscience is now so dynamic that this relationship although secure will undoubtedly expand and alter and enhance the educator's function and will increasingly be taken on an extra and brainbased dimension that ties education and brain research. In Hart's words, (1978) the most sophisticated mechanism known in the cosmos is the human brain.

The most current brain research lab studies in neuroscience, as well as data from autopsies, experiments, and other scans – such as MRI, EEGS, PET, and CAT scans – are the foundation of neuroscience. This knowledge has aided in the understanding of how brain learning takes place. Renate Nummela Caine and Geoffrey Caine, the authors of Making Corrections: Teaching and the Human Brain (1991) and Education on the Edge of Possibility (1997), are two of the many proponents of Hart's strategy for teaching with the structure and function of the brain in mind. Using a list of twelve "brain-mind learning principles, " they developed the concept of braincompatible learning. According to Caine and Caine, these principles combine data from several areas linked to learning and the brain and present it in a

way that educators can use. The twelve principles serve as the theoretical cornerstone of learning that is compatible with the brain.

Principles of Brain-compatible Learning

Caine and Caine (1991) have proposed the following concepts of Brain Compatible learning and its implications for education. These ideas offer a broad theoretical framework for learning that is compatible with the brain. By removing them from conventional frames of reference and assisting them in designing and choosing suitable programs and approaches, these concepts aid educators in rethinking the way they educate.

Principle One: The Brain is a Parallel Processor. The brain continuously carries out several tasks at once (Ornstein & Thompson 1984). Concurrent processes involve thoughts, emotions, imagination and predisposition. They communicate with other information channels.

***Implications for Education*.** All the aspects of parallel processing should be "orchestrated" in the classroom, and the ideas and practices that enable this orchestration must form the foundation of instruction. Teachers require a framework that helps them choose among the wide range of approaches and techniques that are accessible, as no single technique or method can fully capture the variances of the human brain.

Principle Two Learning Engages the Entire Physiology. Learning occurs naturally to the extent that it can be aided or hindered. Experience perception and interpretation are closely linked to neuron development, nutrition and synaptic connections. The brain is impacted differently by boredom, challenge, serenity, happiness, and satisfaction than it is by stress and threat. In actuality, life events and education have an impact on the way the brain works.

Implications for Education. Stress management has to be properly integrated into Brain based learning. Incorporate health-related topics such as education, exercise and nutrition into the learning process. The way the body and brain naturally grow has an impact on learning. For instance, brain research indicates that any two typical children can mature differently by five years. For this reason, evaluating accomplishment based only on age is not suitable.

Principle Three: The Search for Meaning is Innate. This implies that humans have an innate need to find meaning. The human brain's fundamental survival instinct is the need to find meaning and make sense of the world around us. The brain simultaneously searches for and reacts to fresh inputs while simultaneously requiring and instinctively registering the familiar. Every waking moment is spent in this dual process and part of it even happens while you sleep. The notion that humans create meaning is supported by more brain studies. Meaning-seeking cannot be put an end to; it can only be directed and concentrated.

Implications for Education. A stable and comfortable learning environment is essential for brain-based education. It should also be able to satiate the brain's insatiable curiosity and need for novelty, exploration, and challenge. Programs for bright children already mix a rich environment with complicated and significant tasks. The majority of the innovative teaching strategies employed with talented children ought to be implemented with all pupils.

Principle Four: The Search for Meaning Occurs Through Patterning. Information structure and classification are referred to as patterns. The brain functions as a kind of hybrid scientist and artist, trying to identify and comprehend patterns as they arise and expressing original, creative patterns of its own. The brain is not amenable to having meaningless patterns imposed upon it .since it is designed to recognize and create patterns. When the brain's innate ability to integrate

information is acknowledged and used in the classroom, a great deal of initially unrelated or seemingly random information and activities can be presented and assimilated. By meaningless, we mean isolated bits of information that are unrelated to what makes sense to a particular student.

Implications for Education. In one way or another, learners have patterns constantly. We can only change their course; we are unable to stop them. Even if we choose a large portion of the curriculum for our pupils, we should provide the material in a way that makes it easier for the brain to identify patterns rather than trying to force them. Time spent on a job does not guarantee proper patterning since students may be working on busy tasks while their minds are elsewhere. A student has to be able to make meaningful and personally relevant patterns for education to be truly successful. The people who support whole language reading instruction, theme-based learning, curricular integration and learning techniques that are relevant to everyday life are the ones who most obviously identify this kind of instruction.

Principle Five: Emotions are Critical to Patterning. Our motivation to study and create comes from our emotions. They inhabit our feelings. Our passion is them. They are an integral component of our humanity. We must accept them and learn more about them. Emotions and expectancy-based mindsets shape and structure what we learn. individual preconceptions and biases, self-worth and the requirement for social connection. Emotions and thought are therefore inextricably linked. Emotions are important for memory since they help with recall and storage Features. Every daily lesson or experience can have lasting emotional effects lasting long beyond the original occurrence.

Implications for Education. Instructors need to be aware that students' attitudes and moods will influence their learning and shape it in the future. They have to guarantee that the emotional atmosphere is encouraging and characterized

by acceptance and respect for one another. This concept is supported by cooperative learning strategies. Metacognitive strategies and student and teacher reflection ought to be promoted. The genuineness of the support that educators, administrators and students provide to one another determines the emotional tone of teacher-student interactions.

Principle Six: Every Brain Simultaneously Perceives and Creates Parts and Wholes. The brain's left and right hemispheres differ from one another. No matter what a person is doing—words, math, music, or art—the two hemispheres interact intimately in a healthy individual. The two-brain theory is valuable because it compels educators to recognize the brain's independent yet concurrent inclinations toward information organization. One is to break down such data into smaller components. The alternative is to see and handle it as a single whole or as a collection of wholes.

Implications for Education. Since learning is cumulative and progressive, effective teaching acknowledges this and gradually increases students' understanding and skill sets. Parts and wholes, however, interact conceptually. They provide each other with purpose. Therefore, when vocabulary and grammar are integrated into real, whole-language experiences, they are most easily grasped and acquired. In a similar vein, it is better to discuss mathematics and scientific ideas about life science.

Principle Seven: Learning Involves both Focused Attention and Peripheral Perception. The information that the brain is immediately aware of and is focusing on is absorbed by it. Additionally, it immediately takes in signals and information that are beyond the immediate field of view. These may be things like the drab, gray walls of a classroom that one sees out of the corner of their eye. A

hint of a grin or little changes in body posture are examples of extremely light or subtle signals that are inside the field of attention but are nevertheless unconsciously perceived as peripheral stimuli. This indicates that while educating or communicating, the brain reacts to the whole sensory environment.

Implications for Education. Visuals like charts, graphics, set designs, and artwork, even magnificent pieces of art, are examples of peripherals. The use of music to promote and encourage a more organic way of learning has also grown in importance. Teachers' ought to pique students' interests. Students' enthusiasm through their modeling, coaching and enthusiasm to send the right unintentional signals about the significance and worth of what they are learning. It's critical to show our true emotions and to live out our beliefs. Instead of pretending, since learners are always able to detect and interpret our genuine inner state, we should be real.

Principle Eight: Learning Always Involves Conscious and Unconscious Processes. We gained far more knowledge than we could ever fully comprehend. The majority of impulses that our peripheral senses pick up enter the brain subconsciously and interact with one another. We don't only recall what we are taught; we also remember what we experience. Thus, instruction should be planned to maximize pupils' benefits from unconscious processing. This is accomplished in part through education and in part by addressing the peripheral situation.

Implications for Education. Students who actively break down information can go back and examine what they learned. For them to start managing how they learn and how their meaning develops. It alludes to introspection and metacognition. To assist students in understanding the content in personally relevant and important ways, teachers might support active processing by creatively developing processes

and ideas using metaphors and analogies. For instance, a student may become aware of his or her preferred learning style.

Principle Nine: We have two Types of Memory: A Spatial Memory System and a Set of Systems for Rote Learning. We possess an innate system of spatial memory that does not require practice and enables instantaneous recall of events. At a minimum, this memory system is intended to record our experiences in the typical three-dimensional environment. The system is never-ending and continually active. With time, it becomes more comprehensive as we expand our knowledge of natural categories and processes. The system is driven by innovation. One of the mechanisms that propels the hunt for significance is this one. When facts and abilities are handled separately, the brain organizes them differently and requires a lot more repetition and practice. A collection of systems created especially for storing comparatively unrelated information is the spatial memory system's equivalent. We rely more on rote memory and repetition the more knowledge and abilities are isolated from past experiences and knowledge. The information processing concept of memory, which suggests that all new information must be processed before it is stored, informs how this system approaches function. However, focusing too much on remembering and storing disconnected data is an ineffective way to use your brain.

Implication for Education. Multiplication tables, spelling, and a set of concepts with an overemphasis in certain areas are common examples. An excessive focus on these methods impoverishes the student, hinders the transmission of knowledge and most likely impedes the growth of comprehension. Teachers obstruct the learner's brain's ability to operate effectively by disregarding their personal lives.

Principle Ten: The Brain Understands and Remembers Best when Facts and Skills are Embedded in Natural Spatial Memory. It is molded by social contact as well as internal processes. That's an illustration of how meaning is assigned to certain objects. Adopting this kind of embedding improves education when it is woven into everyday experiences. The one most crucial thing that the new brainbased models of learning how to have in common is embedding.

Implications for Education. The greatest way to elicit spatial memory is usually through experimental learning. A strategy that is more highly regarded in some cultures and social strata than others. Instructors ought to incorporate a lot of real-world experiences into their lessons, such as projects, field excursions, visual representations of certain events, drama, the relationship between various disciplines, and so forth. Grammar may be acquired through stories or writing, much as vocabulary can be experienced through skits. It is possible to merge science, math and history to understand and assimilate far more knowledge than is currently the case. Utilizing all senses and exposing the student to a wide range of intricate and dynamic experiences is essential for success. Instructors shouldn't steer clear of lectures and analysis.

Principle Eleven: Learning is Enabled, Enhanced by Challenge and Inhibited by Threat. The brain "downshifts" in response to perceived dangers, yet learns best when given proper challenges. According to phenomenology, when we feel threatened, we become less adaptable and resort to automatic, frequently more basic habitual actions. The limbic system's hippocampus, on the other hand, appears to act in part as a relay hub connecting the brain to the rest of the body. The area of the brain most vulnerable to stress is this one. We lose access to parts of our brain when we detect a threat, most likely due to the hippocampus's high sensitivity.

Implication for Education. Instructors and administrators have to make an effort to instill in their pupils a sense of calm awareness. This implies that they must create an environment that is both strong in challenge and low in threat. Both the instructor and the teachings must consistently embody this condition. The level of relaxed alertness is influenced by every strategy the instructor employs to design the learning environment.

Principle Twelve: Each Brain is Unique. All brains have similar processes, such as the senses and fundamental emotions but they are integrated differently. Furthermore, the more we learn, the more unique we become since learning alters the structure of the brain.

Implications for Education. To enable all pupils to express themselves visually, tactilely, emotionally or auditorily, instruction should be multimodal. The option should also be flexible enough to pique each person's attention, which may include rearranging educational institutions to better reflect the complexity of real life. Education must support the best possible brain function. To achieve optimal productivity, teachers in a Brain Compatible classroom can employ a variety of Brain Compatible tactics. Caine and Caine claim that practicing and exploring may be done in a variety of exciting and challenging ways. A plethora of tools and methods are at our disposal in the shape of games, simulations and multimedia technologies. The many arts and entertainment are appropriate when they stem from immersion.

Brain Compatible Teaching Ideas

Brain Compatible teaching includes certain ideas as follows

- Start with prior knowledge
- Incorporate movement
- Use colour to code information (up to 25% boost in memory).

- Keep in mind that it's simpler to remember the first and last items.
- Create seven sections and a fifteen-minute focus period.
- Think and talk; whoever explains gains knowledge.
- Stress the importance.
- Conclude by having students consider clarity and relevance.

Brain Compatible Planning Strategies

One of the main proponents of Brainbased learning in education is Eric Jensen. Because the fundamental tenet of Brain Compatible learning is that each brain is different, Brain Compatible lesson preparation does not adhere to a predetermined format. The general tactics listed below represent Jensen's (2008) brain-based approach to lesson design. A more thorough set of instructions that corresponds to the seven stages of learning comes after them.

Stage 1: Pre-exposure. Before delving further, this step gives the brain a summary of the new information: Better conceptual maps are developed by the brain with pre-exposure.

- Put a synopsis of the new subject on the notice board. For this, mind maps are more effective.
- Provide memory techniques and abilities for learning to learn.
- Serve as an example and practice life skills, coping and self-esteem.
- Establish a solid immersion learning atmosphere.
- When organizing morning and afternoon activities, take the time of day, the brain cycle and rhythms into consideration.
- Learn about the interests and backgrounds of the students; begin at their current level of expertise.
- Assign students to create personal objectives and have class goals discussed for every unit.

- Post lots of vibrant accessories such as inspirational sayings.
- Schedule mental "wake-ups. "(For instance, do cross-laterals and stretch and rest every hour).
- Create activities that allow pupils to roam about.
- To establish a solid, pleasant connection with the students, clearly communicate your expectations while allowing them to express their own.

Stage 2: Preparation. This is the point at which you arouse interest or enthusiasm. It is comparable to the "anticipatory set, " but it prepares the student much more.

- Establish a "You are there" experience to provide students with a foundation in reality.
- Establish the background for the subject (this might be a reiteration of the synopsis, the traditional "big picture").
- Find out from the students what potential significance and value the subjects hold for them individually. Before they will assimilate the knowledge, they need to have a connection to it. Invite them to discuss whether they think it's significant or not. First, tangible experiences are very effective in helping the brain learn.
- Offer something substantial, tangible or solid.
- Include intricate interdisciplinary connections throughout the lesson.
- Use a "hook, " a surprise or a little something different to pique the learner's interest.

Stage 3: Initiation and Acquisition. The immersion is provided by the stage. Overflowing with information. Provide a virtual overflow of concepts, details, complexity and meanings at first, rather than a presentation that is unique, lockstep,

sequential and one bit at a time. Permit students to experience momentary overload. A sense of expectation, inquisitiveness and a will to find significance for oneself will follow. With time, the students come up with some creative solutions. You are correct if that sounds like learning outside of a classroom. Yes, it is.

- Offer tangible educational opportunities.
- Offer tasks that make use of most, if not all of the many intelligences.
- Provide a team or group project that involves creating, analyzing, investigating or designing.
- Participate in theatre productions, skits, commercials or class or school newspapers.
- Offer enough options so that students may investigate the material using the visual, oral, kinesthetic and other preferred modes of learning.
- At this point, a well-designed computer program may be useful.

Stage 4: Elaboration. This phase is known as processing. It calls for sincere consideration from the student. Now is the moment to interpret the knowledge with a critical mind.

- Conduct an unstructured debriefing of the preceding task.
- Connect the dots to enable cross-disciplinary learning.
- Students create their own learning rubrics or evolution procedures.
- Encourage students to research the subject in the library or online.
- View slides, watch a movie or attend a play on the subject.
- Encourage discussion in small groups and ask them to report back to the class as a whole.
- Make mind maps for yourself, your group or both using the new information.
- Organize a panel discussion, essay competition, debate or school forum.

- Have a time for questions and answers.
- Assign pupils to teach others. (For instance, as pair speakers in small groups or during class).

Stage 5: Incubation and Memory Encoding. At this point, the value of relaxation and review time is emphasized. The best learning occurs gradually, not all at once in the brain.

- Allow time for introspection and rest without direction.
- Assign students to maintain a learning diary.
- Ask students to debate the subject while going on a stroll in pairs.
- Offer relaxation and stretching techniques.
- Establish a space for listening to music.
- Request that students share their new knowledge with friends and family.

Stage 6: Verification and Confidence Check. Students must verify their own learning at this level in order for the teacher to benefit as well. When students can relate new ideas or materials to a model or metaphor they retain new information better.

- Ask students to share what they've learned with others.
- Request that students review and interview one another.
- Encourage students to create summaries of their learning.
- Ask learners to use a project to showcase their learning.
- Allow students to act in a skit, role play or theatrical production.
- Give learners a written or spoken quiz.

Stage 7: Celebration and Integration. Engaging emotions is crucial at the celebration stage. Make it enjoyable, jovial and joyous. This phase cultivates the vital passion of learning.

- Hold a class toast.

- Allocate time for sharing.
- Blow horns, hang streamers and play music.
- Ask a different class, parents, the administration or visitors from the community to observe the project.
- Oversee the planning and execution of a celebratory party in class.
- Use the new knowledge in the next classes. Don't waste time on something you don't think is essential enough to bring up later; if it's not, don't introduce it.

Brain Compatible Learning and Classroom Environments

The following is based on an examination of studies conducted by different researchers. The elements of a Brain Compatible classroom paradigm.

Lack of Threat. The limbic system may be considered the limbic brain's emotional core will prevent learning from happening. They should be placed in a setting that makes them feel comfortable and protected. Since emotions focus attention, which in turn sets the scene for learning, it is important to provide an environment where students may engage their emotions (Parry & Gregory, 2003). It is important to support pupils in taking chances and providing solutions without worrying about being mocked. Rather than demeaning them, we should assist them in feeling welcomed.

To Reduce Tension by Posing Suitable Challenges. According to Scheibel (1994), lessons retained are superior to those learned in a stress-free setting when they are taught under pressure. While some stress is good for you, too much stress might prevent you from learning. Stress levels must be maintained at an optimal level for students to learn well while maintaining their sense of self-worth and

personal effectiveness. Students should be given a customizable project that poses challenges at different skill levels without being overly intimidating.

Curriculum Contents with Meaning. Students should be assisted in connecting the curriculum's content to other subject areas and the actual world for it to have significance. The design of the material should be imaginative, practical and emotive with a topic that is relevant to their age. Using an interdisciplinary approach and teaching one another students can learn (Radin, 2005)

Engaging in Exercise. Equally significant is the psychomotor component of a child's personality domain. In a classroom, the cognitive domain rules. Even so, physical exercise promotes brain growth but its benefits are more general than particular; the brain needs the psychomotor domain to grow to its full potential. Getting moving generally helps the brain grow because it provides the brain with glucose, which is its primary energy source, according to Gabbard, a Texas A & M University professor of motor development (2008). According to Buckley's citation of Raboli, who concurs with this viewpoint, mobility is necessary to improve learning.

Giving Prompt and Pertinent Feedback. When emotional arousal is at its highest, children are best able to acquire reasoning, thus they must receive timely feedback that is suitable for their reactions and development.

Giving Enough Time. Enough time and encouragement should be given to the children to react. By providing them with guidance when needed, forming cooperative groups in place of individualistic ones and providing the group with adequate time one may encourage them to think creatively.

Structural Organization. Either a "U"-shaped or round table should be used for interactive seating. Each group can have a chair set aside for the teacher

so that the teacher can participate in the group as needed. Multiple intelligences should be used in a variety of teaching and learning methods in an enriched environment taking into account individual variances.

Phases of Teaching- Learning Process

Three stages of the teaching-learning process are described by Caine & Caine (2001),

Orchestrated Immersion. Creating learning settings that completely submerge students in an educational experience while keeping their attention on the context as a whole and making the necessary connections is known as orchestrated immersion.

Relaxed Alertness. The goal of relaxed alertness is to help students overcome their fear of danger while still providing a very demanding environment. It consists of two parts: internal motivation needed to raise learning to high levels and overall relaxation. Every child is valued regardless of their unique learning preferences, skills, or impairments. There is a laid-back, welcoming vibe throughout the space. Students are challenged to reach their full potential.

Active Processing. Allowing the students to actively analyze knowledge allows them to internalize and solidify it. It is best understood as an emphasis on meaningful learning as opposed to memorizing. It is the theoretical structuring and assimilation of meaningful knowledge by learners. Before starting a unit of study, the instructor sets the stage by getting the pupils ready to connect new material to what they already know so that the new information has something to hang onto (Jensen, 2000; Caine & Caine, 2001).

Brain Compatible Strategies

The several Brain Compatible tactics include Drawings, art work and brainstorming sessions. excursions for fields. Music, movement, experimentation, games and graphic organizers. Cooperative learning, problem and project-based learning, teaching in pairs, rhyme and rhythm. Acting, narrative, technology, work-study, assignments, role-playing and apprenticeships. etc.

Brain Compatible Curriculum

A curriculum content development, classroom design, atmosphere and assessment should all consider the brain. This is known as Brain Compatible approach. Jensen (2008) asserts that the curriculum has to be designed with a strong sense of logic and the Brain Compatible concept in mind. Social fluency, personal development, artistic expression, information literacy and scientific inquiry are all valued in the curriculum.

Social Fluency. Every learner acquires the necessary set of social skills to engage in constructive communication with others in the world. The following subjects should be covered as part of the social fluency component of the curriculum.

- Intelligence in emotions.
- Respecting differences.
- Language proficiency.
- Occupational literacy.
- Identities that are spiritual or religious.
- Consistent family practices.
- Collaboration or teamwork.
- Resolving disputes.

Personal Development. Gaining the inner strength or ability to reach one's full potential is essential in a culture that prizes creativity and accomplishments. The curriculum should include the following topics in this aspect.

- Managing stress.
- Level of physical fitness.
- Reflection and metacognition.
- A feeling of direction and significance.
- Dietary practices, health and nutrition.
- Establishing and achieving goals.
- Acquiring knowledge of talents
- Individual and moral obligations

Artistic Expression.

- Students should be introduced to a variety of artistic mediums and ideally get formal training in a few of them. The media listed below should be included in this curricular element.
- Audio.
- Writing and storytelling,
- dance, sculpture, theatre, sports, crafts, hobbies and design.
- Visualization.

Information Literacy. For survival, humans require accurate, comprehensive and easily available information. The purpose of this curricular element is to cover the following areas of expertise.

- Composing and reading.
- Scavenging and collecting abilities.

- Modification of cognition.
- Presentation and speaking abilities.
- Technology and digital skills.

Scientific Inquiry. The most insightful minds are familiar with the components, equations, guidelines and forces that govern the natural world. The curriculum should include the following topics in this aspect.

- Environmental research
- Studies on the future or the world, Physics, Biology, Chemistry and Mathematics.

Brain Compatible Assessment. Expanding our methods of assessment is necessary to ensure that students gain from an impartial and genuine evaluation procedure. An effort to shift from quantity to quality of learning is shown in the old Indic evaluation. A foundation for genuine assessment is provided by the next five areas.

- Content – what students already know.
- Emotions (how students feel about it).
- Context (how students make sense of it).
- Processing (the way students work with data).
- Embodiment (depth of learning; application by learners).

These domains encompass history, present and future in addition to mind, body and heart. Students can use a variety of mediums to communicate what they know, including maps, diagrams, lists, conversations, actions, debates and demonstrations.

Problem Solving Ability

Problem Solving

Definition. When a problem solver is faced with a scenario for which there is no apparent solution, problem solving is the cognitive processing that is focused on converting the given circumstance into a desirable situation. Four main concepts are involved in this definition. First of all, problem solving is cognitive, meaning that it takes place inside the problem solver's mind or cognitive system and can only be deduced indirectly from the way the problem solver behaves. Second, the process involves fixing problems. In other words, it entails making changes to the problem solver's knowledge within their mental system or cognitive operations on internal symbolic representations. Thirdly, the process of addressing problems is directed, meaning that its goal is to find a solution. Fourth, overcoming problems that is, the challenge of changing a particular state is an individual endeavor. An issue with a purpose

Theoretical Approach to Problem Solving

Associationism, Gestalt psychology and computer simulation have been the three main theoretical strands in the scientific study of problem solving throughout history.

In line with the associationist perspective the exercise of a series of pre-existing linkages in the issue solvers' related network can be defined as problem solving. The main task in problem solving is to apply strategies based on the strength of current connections until the issue is resolved by trial and error (Thorndike, 1898). Anagrams including popular words like Ugars (sugar), for instance are simpler to solve than anagrams involving less frequent ones, like Cobra. Probably due to the higher associative connections with frequent terms (Tresslet & Mayzner, 1966). The Gestalt perspective states that problem solving begins with the

recognition of a problem and can be defined as an exploration for structural insight or an understanding of how the components of the problem fit together to meet the objectives of the goal. Mentally putting the problem's components into the goal's framework is the primary creative effort in problem solving. The key realization in this issue is that to achieve the goal's functional criteria, each stick must be a component of two triangles, requiring the utilization of three-dimensional space as opposed to two-dimensional space.

The Gestalt psychologist made several significant advancements to our knowledge of problem solving. The idea that stages of problem solving involve successive reformulations of the problem, including an increasingly more specific representation of the given state and the goal State of the problem was first introduced by Gestalt psychologists (Wertheimer, 1959). Second, they distinguished between reproductive thinking, which applies pre-existing solution procedures based on past experiences to a new problem and productive thinking, which generates a novel solution to a new problem (Duncker, 1945). A third Gestalt psychologist offers proof that rigidity in problem solving, such as the incapacity to utilize an object in a novel way can be brought about by prior experiences (Luchins, 1942; Duncker, 1945).

The computer simulation approach states that solving problems entails using a set of strategy guidelines to direct the exploration of a problem space. The provided state, the desired state and any potential intermediate state that may be created by applying the operators to each state are all represented in the issue space. The following is how "means-ends analysis, " a popular search technique (Newell & Simon, 1972), operates: When a solution to the problem is readily apparent, it is implemented. If not, lowering the difference is the sub-goal set by the problem solver. If the problem solver discovers an action that can be applied immediately

between the current state and the objective state, it is executed. If this is not the case, the issue solution creates a sub-global that eliminates all limitations on using the action and so on.

Simon and Newell (1972) computer-based means-ends analysis simulation, there are three main sorts of subgoals that are established by the search rules. One is "Transform state A into state B, " where the issue solver finds differences between the two states by comparing the problem's present state and the intended state. Second, "minimize the D difference between state A and state B. " When the problem solver "applies operator Q to a state A, " either a new state is created or the problem solver finds new constraints that prevent applying the operator. In the first scenario, the operator is found that can be applied to one of the states to lessen the differences between States and three. Recent developments in cognitive science, especially those in artificial intelligence ideas that build upon or are inspired by the groundbreaking research of Newell and Simon (1972) have given rise to fresh insights into the characteristics of problem-solving in both people and computers. Especially the most cutting-edge and pertinent problem-solving methods for illustrating planning and knowledge processes in both inexperienced and skilled problem solvers.

Steps in Problem-solving

John Dewey characterized thinking as a problem-solving process and analyzed the steps involved.

A Felt Difficulty. Reasoning occurs only when a person is faced with certain issues. Therefore, he must encounter a specific challenge for which there needs to be a fix. It might be a difficulty with theory or practice.

Locate and Define Difficulty. The location and definition of reasoning constitute the second phase. In addition to describing or expanding on the issue, this

requires analysis of the problem or difficulty and tracking it down to a precise location. In this endeavor, a student's background and aptitude are taken into consideration. Students can't even start fixing an issue unless they have identified exactly where it is.

Locate, Evaluate and Organize Information. It makes sense that the person would want to know everything there is to know about a situation before beginning to reason about it, which requires gathering facts. Data should be categorized and structured after it has been gathered and assessed.

Evaluation of Hypothesis. Concept classification aids in revealing hidden patterns in the data, which a person may use to assess any theories they may have developed while trying to solve an issue. To do this, a person starts by formulating certain hypotheses, which are then either supported or refuted by more data that comes to light.

Apply the Solution. The application of influences or solutions to the problem must come next since it is only then that the validity of the inference can be established.

The Problem Solving Cycle

The process of fixing problems has been characterized by psychologists as a cycle. (Hayes, 1989; Sternberg, 1986; Bransford & Stein, 1993). The following steps make up the cycle:

- Identify or recognize the problem.
- Mentally define and depict the problem.
- Formulate a plan for a solution.
- Arrange what they know about the problem.
- Devote physical and mental resources to the problem's solution.

- Track their advancement toward the objective.
- Check the correctness of the solution.

The cycle is descriptive; it does not imply that addressing problems always follows this exact sequence of steps. The processes are called "forming a cycle" because, when they are finished, they typically result in a new issue that requires repeating the previous phase.

Classes of Problems

Problems may be classified into two categories: well-defined issues and poorly defined difficulties. An issue is considered well-defined when its objectives, course of action, resolution, and possible hurdles are evident from the available data. The absence of a clear solution route is a defining feature of ill-defined issues. The difficulty of defining and representing such challenges is increased by the fact that they frequently lack a clear problem description. There is omission of one or more of these elements. challenge solvers encounter routine difficulties when they have a pre-existing approach for solving the challenge, while nonroutine problems arise when they don't. It's helpful to think of the difference between routine and nonroutine challenges as a continuum where different levels of inventiveness are needed. When solving problems, creativity entails coming up with and assessing original ideas. Creative ideas for presenting the issue or creating a plan of action. It would be impossible to classify as a problem at all an exceedingly ordinary situation when the answer is readily apparent to the problem solver.

Problem Recognition, Definition and Representation

The three meta-level executive processes of problem recognition, description and representation are referred to as meta components. In the Triarchic Theory of Human Intelligence proposed by Sternberg (1985). According to this idea, planning,

observing and assessing the problem solving process allows meta-components to direct problem solving. The meta components consist of the following processes:

- Acknowledging the problem's existence;
- Characterizing the problem; and
- Devoting physical and mental resources to its solution.
- Selecting a representational strategy for issue information.
- Coming up with the series of actions required to resolve the issue
- Integrating these actions into a practical plan for solving the issue.
- Keeping an eye on the continuing problem solving process
- After the problem has been solved, assess the approach taken.

The steps involved in problem detection, definition, and representation are theoretically equivalent to the first, second, and fourth meta-components utilized during the planning stage of problem solving.

Types of Problems

Greeno (1978) distinguished three categories of problems.

Problems with Causing Structure. It happens in situations like series completion and analogy issues, where a problem solver is given a set of examples and has to figure out a pattern or rule.

Problems with Transformation. It happens when a problem solver is given an issue in its original condition and has to figure out the steps that need to be taken to get the problem to the desired state. Examples of these are the Tower of Hanoi problem and the water jar problem (Luchins, 1942).

Arrangement Difficulties. These include anagram and crypt arithmetic problems, in which the problem solver must arrange all of the issue's components to answer the puzzle.

Gilhooly (1982) made a distinction between problems as

- Adversary problems - like chess games and non-adversary issues, which are solved by a single person or by a group of people.
- Inductive reasoning questions are a type of reasoning problem where the solution must infer the rules from the available data.
- Deductive reasoning issues, where knowledge is provided by the application of logically sound techniques by the problem solver.

To arrive at a conclusive result, questions involving inductive and deductive reasoning can be classified as problems of transformation and problems of producing structure, respectively.

Process in Problem Solving

Four interconnected stages make up the problem solving process

- Representing,
- Planning,
- Executing
- Monitoring.

When a problem solver converts the provided problem into an internal mental representation of the givens, objectives and accessible operators in the problem, this is known as the representing process (Mayer, 1983). This procedure is referred to as “understanding the problem” by Polya (1945) and as “an understanding process” by Hayes (1978). Creating a hierarchy of sub-goals to solve the problem is part of the planning process or what Polya refers to as "developing a plan." The issue solver carries out a sequence of activities to carry out the plan; Pólya refers to this process as "carrying out plans." This is the executing phase. The process of monitoring

culminates when the individual tasked with fixing the problem evaluates their progress and ascertains how each action taken fits into the overall solution strategy.

The information that the issue solver brings to the work of solving problems determines how the problem is solved (Mayer, 1985). For instance, factual and linguistic knowledge such as proficiency in the English language is necessary to accurately explain the situation. Strategic and schematic knowledge is essential for effective planning. Examples of the former include understanding issue categories and the establishment of sub-goals. Computational expertise is required for execution. Like being able to subtract and add full numbers. Monitoring is dependent on the assessment abilities of the issue solver, such as figuring out whether two facts are compatible with one another. Lastly, those who solve problems think that the process of addressing an issue may influence the quantity of work required to solve it.

Perceptual Speed

Perception

The process by which information received from the world through the senses is converted into experiences of things, occasions, sounds, tastes, etc. is referred to as perception. Roth (1986, page 81). Every one of the sensory modalities may be used to study perception. The majority of studies and theories have concentrated on how people perceive sound and vision. Although conscious awareness is necessary for perception, there is mounting evidence that substantial perceptual processing can take place even in the absence of conscious awareness.

Visual Perception. To understand and engage with our environment, visual perception uses information on the characteristics and positions of things.

Visual Perceptual Development. This word refers to the way that children's developing perceptual processes and skills evolve systematically. It is common to

distinguish between perception and cognition with the former referring to the fundamental identification and processing of sensory data and the latter to the capacity to derive meaning, order and sense from this data. This entry's main subject is "from sensation to cognition." Accounts that focus specifically on vision. This justification is based on the fact that vision is the modality whose evolution has received the greatest attention and one may argue that it is the most significant sense overall.

Perceptual Set. The active process of perception depends on the idea of a perceptual set. A propensity to see or notice certain aspects of the available sensory input while ignoring others is known as a perceptual set.

Sensation to Perception to Cognition. Cognitive development starts at birth and is supported by the senses. Data for the progressive arrangement and building of a logical universe. Making the distinction between perception and cognition is never simple. Early perceptual competence is matched by cognitive incompetence and the growth and creation of cognitive structures that provide access to the world of things, people's language and events is crucial for the recognition of perceptual representation.

Theoretical Approach to Perception

The relative contribution to the impression of a top-down, conceptually driven process and a bottom-up, data-driven process is a significant theoretical concern. According to theoretician Gibson (1972), the stimulus is a very rich source of information and usually contains all the data needed to generate genuine perception. Constructive theorists have maintained that conceptually driven processes are important for perception, in opposition to Gibson's (1972) emphasis on data-driven processes. Though they seem to anticipate that perception should be more prone to mistakes than it is, these theories explain the visual illusion.

Some theorists of perception have focussed on the perception of relatively particular categories of stimuli, whilst other theorists have focused on the general principle of perception. which are crucial in daily life; speech for instance is a highly essential auditory stimulus and human faces are a crucial visual stimulus.

In the last fifteen years or more, there has been a growing focus on taking cognition into account while analyzing perception, cognitive science and neuropsychology. Agnosia and blindsight are two conditions that cognitive neuropsychologist's study (Weikrantz, 1986). The cognitive theory of perception has found a home in the study of brain-damaged people. Marr (1982) and other cognitive scientists have created a large number of computer applications intended to mimic the way that perception is processed by humans. Many of the lacunae in the earlier theories of perception advanced by cognitive psychologists have been demonstrated by these programs.

Top-down Approach. A constructivist, or "top-down, " theory of perception was put out by Gregory in 1970. He maintained that there must be intermediary mechanisms between sensation and our conscious sense of reality. These kinds of processes would be outside the realm of sensory evidence. The immediate registering of a feeling is only one aspect of perception; another is the interplay of external events between stimulus and experience.

According to psychologist Richard Gregory (1970), top-down processing is necessary for perception to be a constructive process. The stimulus data we get from our surroundings is sometimes difficult to comprehend; to conclude what we see, we need higher-order cognitive data, which might come from experience or prior knowledge.

Bottom-up Approach. A "bottom-up" approach known as the direct theory of perception was put out by Gibson in 1966. As perception starts with the stimuli,

bottom-up processing is often referred to as data-driven processing. From the retina to the visual cortex, processing proceeds in a single direction, with each step of the visual pathway analyzing the data in ever more complex ways.

According to Gibson's bottom-up approach, perception is facilitated by natural processes that have developed during evolution, negating the need for learning. This implies that perception is essential to existence since, in the absence of perception, our surroundings would be extremely hazardous.

Mathematics Anxiety

Early in the 1950s, math instructors' findings sparked the attention of researchers in mathematics anxiety. Dreger and Aiken coined "mathematics anxiety" in 1957 to characterize students' attitude problems with the subject (Baloglu & Zelhart, 2007).

Math anxiety is a tense emotion that makes it difficult to work with numbers and solve mathematical issues in academic and real-world contexts. Pupils of all grade levels frequently feel anxiety or phobias related to mathematics as a result of bad experiences in previous or present math classes or just a general lack of confidence when it comes to numbers. It seems to affect girls more often than boys (Smetackova, 2015; Divine et al., 2012).

Anxiety related to mathematics evokes fear of some kind. Or maybe it's the fear of failing, which frequently results from having or the concern that one won't be able to complete the computation or that it will be too tough. People with marks frequently have low self-esteem, worry and a fear of failing, which makes it easy for their thoughts to go blank and result in further irritation and blanks. Many students experience increased anxiety as a result of the additional strain of time limitations on mathematics exams.

How inadequate one's grasp of mathematical ideas without any conceptual knowledge, they could primarily rely on memorization of procedures, regulations and routines which could lead to panic attacks. Although math skills might be just as difficult as any other learning impairment, it's crucial to keep in mind that these children have normal neural systems for computation. Their main requirement is assistance in substituting the potential of success for the memory of failure.

No matter where the worry comes from, low achievement and low math grades are the most common outcomes. Any kind of biological worry triggers the body to produce the hormone cortisol into circulation, which may be one factor contributing to the subpar performance. Heart rate rises and other bodily signs of worry develop; cortisol's primary job is to concentrate the brain on the cause of the anxiety and to decide what steps to take to reduce stress. As this is going on, the frontal lobe appears to be more concerned with an individual's safety than it is with learning or understanding mathematical procedures. As a result, the learner experiences the irritation of being unfocused and is unable to concentrate on the current learning activity. Additionally, anxiety impairs one's capacity for working memory, which is necessary for manipulating and remembering numbers and their expression (Trezise & Reeve, 2014; Vukovic et al., 2013).

Theories Related to Mathematics Anxiety

Traditional Arousal Theory. According to conventional arousal theories, the center of the arousal dimension represents the ideal degree of arousal. An inverted U-shaped curve that shows a curvilinear link between anxiety and performance can be used to graphically express this notion. According to the arousal theory, worry can sometimes improve performance but eventually becomes a hindrance. (Ma, 1999)

Numerous scholars have observed the non-linear correlation between worry and mathematical achievement, which is the opposite of Munz and Smouse's (1968) finding. According to the U-curvilinear theory, there is an ideal level of arousal for carrying out a certain job. This concept states that those who are mildly nervous do better than those who are neither affected nor excessively impacted. (Bessant, 1995)

Two-factor Theory of Test Anxiety. The first two-factor model of test anxiety that made a distinction between the cognitive concern dimension and effective emotionality was developed by Libert and Morris (1967).

Affective Test Anxiety. Refers to the emotional aspect of anxiety that manifests as tenseness, dread, terror and uncomfortable physiological reactions to test conditions.

Cognitive Anxiety. Refers to the concern aspect of anxiety, which is frequently shown as a fixation on unfavorable expectations and self-deprecating thoughts over a circumstance that causes anxiety.

It has also been discovered that this two-factor approach, which addresses both affective and cognitive aspects, is pertinent to anxiety related to mathematics. Nonetheless, it seems that there is a different pattern of correlation between the aspects of math anxiety and math performance than there is between test anxiety and performance. That example, it has been shown that the emotional component of math anxiety measures correlates adversely with math performance but the cognitive concern part of general test anxiety is said to negatively correlate with test performance (Ho et al., 2000).

According to Wingfield and Meece (1998), while the cognitive aspect of math anxiety may have some good motivating effects on students' drive to put in more effort and consequently, their performance in mathematics, the negative effective

responses component of math anxiety may be crippling. Then, depending on the person and the work, a reasonable level of anxiety could help with performance. But anxiousness may become crippling to performance beyond a certain point especially when it comes to higher-order brain functions and intellectual processing. Thus, even if anxiety related to mathematics may occasionally have good impacts, it may be more necessary for educators to concentrate on its potential detrimental implications on performance. (Newstead, 1998)

The Linear Relationship between Mathematics Anxiety and Performance. The majority of investigations begin with the simple assumption that worries negatively affect performance. More specifically, a lower accomplishment level is linked to a higher degree of worry. Numerous age groups have shown signs of this unfavorable association. Adults' general and college students' specific proficiency in mathematics is inversely connected with mathematics anxiety. The primary and secondary levels exhibit the same negative association. According to Hembree (1990), who observed an average negative connection among schoolchildren, anxiety related to mathematics significantly impairs performance in mathematical activities and reducing anxiety is regularly linked to increased accomplishment (Ma, 1999).

Research indicates that the notion of test anxiety is the basis of the theoretical explanation of the negative association. Several experts believe that anxiety related to mathematics is a particular kind of test anxiety. Math anxiety is assumed to be supported by theoretical models of test anxiety as well (Ho et al., 2000).

The study of mathematics anxiety has been influenced by two theoretical models of test anxiety.

Interference Model. Mandler &Sarason (1952) and Wine (1971) have both interpreted mathematics anxiety as a disruption of the recall of previous mathematical knowledge and experience, drawing on the work of Libert and Morris (1967). Consequently, low accomplishment is a result of increased worry. Ma (1999).

Deficit Model. According to Tobias (1985), excessive anxiety in mathematics is caused by bad performance. since it is a memory of earlier arithmetic failures. This paradigm attributes a student's low math success to poor study habits and exam taking techniques rather than math fear (Ma, 1999). This approach does not attribute poor performance to math anxiety. In contrast, mathematics anxiety is brought on by an awareness of prior performance shortcomings.

Relationship between Mathematics Anxiety and Mathematics Achievement. Students from varied social and intellectual backgrounds will have radically different relationships between mathematics achievement and mathematics anxiety. The. Students' social and intellectual traits seem to be crucial in understanding this achievement anxiety dynamic. Relationships are diverse and distinct when student traits are as well. Anxiety related to mathematics can help or hinder or have no connection to arithmetic performance (Ma, 1999).

While it is acknowledged that anxiety can play a motivating role and so improve performance, (WigField & Meece, 1988), anxiety related to mathematics is also known to hurt higher-order mental processes like problem solving and divergent thinking (Newstead, 1998).

Cognitive Processing and Maths Anxiety. An alternative method for researching math anxiety is provided by cognitive psychology. Students with high math anxiety scores scored poorer on an accomplishment exam in mathematics, according to research by Ashcraft et al. (1998). However, after doing a more thorough analysis of the achievement test results, they discovered that the simpler

test segment, which consisted of whole-number arithmetic questions, did not exhibit any impact on math anxiety. The only time anxiety effects were shown was when the items got harder. The group identified a specific distinction between high and low math anxiety groups in prior experiments. The high group took a lot longer to finish arithmetic tasks that were a little challenging. We concluded that performing out calculations or any other procedural part of arithmetic might put a significant strain on working memory.

The mental processing system requires conscious effort (Ashcraft, 2002, p. 183). Processing efficiency theory served as their primary theoretical framework (Eysenck & Calvo, 1992). According to this, anxiety interferes with task performance because people who experience it focus more on their intrusive thoughts and feelings than on the work at hand. Their ability to do math tasks effectively is impacted by these intrusive ideas to the extent that working memory is required. They concluded that this could help explain why participants with high levels of anxiety perform comparably to less nervous people on basic math problems but significantly worse on more challenging things.

Alleviating Mathematics Anxiety. Five strategies are recommended by research studies to reduce arithmetic anxiety and raise math proficiency among students (Beilock & Maloney, 2015; Powell, 2015; Finlayson, 2014; Geist, 2010).

Teacher's Attitudes. When educators present mathematics as a wonderful human invention that benefits society and other academic fields, they may foster a positive attitude in both themselves and the students they teach.

Curriculum. Less significant material is cut from the mathematics curriculum to focus on developing a better comprehension of the core subjects and provide tasks that continuously challenge students to apply what they've learned to novel concepts.

Instructional Strategies. One of the primary causes of mathematics anxiety is teaching methods that emphasize "explain-practice-memorize," which places more emphasis on memorizing than on comprehending the topic and logic involved.

Classroom Culture. Teachers provide an environment where children feel free to explore ideas, learn new things, and ask questions. Encourage students to make meaning of what they are learning rather than merely memorizing steps or processes, discourage the value of speed over time for contemplation, and create a climate where students feel comfortable taking risks and won't feel accepted for providing incorrect answers.

Assessments. Include a variety of evaluation techniques, such as oral, written or demonstration forms, and give feedback that emphasizes work over aptitude to help students maintain their confidence in their capacity to become better.

The therapy for math anxiety, if it is recognized as a personal phobia, will probably involve a psychologically based intervention, such as systematic desensitization, with the nervous person. If, on the other hand, anxieties are thought to arise from the way the subject is presented or taught or from the way language represents the number system or if anxieties are connected to only certain parts of the subject and not others, then it appears that the issue can be resolved without pathologizing the learner and without having to intervene. Math anxiety can be lessened by modifying the workload that a mathematical activity exerts on working memory, according to "Cognitive Processing and Math Anxiety. "

Review of Related Studies

Studies Related to Brain Compatible Learning

Procopio et al. (2024) carried out a study on using games to build information and communication technologies based on neuroscience in primary school mathematics. an assessment of a case study. 28 pupils ranging in grade from third to sixth made up the sample. The results show a notable discrepancy between the student instructors' preconceived beliefs and the reality of teaching mathematics. In addition to highlighting the necessity for thorough comprehension and implementation of neuroscientific concepts to enhance learning results, this work offers new opportunities for integrating neuroscience into education, notably through game based learning.

El-Sayed and Al-Mahari (2023) conducted research using Brain Compatible learning theory to foster inductive reasoning and mathematical proficiency. The experimental investigation included 74 Oman sixth-graders as a sample. The findings suggest that using the theory of learning compatible with the brain while teaching mathematics had a noteworthy effect on the participants' growth of accomplishment and inductive reasoning.

Rasheed and Hanafy (2023) examined how executive functions and mental habits of young children at risk for learning problems were affected by Brain based training. Utilizing a sample of forty students (twelve females and eight males in the treatment group), the study used a quasi-experimental pretest, post-test, and follow-up approach. 9 men and 11 women make up the control group. The findings suggest that brain based training is an effective strategy for improving cognitive processes and habits in children who are at risk of learning impairments.

El-Sayed (2022) performed experimental research to determine how using Brain Compatible learning theory-based method affected the development of numerical scientific abilities in Oman's basic education standard pupils. The sample comprised seventy fifth-grade kids from schools located in Salala City, Oman, each grouping thirty-five. The design of a quasi-experiment was used. The post-test results indicate a statistically significant difference ($p < 0.01$) between the experimental group's and the control group's primary grades. Use of the numerical sense skill test to support learning that is compatible with the brain.

Salim and Ameer (2022) explored the effects of a Brain Compatible instructional learning design on the systematic thinking of female first-intermediate math students. There were 37 students in the experimental group and 38 students in the control group that made up the sample. The outcome demonstrated that, in comparison to the control group, the Brain Compatible model group outperformed itself and displayed noteworthy variations.

El-Wakeel et al. (2022) evaluated the literature that was indexed by Scopus using bibliometric analysis. Several scientometric methods were utilized to map, illustrate, and evaluate research papers in the article, which focused on brain based learning in design and visual arts education. The research looked at patterns in yearly publications. The study's findings on productive organizations, prolific writers, authorship patterns, relevant sources and funding agencies across nations indicated a downturn in Brain based learning research in the fields of design and visual arts education. A few publications that connect visual arts and Brain based learning design.

Bada and Jita (2022) Provided a comprehensive analysis of how Brain based learning has been incorporated into scientific classrooms. Finding out if applying Brain based learning has major effects on science (biology, chemistry, math, and physics) instruction at the elementary and secondary school levels was the primary

goal of the review. Twenty-five peer-reviewed journals were chosen for this review. The results showed that the integration of Brain based learning in the classroom has mostly involved the use of quasi-experimental research and that Brain based learning has been mostly integrated with mathematics.

Jang et al. (2022) examine the research on. Brain based learning for human resource development and adult education. The study examined recent research on Brain based learning from 1985 to 2019 that covered subjects related to adult education and human resource development. It is seen to be a significant issue in overcoming misunderstandings regarding the neurobiology of learning using theme analysis. The results provide useful advice on how human resource managers and adult educators may successfully implement neuroscientific techniques.

Lagoudakis et al. (2022) researched the impact of a Brain Based learning technique on biology students' performance in a classroom setting. Using a pretest and post-test, quasi-experimental study method was employed. Ninety-seven seventh-grade children from public standard schools in Athens, Greece (53 males and 44 females) made up the sample. The experimental group's mean scores were much higher and academic performance was enhanced by the teaching strategy that included Brain Based learning components.

Amjad et al. (2022) analyzed the impact of a brain-based learning technique on the mathematical performance of primary school pupils. A single subject A-B-A research design was used in the study. Sample drawn from public school eighth grades. The findings showed that Brain Based learning had a big impact on students' academic achievement. The researchers advised educators to use Brain Based learning activities based on principles while instructing primary school students in mathematics.

Bhaurao and Hrushikesh (2022) examined how well Brain Based learning initiatives affected secondary school pupils' attitudes toward mathematics as well as

their arithmetic performance. A sample of 720 ninth-grade students from both urban and rural Maharashtra State Board Schools and schools connected with the CBSE were used in the study. The study's chosen design, which included the pretest-post-test control group, was overly experimental. The outcome demonstrates that Brain-Based learning program outperforms the traditional approach in raising students' achievement and attitude toward mathematics.

Larsen and Deans (2022) investigated the attitudes of educators and their use of Brain Based learning at a single Australian primary school where the pedagogy is particularly grounded in neuroscience. Fourteen educators provided survey data. The findings demonstrated that, despite being founded on neuroscience, primary school teachers in Australia held a mixed bag of ideas about brain-based learning that were impacted by neuro myths.

Wiantara et al. (2020) investigated how well Brain-based learning model supported by crossword puzzles affected students' comprehension of scientific topics and ability to think critically. The quasi-experimental study design with a non-equivalent post-test control group design was used. The sample comprised five classes with 129 pupils each from five primary schools. The findings demonstrated that science instruction in elementary schools can benefit from the application of Brain-based learning model that uses crossword puzzles to enhance students' conceptual understanding and critical thinking abilities.

Kumar (2020) performed experimental research to determine "the effectiveness of Brain Compatible learning on high school students' achievement in social studies." 89 high school students enrolled in the CBSE stream's grade IX make up the study's sample. There were 44 pupils in the experimental group and 45 in the control group. Pretest, post-test, non-equivalent parallel group experimental design was the methodology employed in this investigation. The outcome demonstrated the

superiority of Brain Compatible learning over traditional approaches in the field of social science and its beneficial impact on academic performance.

Jithin (2019) investigated the impact of accelerated learning and Brain Based learning strategies on standard nine students. Social science proficiency. The non-equivalent group pretest post-test comparison group design was the methodology employed in this investigation. There were eighty students in the sample. The findings demonstrated the efficacy of both Brain Based learning and accelerated learning strategies in promoting correct comprehension and lucidity of the fundamental ideas employed in social science education. When taught using a brain-based learning technique, pupils may do better than those taught using an activity-oriented method when it comes to grasping social science concepts.

Mastoni (2019) examined how junior high school students and math teachers at the Junior High School of SMP Assahil Lampung Timur learned mathematics in the 2018–19 academic year. Both qualitative and quantitative descriptive analyses were employed in this study. The results showed that incorporating brain-based learning strategies and intrapersonal intelligence into junior high school mathematics instruction will help to improve students' mathematical learning outcomes.

Anupamamol (2018) researched the creation of Brain Compatible learning designs for students in Biotechnology for higher secondary schools. 110 pupils from Standard XII made up the study's sample. Pretest, post-test, and delayed post-test non-equivalent group designs were used in this investigation. As demonstrated by the results, the Brain Compatible learning group outperformed the field study learning group. Regarding retention power on the science process competence, they are using.

Kosar (2018) examined the perceptions of young adult learners regarding Brain Compatible learning and their plans to implement these principles. Twenty-

seven University Preparatory School students, ages 18 to 21, made up the sample. They received instruction for four and a half months using a Brain Compatible learning approach. Participants participated in a semi-structured interview and completed a questionnaire. The study's findings demonstrated that participants had a favourable opinion of Brain Compatible learning and intended to keep using Brain Compatible concepts in the future.

Balaa and Hassan (2018) explored how Lebanese children in grades four and five performed when solving problems using Brain Compatible methodologies. Forty-five students made up the sample; twenty were in the control group and twenty-five were in the experimental group. The outcome demonstrated a significant difference in the mean differences between the pre- and post-statistics scores of high-achieving and low-achieving students in the experimental group. Only on word problem solving in arithmetic, which benefits underachievers.

Paul (2017) investigated the impact of the Circles of Learning Strategy and the Brain-Based Learning Strategy on math achievement and standard eight students' self-efficacy. Three whole eighth-grade classrooms with forty students made up the sample for this investigation. A quasi-experimental design using the non-equivalent group, pretest, Post-test, control group and comparison group design was administered. One of the study's primary conclusions was that, in terms of improving student success and self-efficacy, Brain-based learning techniques outperformed activity-oriented and circular learning strategies.

Olaoluwa and Ayantoye (2016) examined how Brain-based teaching techniques affected deaf or hard-of-hearing students' academic achievement in mathematics. The quasi-experimental design, with a pretest-post-test control group, was used. 41 pupils from Nigeria's Oyo School of Handicapped made up the sample. The study's conclusions showed that a Brain-based educational technique was

superior to the traditional approach in reducing students' anxiety and fear of exams in terms of enhancing their attitudes toward mathematics. Because students who are deaf or hard of hearing can employ a variety of instructional materials that are suitable for their brains, the teaching-learning process in mathematics has been greatly shortened.

Studies Related To Problem Solving Ability In Mathematics

Fitriana and Waswa (2024) have performed an investigation into the impact of a practical approach to mathematics instruction on students' capacity for mathematical problem solving. A quasi-experimental study design using a post-test alone methodology was employed. The cluster random sampling approach was used for the sampling process. The results showed that learners in the experimental group were better at solving mathematical puzzles than those in the control group. With more relevant and real-world material, this method enhances students' learning experiences while also helping them become better mathematicians.

Dilip and Kumar (2023) examined secondary school students' problem-solving ability in mathematics about their mathematical aptitude and self-concept. 482 ninth-grade students from Varanasi city's UP and CBSE board secondary schools made up the sample. The findings revealed a multiple correlation of 0.456 between mathematical aptitude, mathematical self-concept and problem solving ability, suggesting a modest level of linkage between these three factors.

Ramalu (2023) examined secondary school students' aptitude for mathematical problem solving ability about their mental health, anxiety and attitude toward mathematics. The study used a sample of 1000 secondary school students from 30 schools in the Adilabad area of Telangana for a normative survey. The findings showed that (i) secondary school pupils could solve mathematical problems at a level above average. (ii) Students in secondary schools had a poor opinion of

mathematics; (iii) students in secondary schools generally had good psychological health. (iv) The research indicates that mathematics anxiety is comparatively low among secondary school pupils.

Santosa et al. (2023) examined students' aptitude for solving mathematical problems according to their gender and level of mathematical resistance. Findings showed that students' mathematical problem-solving abilities are still lacking. Qualitative research design and deliberate sampling techniques were used with six research subjects in class VIII SMP Negeri 5 Tanjung Jabung Timur based on three categories of mathematical resilience and gender. Low problem solving ability is caused by low mathematical resilience.

Firmansyah and Syarifah (2023) performed research on the significance of problem solving abilities in mathematics education and how different factors, such as learning styles, impact them. It explains how children who study visually, auditorily, or kinesthetically might solve problems. The sixth-semester student was the sample that was chosen. Two pupils from each of the three learning styles—visual, auditory, and kinesthetic—were chosen to participate in the study, which involved a total of six children. Results indicate that visual learners can plan, organize, carry out and double-check solutions to problems. Auditory learners have trouble double-checking their responses but they can comprehend, plan and execute.

Safitri et al. (2023) examined students' aptitude for solving math problems while learning online during the COVID-19 epidemic. The research used a descriptive qualitative methodology. Students enrolled in SMA Negeri 2 Lubuk Basung's class X for the 2020–2021 academic year made up the sample. The findings indicated that 15%, or five pupils, have extremely excellent problem solving abilities. The percentage of students that can solve problems well is 30% or 10 students. Seven students, or 22 percent of the students, have intermediate abilities in problem

solving. Six students or 18% of the students have poor problem solving abilities. Five students, or fifteen percent of the class have poor ability to solve problems.

Supu (2023) researched enhancing mathematical problem solving abilities using the mean end analysis methodology. This study is a type of action research in the classroom. A set of 29 junior high school students from Kabila Junior High School, who were in the 7th grade, made up the sample. The findings indicate that student's ability to solve mathematical problems was enhanced by the mean end-analysis learning approach and that greater student and teacher activity led to better test scores.

Widodo et al. (2023) emphasized the value of developing students problem solving ability in mathematics through practical mathematics instruction at all educational levels, including elementary, junior high school , senior high school and postsecondary education. The research employed a purposive sampling strategy. A meta-analysis using a sample of twenty papers from the National Journal is the study methodology. The meta-analysis's findings demonstrate that at the primary school level developing students' ability to solve mathematical problems using realistic-based learning has an effective size of 0.90 (high effect). The medium impact at the junior high school level was 0.63. At the secondary school level, 0.23 (little impact). The average value of the effective size at the university level is 0.38 (a minor influence) between the educational levels of elementary school, junior high school, high school and college.

Karlina (2022) examined students' aptitude for using the Polya technique to solve mathematical problems. Qualitative descriptive research design was the method used. Two low-achieving students from Semester five made up the sample. Problem solving-related course content was given to the pupils. The study's conclusions demonstrated that students' capacity for problem solving when it comes

to tackling narrative issues is deficient. Pupils have difficulty grasping the issue and putting the right solutions into practice.

Siska and Fauzi (2022) investigation into evaluations of the research about higher-order thinking capabilities and students' aptitude for problem solving ability in mathematics. It contains questions from a variety of learning paradigms, such as exploration and problem based learning. The findings of the analysis showed that problem based learning and discovery learning models might help students become more adept at solving problems in mathematics. The most effective learning approach to employ is problem-based learning.

Safitri and Suryani (2022) performed a study at Nyemplak Boyolai on the examination of cognitive abilities in arithmetic problem solving SMA students. The research employed a survey methodology, utilizing a sample of 150 students from four high school courses who met the tenth standard. According to the findings, 23% of pupils had strong metacognitive skills when it came to problem solving ability in mathematics. The metacognitive skills of 57% of the pupils were inadequate for solving mathematical issues. In general, pupils' use of cognitive abilities to solve mathematical problems is subpar.

Nanda and Usman (2022) investigated junior high school pupils' aptitude for problem solving ability in mathematics. A descriptive qualitative technique was employed in the investigation. Sixth graders from SMPNI Meureudu made up the sample. The findings indicated the student's mathematical ability to solve problems is still low.

Fulop (2021) evaluated the impact of including problem solving techniques within the curriculum-mandated mathematical material. The study used a quasi-experimental method and the sample was chosen. Swedish Upper Secondary School. The study focused on teaching problem solving abilities that are

incorporated across the curriculum, which has important implications for practitioners and other educational designers looking to improve students' problem solving abilities.

Milan (2021) examined the connection between secondary school students' aptitude, interest in math accomplishment and problem solving abilities. The research employed a descriptive and correlative approach, utilizing a sample of 688 ninth-grade students from Karnataka's government schools. The research findings indicate a weak positive link between ninth-standard students' success and their capacity to solve mathematical problems, their aptitude for solving problems and their interest in the subject, and their accomplishment in mathematics.

Kumar (2021) studied at how active learning techniques affected secondary school pupils' arithmetic performance and capacity for problem solving. 156 students were included in the experimental design of the study. Eighty pupils from Mandya City's ninth standard made up the control group while seventy-six students made up the experimental group. The results show that students' overall academic performance is improved and that there is a favourable correlation between problem solving abilities and mathematical accomplishment.

Bindhu (2021) carried out a survey type enquiry. The sample comprised 1290 standard nine students in the Y. S.R. Kadapa district of the state of Andhra Pradesh. Nine-standard student's problem solving abilities are influenced by their surroundings. The results showed that mathematical achievement had an impact on ninth-grade students' ability to solve problems and emotional intelligence had an impact on the same.

Vidad and Quimbo (2021) examined the challenges that students faced when solving problems by applying a design research methodology and a four-

phase model-building framework. (i) Examination; (ii) Development; (iii) Validation or implementation; and (iv) Assessment. The sample was selected using the purposive selection approach and included 297 respondents from 425 institutions that were engaged in the model development stage. According to the study, educators ought to assign problem solving exercises to their pupils that center around the stages at which they find it most difficult. According to this study, teachers should let their students use the coping mechanisms that they find most effective to improve their performance when solving problems in mathematics.

Khalid et al. (2020) researched how teaching mathematics through creative problem solving might improve students' creativity and problem solving abilities. This study used a sample of 172 students using a quasi-experimental approach. from four Malaysian educational institutions. For the majority of the creative and problem solving exam areas, the results revealed a statistically significant improvement in scores. To improve students' problem solving abilities in mathematics, this study gathered together educators and researchers to explore innovative problem solving abilities for teaching mathematics.

Surur et al. (2020) examined the problem solving abilities of students who received varied instruction using group discussion and problem solving learning approaches. The research employed a non-equivalent control group design in a quasi-experimental setup. The example came from MA. Badrul Arifin Situbondo's class 9. The outcome has shown that students using the problem solving model in their studies were more adept at solving problems than students using the group discussion approach.

Jusra and Iskandar (2020) inquired into how pupils felt about their capacity to problem solving ability in mathematics. The study used a sample of 79 eighth-grade students using the descriptive qualitative research approach. The findings

showed that while most students had a moderate degree of excitement for mathematics and self-regulated learning, they also exhibited low levels of anxiety and low levels of self-confidence.

Ghatak and Mittal (2019) delved into review-based research to determine the connection between students' academic success and their capacity for problem-solving. Reviews of several studies showed that boys are better at problems solving ability than girls and that academic achievement is positively correlated with several characteristics, including personality, study habits, behavior, learning styles, scientific mindset, intellectual capacity, exam anxiety and so forth.

Studies Related to Perceptual Speed

Peters et al. (2024) investigated that Cognitive tiredness does not affect the processing of visual perception. The study measured perceptual processing speed before and after cognitive fatigue, math and memory or non-fatiguing documentary film intervention using a visual inspection time test. Verifying the inclusion of cognitive tiredness. The results indicate that cognitive tiredness does not significantly affect the speed at which information is processed perceptually and that response delays may be the cause of cognitive fatigue-related increases in reaction times.

Gabriel (2023) explored Perceptual-motor training for mathematical proficiency in pre-adolescent children was investigated, along with a comprehensive evaluation of intervention research. A selection was made for a systematic review of cross-sectional intervention studies. The study's conclusions provide an overview of the available data supporting and refuting the hypothesis that there are causal relationships between mathematical skills involving magnitude and quantity

recognition and fine motor abilities. Weak evidence in Favor of these relationships was discovered.

Closser (2023) persisted in researching the relationship between perceptual signals and inhibitory control in arithmetic performance examines the effects of visual cues, such as spacing on students' performance in arithmetic tasks. College students participated in the online experiment and the results of an exploratory study on a performance measure that incorporated accuracy and reaction time showed that issue type and inhibitory control interacted. The findings imply that mathematical performance is influenced by visual cues, however, this influence is complicated and involves interactions between inhibitory control and perceptual signals.

Vecchione et al. (2023) performed research on the field of dependence-independence mediating the relationship between mathematics and visual perception. a cross-sectional investigation including children and young teens. The study investigated the connections between field-dependent or independent cognitive styles, mathematics and visual perception. The Ninety-eight students from Rome, Italy's public schools made up the sample. The findings showed that in pre-adolescence, visual perception and mathematics are mediated by field-dependent independence. Results showed that the cognitive style of field-dependence-independence strengthens the beneficial relationship between mathematics and visual perception.

Fang and Zhou (2022) perception speed was studied because it is important for understanding how nonverbal numbers relate to arithmetic fluency. 227 fifth-graders who were selected and split into two experimental groups at random made up the sample. The group engaged in a varied stimulus duration for the identical

figure-matching task. Either 400 or 1000 milliseconds. The 400 milliseconds group outperformed the 1000 milliseconds group in arithmetic fluency according to the results. The association between arithmetic fluency and nonverbal number sense might be explained by form perception which was only tested in the 400 milliseconds group.

Clark et al. (2021) investigated that in those with neurodevelopmental conditions, the association between math performance and attention is mediated by their perceptual reasoning skills. 137 students who were diagnosed with a neurological developmental disorder and took part in a school-based study made up the sample. The results showed that for students with a neurological developmental abnormality, perceptual reasoning moderated the association between attention and math ability.

Zhang et al. (2021) conducted research on the characteristics of children with various forms of mathematics learning disabilities in terms of their visual and auditory perception. The sample comprised primary school students with both auditory and visual arithmetic learning disabilities. All of the students exhibited difficulties with both visual and auditory perceptions, suggesting that they may have had perceptual speed deficiencies when it came to math activities. The results imply that children with visual mathematics learning disabilities have more severe deficiencies in their visual perception, whereas children with auditory mathematics learning disabilities have less severe deficiencies in their auditory perception.

Gnambs et al. (2021) carried out research comparing perception speeds in various learning environments. 3312 students from four German schools—Special, Basic, Intermediate, and Upper Secondary Schools—made up the sample. In

educational examinations, the research was utilized as a perceptual speed test to compare school tracks. The finding shows that perceptual speed may be quantified similarly in special schools, allowing researchers to examine perceptual speed in cognitive functioning components that predict results in real life as well as the schooling effect in the German educational system. Students with cognitive impairments display poor cognitive ability in numerous fields.

Thakur (2020) assessed the attentiveness and visual perception of both typical school-age children and children with hearing impairments. Thirty pupils from nearby schools with hearing impairments and thirty students with normal hearing made up the sample. The findings showed that students with normal hearing, and reading ability correlate with visual motor integration, visual-spatial relation and reading ability. On the other hand, there was a positive link observed in the Visual Motor Integration, Visual Sequential Memory and Visual Closer of hearing-impaired pupils.

Fould et al. (2020), their article used several machine learning models trained on variables derived from TREC Common Core Search task logs to assess whether perceptual speed can be automatically categorized from search activity. Results showed that distinct behavioral elements of perceptual speed assessments assess various facets of an individual's cognitive capacity.

Foulds et al. (2020) researched the constraints, difficulties and suggestions associated with reflecting on perceptual speed assessments in information retrieval. They examined the application of perceptual speed tests in information retrieval in this research and found many perceptual speed ambiguities. management of content, analysis and results reporting. The outcome demonstrates the difficulties in

improving the way that upcoming perceptual speed tests are applied to information retrieval.

Krishnamurthy (2019) researched the relationship between the educational environment and perceptual speed and mathematical success. An investigation at IXth level. A survey design with both exploratory and descriptive purposes was used for the investigation. 960 pupils from 50 Andhra Pradesh schools made up the sample. In comparison to the other dimensions of perceptual speed, the results show that the students require greater training in the areas of number or formula comparison and picture recognition.

Sumana (2019) carried out a study on the part ideas play in perceptual experience. With particular attention to the concept's function in perceptual experience, the research attempts to make sense of perception. The outcome demonstrates that perceptual experiences are inherently conceptual and that gaining a genuine perception of an item without first understanding its pertinent conceptual framework is nearly impossible.

Thambi (2018) researched to determine the impact of a path-smoothening model-based teaching technique on secondary students' creative problem-solving skills, perceptual speed and mathematical success. The study looked at how well a route smoothing model-based teaching technique affected secondary students' capacity to solve creative problems, their perception speed and their mathematical accomplishment. The study used an experimental design, with a non-equivalent group design and a pre-test-post-test layout. 296 eighth-standard pupils from four secondary schools made up the sample. The study's conclusions show that path smoothening is the foundation of the instructional technique. The

paradigm is superior to the current activity-oriented approach for raising students' perceptual speed in terms of gender and managerial style.

Chinta (2018) examined the phonological and perceptual deficiencies that Telugu native speakers had when it came to reading difficulties. The sample comprised 21 dyslexic children out of 63 right-handed students from two Hyderabad primary schools, both with and without dyslexia. According to a qualitative examination of the reading mistakes, Telugu native speakers' dyslexia is caused by impairments in the visual letter detector components, which results in peripheral dyslexia and in the sub-lexical root, which causes vowel letter dyslexia. The outcome demonstrates that dyslexia appears to be a persistent reading deficit rather than a passing one. This implies that while dyslexia may be treated with the right therapies, a person will never be able to match their non-dyslexic peer in terms of accuracy and speed.

Taneja (2016) examined the impact of spatial aptitude and perceptual speed on secondary school students' mathematical proficiency. Five hundred children from two districts in Haryana who are in grade IX make up the sample. The findings clearly show that pupils enrolled in government schools have a strong positive link between their perceptual quickness and their mathematical ability.

Krichevest et al. (2014) in this paper, they examine the visual process that enables the pursuit of images as mathematical idea representations. Expert mathematicians, university students, and schoolchildren made up the sample. The outcome demonstrates the basic interlacing of conceptual structures and visual processes, the latter of which are arranged by preexisting knowledge.

Li and Cai (2014) carried out research on how a digit's perceptual processing speed is affected by its numerical magnitude. The first trial in the research included judging the temporal order of two digits, while the second experiment involved judging if digits were present concurrently. The study's conclusions showed individuals see small numbers more quickly than large ones. Test tasks involving simultaneity judgment and temporal order judgment entail distinct cognitive systems.

Studies Related to Mathematics Anxiety

Wahyuni (2024) performed a bibliometric analysis in research on mathematics anxiety in mathematics education. Biblioshiny tools and the VOS viewer were utilized for the analysis of the data collected from Scopus. 321 papers that were published between 2013 and 2023 were chosen by the investigator, who carefully examined and extracted them. Based on research trends and prestigious publications, researchers may investigate other options for this major and gain insight into the degree of study that has been done in this subject thanks to the research's findings.

Aruvee and Vintere (2023) carried out a study on overcoming mathematical anxiety to encourage advancement in mathematics throughout university undergraduate engineering courses. The study addresses the causes of arithmetic anxiety and looks at strategies for overcoming it. In this study, students used math software and ICT technologies to comprehend math ideas and apply cooperative learning to complete independent work projects during extra math lessons. Results indicate that (i) Latvian pupils are less anxious and irritated with arithmetic than Estonian students. (ii) Using technology and facilitating collaborative learning are useful strategies for lowering math fear.

Gibeau et al. (2023), have researched the association between gender, mathematics anxiety, spatial anxiety and anxiety related to statistics. According to the study, statistical anxiety and spatial anxiety are associated with mathematics anxiety. 778 students in the social and health science programs made up the sample. An online survey was conducted by the participants. They gathered information from university students in Canada, France and Belgium who were enrolled in statistics courses. The findings indicate a rather substantial positive link between anxiety related to statistics, mathematics and spatial relations.

Ryan et al. (2023) conducted a study on mathematics anxiety among mature students in Service Mathematics course using the Mathematics Anxiety Scale, UK. The research. Examines the fear of mathematics among older students studying service mathematics in Ireland. Points out the gaps in the literature and makes recommendations for further research. Mature students' anxiety related to mathematics was examined using a qualitative method. The Biographical Questions and Mathematics Anxiety Scale UK, or MAS-UK, was used to administer the survey. The result revealed that. Mature students studying service mathematics have anxiety related to mathematics. Higher degrees of mathematics anxiety are the outcome of Ireland's Situation of Mathematics Evolution.

Ponetti and Wallymahmed (2023) carried out research for a meta-analysis on how treatments affect young people's anxiety related to arithmetic. A meta-analysis of treatments on young people's anxiety levels related to mathematics is included in the paper. A meta-analysis review of twelve research published from 2000 onwards examines therapies for mathematics anxiety. Interventions might take the form of one-time meetings or a six-month course. The outcome demonstrates the minor to medium importance that the meta-analysis revealed. All things considered, the

intervention's impact on reducing math anxiety was consistent and yielded comparable results.

Brewster and Miller (2023) performed research on intervention, anxiety, and thoughts on mathematical proficiency. The research on mathematics anxiety is included in the paper, along with its contributing components and potential interventions, such as expressive writing and mindfulness exercises. The work is a review that summarizes the body of current research. The writers looked for Google Scholar, Thesis, and Dissertations databases that may be searched all at once. The findings indicate that the quality of the intervention group did not differ statistically significantly in terms of measured anxiety related to mathematics. It's possible that the instrument instructions reduced the students' arithmetic anxiety.

CUI et al. (2023) analyzed data from a resting state fMRI to investigate the brain mechanism behind the effect of mathematical anxiety on math conceptual understanding. The influence of mathematics anxiety on mathematical concepts and knowledge is covered in the study. The higher iron mechanism was investigated in the study using resting-state FMRI. The outcome demonstrates a negative correlation between math anxiety and math concept mastery. Those with high levels of math anxiety had higher activity in the brain areas associated with unpleasant emotions.

Ongcoy et al. (2023) carried out a study on STEM students' experiences with mathematics anxiety. The research cited several investigations on mathematics anxiety, including those that examine the variables that contribute to reduced mathematics anxiety such as gender disparities and the effects of mathematical modeling and reciprocal learning procedures. 101 Picket National High School STEM students made up the sample. The study suggests that STEM

students perceived relatively good teacher contact than student-centered education. The degree of mathematics anxiety among students was significantly correlated negatively with their perception of the teacher's interactions and mathematical ideas.

Kaur (2023) investigated how web-based training affected slow learners' worry about math and their attitude toward the subject as well as their ability to compute mathematical ideas. The experimental study uses a sample of fifty slow learners enrolled in the seventh-class government schools in the Gurdaspur district and employs a pretest-post-test control group design. The outcome demonstrates that when taught via web-based education, slow learners' mathematics anxiety was shown to be much reduced than when taught using a traditional technique. The mathematical computational skills and mathematics anxiety of slow learners were shown to be significantly impacted by the relationship between instructional tactics and attitude toward mathematics.

Sathishkumar (2023) carried performed a study on students' performance in mathematics concerning their interest in, attitude toward, and worry about the subject. 590 higher secondary school students from ten schools in the Tamil Nadu state's Cuddalore area made up the sample. The research is based on a descriptive survey. The results showed that the study's subsamples and independent variables—gender, school location, management style, instruction medium, father's educational background, attitude toward mathematics, interest in mathematics and mathematics anxiety – remain the most important factors influencing higher secondary school student's performance in mathematics.

Sarabjeet (2022) conducted a study to look at how peer tutoring affected ninth-graders math ability in terms of their anxiety and self-concept. A group pretest and post-test design were used in the experimental investigation. There were 200

pupils enrolled in the CBSE school who made up the sample. The findings indicate that there is no discernible connection between ninth-grade students' mathematical achievement and their self-concept in the subject.

Nandhini (2022) conducted a study on learners in higher secondary schools' self-efficacy hemisphericity to academic accomplishment in mathematics and mathematics anxiety. The sample for this study, which used the normative survey approach, included 1050 higher secondary school students from 42 schools in the Chennai area. The findings indicate that students in higher secondary schools have a modest level of general anxiety related to mathematics. In terms of total mathematics anxiety as well as its three components—teacher, parent and friend - boys exhibited higher levels of anxiety than females.

Vipul (2022) investigated the impact of brain-based learning initiatives on secondary school students' academic performance and anxiety related to mathematics and how they learn best. The pretest-post-test control group design is used in the experimental investigation. There were 78 ninth-grade students in the sample. The study's findings showed that brain-based learning systems had a statistically significant impact on lowering math anxiety and raising arithmetic achievement.

Vishwanathan (2022) examined secondary school students' ability to solve problems and their level of anxiety in mathematics concerning their academic success. The study was designed using the descriptive research survey approach. Six hundred high school students in the ninth grade in the Mahabubnagar district of Telangana were selected as a sample. The findings indicate that there was a strong positive association between academic achievement and the capacity to solve problems among secondary school pupils. The capacity to solve problems and mathematical anxiety was shown to be somewhat positively correlated among secondary school students.

Bhat (2022) examined secondary school students' academic performance in mathematics and examined their levels of self-assurance, mathematical anxiety and problem-solving skills. Using a sample of 810 grade X secondary school students chosen from 40 high schools in the Baramulla and Srinagar districts of the Jammu and Kashmir Union territory, the study used a descriptive research approach. The results showed that self-confidence, mathematical anxiety, and problem-solving skills were important predictors of secondary school students' academic success in mathematics.

Ulum and Küçükdanacı (2022) conducted a meta-analysis investigation on the connection between math anxiety and math achievement. The study examines a meta-analysis that summarizes earlier research on the connection between math anxiety and scholastic achievement in mathematics. 21 papers, including master's and doctoral degree theses, were examined in this study articles. The findings indicate that there is an inverse relationship between math achievement and math anxiety. Based on moderate factors, there was no statistically significant change in the impact size.

Kaur (2021) examined the impact of a three-tiered method on elementary school pupils' arithmetic achievement and mathematical anxiety. The experimental investigation uses 200 children picked at random from six randomly chosen schools in Tensil Jalalabad, using a pretest-post-test Control group design. The researcher discovered that groups taught using a three-tiered strategy had significantly different mean growth scores for mathematical anxiety.

Navneet (2021) examined how self-regulated learning techniques affected math achievement as well as motivating attitudes related to math anxiety and math creativity in a sample of 400 class IX students from four different Chandigarh schools connected to the Central Board of Secondary Education (CBSE). The

findings showed that self-regulated learning techniques, mathematical anxiety and motivating views did not significantly interact.

Drudu and Pramod (2020) examined how Standard XI pupils in higher secondary schools performed in mathematics with IQ, creativity, attitude toward mathematics, mathematics anxiety and socioeconomic level. The study's research design is based on the Path model. 770 Tamil Nadu students in the Class XIth Standard Science and Commerce group made up the sample. The findings indicate that among standard XI students at Tamil Nadu Higher Secondary School, intellect, creativity, mathematics anxiety and socioeconomic position all significantly contribute to mathematics performance under influencing situations. Among pupils in the XIth standard, there is a noteworthy inverse relationship between mathematics anxiety and mathematical performance.

Conclusion

The investigator's conceptual framework for the variables and instructional technique was aided by the theoretical review of Brain Compatible learning strategies, problem solving abilities, perceptual speed and mathematics anxiety. It aided in providing clarification on the study's design and provided support for the choice of the research topic. Some of the most significant publications and research on variables and instructional practices from across the globe are the foundation of the theoretical overview part. Concentrating on the key elements that this specific research required of consideration was helpful. The investigator found it easier to identify the approach for the next steps.

Analysis of the reviews reveals that a considerable number of research on the effectiveness of Brain Compatible learning strategies in mathematics and other subjects has been conducted, with a focus on the strategies' individual effects. Based on the review, it can be concluded that a variety of instructional techniques were

employed to help the students become competent in mathematics, particularly concerning improving problem solving abilities and lowering mathematics anxiety. Research on the perceptual speed of mathematics has been limited. The researcher was unable to locate a single study that investigated the combined impact of all these variables. Thus, the researcher felt the need to investigate how Brain Compatible learning strategy affected the subjects' capacity for problem Solving ability, perceptual speed and anxiety related to mathematics among coastal area secondary school students.

Chapter 3

METHODOLOGY

- Preliminary Survey
- Variables in the preliminary survey
- Design of the preliminary survey
- Sample selected for the preliminary survey
- Tools used in the preliminary survey
- Statistical techniques used in the preliminary survey
- Experiment
- Variables in the Experiment
- Design of the experiment
- Samples selected for the experiment
- Tools used in the experiment
- Statistical techniques used in the experiment

METHODOLOGY

This chapter discusses the methodology adopted for the present study. Methodology refers to a design whereby the researcher selects data collection and analysis procedures to investigate a specific research problem. (Millian & Schumacher, 1989) Methodology is a systematic and theoretical analysis of the method applied to the field of study. It analyses the principles or procedures of inquiry in a particular field. The proper selection of the sample, use of appropriate tools and techniques for the study etc in methodology depends on the success of the research.

The present study is an attempt to compare the effectiveness of instructional strategy based on Brain Compatible learning over the Existing method of teaching in terms of problem solving ability, perceptual speed and mathematics anxiety of coastal area Secondary School Standard VIII students. The present study followed mixed method. The investigator conducted a preliminary survey on problem solving ability, perceptual speed and mathematics anxiety of secondary school students to study whether there exist any significant difference in problem solving ability, perceptual speed and mathematics anxiety of secondary school students in the component-wise among coastal area and non-coastal area and the investigator conducted a preliminary survey to secondary School mathematics teachers to find out the perception of secondary school mathematics teachers towards the prevailing strategies and methods, constraints and suggestions for improvement in teaching mathematics at a secondary level. The purposive sampling technique were used in the preliminary survey of secondary school students and the preliminary survey of secondary school teachers. The preliminary

surveys lead to the experiment. The experimentation was conducted to find out the effectiveness of Brain Compatible learning strategy in terms of problem Solving ability, perceptual speed and mathematics anxiety among secondary school students in coastal areas. For this, pre-test -post-test non-equivalent group design (Quasi-experimental design) was used. The methodology following in the study has been briefly discussed below

Variables of the Study

The Independent variable, dependent variables and control variables selected for the study are described below. The main focus of the present investigation was to measure the effectiveness of Brain Compatible learning strategy over the Existing teaching method in terms of problem Solving ability, perceptual speed, and mathematics anxiety of coastal area Secondary School standard VIII students.

Independent Variable

The Independent variable selected for the study are two levels of instructional method. Brain Compatible learning strategy and Existing method of teaching.

Brain Compatible learning is the instructional strategy that works out under the principles of brain learning. In the present study, Brain Compatible learning strategy is developed based on brain-based planning strategies outlined by Eric Jensen. (Jensen, 2008)

The Existing Method of Teaching

It refers to the present method of teaching adopted by secondary schools for transacting the curriculum implemented by the Government of Kerala.

Dependent Variables

The main dependent variables are problem Solving ability, perceptual speed and mathematics anxiety.

- The variable problem solving ability includes five steps; sensing the problem, collect and classifies data, analysis, evaluation and generalisation.
- The variable perceptual speed includes components as sub-tests. The sub-tests are the Geometric shape comparison test, number comparison test, symbol comparison test and basic arithmetic operations test.
- The variable mathematics anxiety consists of five components Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, classroom performance anxiety and mathematics test anxiety.

Control Variables

The control variables selected for the study are the pre-experimental status of the students in terms of problem solving ability, perceptual speed and mathematics anxiety, non-verbal intelligence, socio-economic status and classroom environment. Pre-experimental status refers to the previous knowledge of students in mathematics. ANCOVA is used to control these factors statistically. Both the experimental and control groups were instructed by the investigator, So the teacher factor remains constant.

Classificatory Variable

Gender is considered as the classificatory variable in the experimental study

Design of the Study

The present study followed mixed methods. The investigator conducted a preliminary survey on the problem solving ability, perceptual speed and mathematics

anxiety of Secondary School students; a preliminary survey of secondary school mathematics teachers and an experimental study was conducted on the coastal area secondary school students.

Preliminary Survey

Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

The objective of the preliminary survey is to study whether there exists any significant difference in problem solving ability, perceptual speed and mathematics anxiety and its subcomponents between the coastal area and non-coastal area secondary school students. The purposive sampling technique was used for the initial survey to compare the problem solving ability, perceptual speed and mathematics anxiety.

Variables Selected for the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

In this stage of investigation, three criterion variables and one classificatory variable were selected. The criterion variables selected were problem solving ability, perceptual speed and mathematics anxiety and the classificatory variable is locale (coastal area and non-coastal area).

Sample Selected for the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

The study was conducted on a sample of 400 secondary school students from the VIII standard of nine schools. The selected schools were both in the coastal area and non-coastal area of Kozhikode district.

Table 1

Break up of Sample Selected for the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

Sl. No.	Classificatory Variables	Number of Students	Total
1	Coastal area	149	400
2	Non-coastal area	251	

The name of the schools selected were UHHSS Chaliyam, CMHSS Mannur, GGVHSS Feroke, GVHSS Cheruvannur, GVHSS Payyanakkal, RKMHSS Panniyankara, GVHSS Meenchandha, GVHSS Kuttichira, MMVHSS parappil.

Tools used for the Preliminary Survey on Problem Solving Ability, Perceptual Speed, and Mathematics Anxiety of Secondary School Students

The tools used for collecting data from the preliminary survey were the test of perceptual speed (Aruna & Lisheetha, 2019), the Test of problem solving ability (Aruna & Lisheetha, 2019) and the mathematics anxiety scale (Aruna & Lisheetha, 2019). Which is developed and standardized by the investigator with the help of the supervising teacher. The test of perceptual speed consists of 42 items based on the sub-components such as the Number comparison test, symbol comparison test, geometric shape comparison test and basic arithmetic operation test. The problem solving ability test consists of five sub-components. The components are sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation. The sub-components of the scale of mathematics anxiety were Topics related anxiety, the concern of learning mathematics, Resolving problems in mathematics, classroom performance anxiety and mathematics test anxiety. A detailed description of the steps involved in the development and standardization of the tools was presented in the experimental phase of the study.

Statistical Techniques used for the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

The statistical technique used for the preliminary survey was mean difference analysis.

Preliminary Survey of Secondary School Mathematics Teachers

The objective of the preliminary survey of secondary school mathematics teachers was to find out the perception of secondary school mathematics teachers towards the prevailing strategies and methods, constraints and suggestions for improvement in teaching mathematics at the secondary level. purposive sampling techniques were used for the initial survey of secondary school mathematics teachers.

Sample Selected for the Preliminary Survey of Secondary School Mathematics Teachers

The sample consists of 30 secondary school mathematics teachers. The study adopted a purposive sampling technique. Samples were collected from nine schools in the Kozhikode district.

Tools used for the Preliminary Survey of Secondary School Mathematics Teachers

The tool used for this stage of the study was "A questionnaire on Teacher's perception towards prevailing strategies and methods, constraints and suggestions in Teaching Mathematics" (Aruna & Lisheetha, 2019), which is developed by the investigator with the help of the supervising teacher. The dimensions for the selection of questions are the prevailing methods and strategies, constraints in teaching mathematics and teacher's suggestive measures for improving the quality of teaching mathematics.

A copy of the questionnaire is attached as Appendix XIII.

Statistical Technique Used for the Preliminary Survey of Secondary School Mathematics Teachers

The statistical technique used for the preliminary survey for teachers was percentage analysis.

Experiment

Design of the Experiment

"Experimental design is the blueprint of the procedures that enable the researcher to test the hypothesis by reaching valid conclusions about the relationship between Independent and dependent variables". (Best & Kahn, 2008)

The present study was intended to study the effectiveness of Brain Compatible learning strategy over Existing method of teaching in terms of problem solving ability, perceptual speed and mathematics anxiety. So, the present study has been conducted by employing the experimental design specifically the Quasi-experimental design. The particular designs selected were pretest-post-test Non-equivalent- Group Designs.

Research Design Selected

To test the effectiveness of Brain Compatible learning strategy in terms of problem solving ability, perceptual speed and mathematics anxiety of coastal areas secondary school students. pretest-post-test non-equivalent group design was employed. The design incorporates one experimental group and one control group. The experimental group was taught through the Brain Compatible learning strategy and the control group was taught through the Existing method of teaching employed in secondary classes of the state using the Kerala syllabus.

The layout of the design is as follows

The pretest- post-test Non-equivalent- Group design (Best& Kahn, 2006)

O1 X O2

O3 C O4

O1 O3 = pretests

O2 O4 = posttest

X exposure of the group to an experimental (treatment) variable

C exposure of a group to the control condition

O observation or test administered.

Sample Selected for the Experiment

In the present study, standard VIII of coastal area secondary school students of Kerala state were considered as the population. since the study was experimental, the investigator felt it was difficult to experiment with a large sample. The investigator therefore selected two intact class divisions of Standard VIII students from two schools selected randomly one experimental group and one control group for experimental and control treatments. Certain aspects of the groups were considered in the selection to ensure the equivalence of the groups. The two schools selected were situated in the coastal area of Kozhikode district. The two schools from which the samples were drawn were provided with co-education. The two groups were equated based on their pre-experimental status in terms of problem solving ability, perceptual Speed, Mathematics anxiety, nonverbal intelligence, classroom environment and socio-economic status. Appropriate tools were used for this purpose.

Allocation of Experimental and Control Groups

Since it is an experimental study, to avoid difficulty in experimenting two intact class divisions of standard VIII of two coastal area Secondary schools were

selected for the study. The investigator randomly selected 54 students from Standard VIII. (26 boys and 28 girls) from one school as the control group and 54 students from Standard VIII. (24 boys and 30 girls) from another School as the experimental group. The final sample selected for the experiment consisted of 108 students.

Details of the sample selected for the treatment are given below in the table 2.

Table 2

Details of the Sample Selected for Experiment

Groups	Name of School	Boys	Girls	Total
Experimental Group	UHHSS Chaliyam	26	28	54
Control Group	GVHSS Payyanakkal	24	30	54
Grand Total		50	58	108

The experimental group was taught through Brain Compatible learning strategy and the control group was taught through the Existing method of teaching.

Selection of Topic for the Treatment

The topics for treatment in the present experiment were selected from the syllabus of mathematics prescribed for the standard VIII students of Kerala state for the academic year 2019-2020. Before the selection of the topic the curriculum, syllabus, textbook and teacher's handbook prescribed for Standard VIII were reviewed carefully, in addition, necessary details regarding the topics were sought from experts and the concerned teachers. Thus, three chapters were selected for the treatment "polygons", "ratios" and "area of quadrilaterals". These chapters were again divided into 30 subunits. The topic selected and the specific objectives set for each learning unit are the same for the experimental groups and the control groups.

1. Polygons

    - Shapes
    - Sum of angles
    - Around a point
    - Outer angles
    - Unchanging sum
    - Sum of outer angles of any polygon
    - Regular polygons
    - Circle and regular polygons

2. Ratio

    - Part relations
    - Elementary ratios
    - Changing relations
    - Ratios and area
    - Three quantities
    - Centre of a triangle

3. Area of Quadrilaterals

    - Same area
    - Parallelogram
    - Long diagonal
    - Without changing area
    - Rhombus
    - Isosceles trapezium
    - Trapezium and triangles
    - Unchanging area and changing parameters.

All lessons were examined with great care and found amenable to Brain Compatible learning strategy and Existing method of teaching. The three units were taught in thirty periods. The time duration of each period was forty minutes.

Tools used for the Study

The efficacy of the tool employed and the procedure adopted for collecting data determines the quality of any research. To analyze the relationship between the selected Independent and dependent variables specific tools were used at various stages of Data Collection they include both the tools developed by the investigator as well as developed by others and both are detailed in this section.

Tools used in the Experiment

The following tools were used for collecting data in the Experimental phase of the study.

- Lesson transcript for Brain Compatible learning strategy (Aruna & Lisheetha, 2020)
- Lesson transcript for the Existing method of teaching (Aruna & Lisheetha, 2020)
- Test of problem solving ability (Aruna & Lisheetha, 2019)
- Test of perceptual speed (Aruna & Lisheetha, 2019)
- Mathematics anxiety scale (Aruna & Lisheetha, 2019)
- Class Room Environment inventory (Aruna, Sureshan& Unnikrishnan, 1998)
- Raven's progressive Matrices (Raven, 1958)
- Socio economic Status Scale (Aruna & Sumi 2010)

Detailed descriptions of each tool are described in the following sections.

Lesson Transcript based on Brain Compatible Learning Strategy (Aruna & Lisheetha, 2020)

The Investigator reviewed various literature related to Brain Compatible learning strategy. From those reviews of the literature, the investigator concluded that Brain Compatible learning works out under the principles of brain learning. In the present study, Brain Compatible learning design is prepared based on seven staged brain-based lesson planning outlined by (Jenson, 2008). In the present study, the brain compatible lesson transcript is presented in seven stages.

The investigator prepared a lesson transcript for Brain Compatible learning strategy with the help of supervising teacher from the selected chapters of the standard VIII mathematics textbook of the Kerala syllabus. For the selection of chapters, the investigator consulted many subject experts and selected different disposes related to the area. Selected chapters for the treatment work were divided into 30 subunits. The topics selected and the specific objectives set for each learning unit were the same for the experimental group and the control group. Brain Compatible learning design in mathematics is intended to give a positive environment for students studying in coastal area Secondary Schools so the present investigation is planned in such a direction for enhancing problem solving ability and perceptual speed and reducing mathematics anxiety among coastal area secondary school students.

The seven stages of Brain Compatible learning design are presented below.

Stage 1: Pre-exposure

This stage provides the brain with an overview of the new learning before really digging in.

Stage 2: Preparation

This is the stage at which we create curiosity or excitement

Stage 3: Initiation and Acquisition

This stage provides the immersion. Flood with content. providing a concrete learning experience.

Stage 4: Elaboration

This is the processing stage; it requires genuine thinking on the part of the learners. This is the time to make intellectual sense of learning.

Stage 5: Incubation and Memory Encoding

This stage emphasizes the importance of downtime and review time.

Stage 6: Verification and Confidence Check

This stage is not just for the benefit of the teacher; learners need to confirm their learning for themselves as well. Learning is best remembered when a student possesses a model or metaphor regarding the new concept or materials

Stage 7: Celebration and Integration

In this stage, it is critical to engage emotions. Make it fun, light and joyful. This stage instills the all-important love of learning also incorporates the new learning in future lessons

A copy of Malayalam and English versions of lesson transcripts of the Brain Compatible learning strategy is attached as Appendices XVII and XVIII.

Lesson Transcript of Existing Teaching Method (Aruna & Lisheetha, 2020)

The investigator consulted secondary school teachers and based on the textbook and teacher's handbook prepared lesson transcripts for the existing method of teaching with the help of supervising teacher. The investigator prepared 30 lesson transcripts based on the existing teaching method integrated with critical pedagogy.

Time duration of each lesson transcript is 40 minutes the various steps included in the lesson transcript are described below

Learning Objectives

It was the basic learning objectives which have to be attained by the students by teaching that particular lesson.

Content Analysis

It is the process of breaking down the teaching content by a teacher for effective planning and transaction. By content analysis, the teacher can identify the significant areas, facts, concepts, and other relevant particles of the contents.

Pre-requisites

It included examining the basic knowledge of the learner, which was relevant for teaching the new topic.

Resources

It consists of all teaching learning aids which could be used by the teacher while teaching the content.

Development

It includes the presentation of the content and presentation of appropriate activities followed by oral presentation and evaluation techniques.

Follow up Activity

This was the activity to be carried out by the students to ascertain the knowledge they gained

The investigator taught the control group using the existing method of teaching. Thirty lesson-transcripts of 40 minutes duration were prepared by the investigator.

A copy of Malayalam and English versions of Lesson Transcripts based on the Existing method of teaching is attached as an Appendices XIX and XX.

Test of Problem Solving Ability

Problem solving ability test is an instrument described to measure the relative accomplishment of a pupil in a specific area of learning. The test of problem solving ability for the present study was developed and standardized by the investigator with the help of a supervising teacher. This test was used for both the pretest and post-test by the investigator to collect data on problem solving ability in mathematics.

The different procedures of construction and standardization of the problem solving ability test are described in the following section

Planning of the Test

At this stage, the investigator gives importance to aspects like what to test, what kind of questions to be included, how many questions to be included and the duration of the test etc. The investigator desired to include objective-type items like multiple choice to access problem solving ability in mathematics. Multiple choice questions provide a platform to think in different dimensions to find problem solving relations through mathematics. A major source of problem solving ability is the problem solving process in terms of a cycle (Bransford & Stein, 1993; Hayes, 1989; Sternberg, 1986) and with the help of literature, suggestions of experts and supervising teacher various steps of problem solving were identified.

For the preparation of the problem solving ability in mathematics tests, the investigator made an extensive study on the features of problem solving ability and its components and thoroughly analyzed the textbook of standard VII, standard VIII and teacher's handbook for the year 2019-2020.

The investigator consulted with the supervising teacher and subject experts to make a content outline and prepared literature on content areas that could be covered for the test. The areas were selected and they were scrutinized in consultation with the subject expert to ensure content validity. After a series of discussions and Critical appraisals, the content area for the test was approved. The weightage to content was given for the selected topics. The weightage given to different topics is given in Table 3.

Table 3

Weightage to Content

Sl. No.	Content	No. of Questions	Mark	Percentage
1	Polygon	5	5	12.5
2	Numbers and algebra	6	6	15
3	Unchanging relations	7	7	17.5
4	Adding angles	3	3	7.5
5	Repeated multiplication	5	5	12.5
6	Ratio	7	7	17.5
7	Area of Triangle	2	2	5
8	Speed math	2	2	5
9	Money math	3	3	7.5
	Total	40	40	100

Preparation of the Test

The investigator prepared a test containing 40 items. From five steps. The nature of items under each category is given below

Sensing the Problem. The items under this step measure the ability of the pupil to read a problem, recognize necessary points

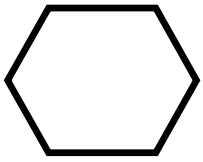
Example. How many triangles are there in a rectangle by joining the diagonals through opposite corners?

Collect and Classify Data. The investigator gives questions that require the formulation of the equation to identify the variables and the relation between them

Example. Addition (+) indicates division (/) and subtraction (-) indicates multiplication (*). multiplication (*) indicates addition (+). division (/) indicates subtraction (-). then find out 30/15+2*5-7.

Analysis. In addition to the above-mentioned abilities pupils should have the ability to analyze, solve problems, use appropriate methods, formulate hypothesis

Example. Divide the given regular hexagon into triangles, by using that find out the sum of interior angles of a given regular hexagon.



Evaluation. The pupils are supposed to locate errors, justify their results and verify their results.

Example. Is the statement correct? If not, write the correct statement "All Isosceles Triangles are Equilateral Triangles ".

Generalisation. The pupil should apply the conclusion to the new situation and formulate generalizations based on the relationship identified

Example. A four-sided polygon contains two Triangles and the sum of the interior angle of the given polygon is 2 * 180. five-sided polygon contains three Triangles in it and the sum of the interior angle of the polygon is 3 * 180. A six-sided polygon contains four Triangles in it and the sum of the interior angle of the polygon is 4 * 180. How many Triangles are there in a polygon with "n "sides Find out the sum of the interior angle of a polygon with "n" sides.

The weightage given to different steps of problem solving ability is shown below in Table 4.

Table 4

Weightage Given to Steps

Sl. No.	Step	Item Number	Mark	Percentage
1	Sensing the problem	2, 3, 4, 5, 8, 15, 17, 27	8	20
2	Collects and classifies data	6, 7, 11, 12, 13, 14, 18, 21	8	20
3	Analysis	1, 9, 10, 22, 24, 28, 32, 33	8	20
4	Evaluation	16, 19, 20, 25, 26, 29, 31, 34	8	20
5	Generalisation	23, 30, 35, 36, 37, 38, 39, 40	8	20
		Total	40	100

Scoring Key

A scoring key was prepared and it was used for scoring the answer sheets. The items in the present test were objective type. The investigator decided to give one score for each correct answer and zero score for each wrong answer. The window was prepared as per the scoring key and all the response sheets were scored.

Try Out

The draft test with forty Multiple choice items was tried out on a sample of 149 pupils of standard VIII, other than the experimental and control groups. The students were given the necessary guidelines for the test. The question paper and separate answer sheets were given to the sample. The question paper contained all the necessary instructions and additional information was provided by the investigator. All 149 response sheets were scored as per the scoring key. The response sheets were selected for item analysis.

Item Analysis

The procedure suggested by Ebel (1972) was used. After the administration of the draft test, the scored answer sheets were arranged in the order of scores from high to low. The lowest 27% and the highest 27 % were selected for calculations. For the selection of items in the final Test, the difficulty index and discriminating power of each item were found.

Difficulty Index. The difficulty index of an item was considered as the percentage of the group to which the subject has given the correct response. The larger the index, the easier the item. The following formula suggested by Ebel and Frisbie (1991) was employed to calculate the difficulty index of each item.

Difficulty Index (DI) = U+L/2N

Where

U - The number of correct responses in the upper group

L - The number of correct responses in the lower group

N - The number of individuals in each group

Discriminating Power. The higher the average discrimination index for an item in a test, the more variable the scores are likely to be and the more reliable the scores are expected to be (Ebel & Frisbie, 1991). The formula used for Calculating the discriminating power of each item is as follows.

Discriminating Power (DP) =U-L/N

Where

U -the number of correct responses in the upper group

L -the number of correct responses in the lower group

N- the number of individuals in each group

Difficulty index and discriminating power for 40 items of test of problem solving ability in mathematics are given in the Table 5.

Table 5

Difficulty Index and Discriminating Power of Items in the Test of Problem Solving Ability in Mathematics

Item No.	DI	DP	Status	Item No.	DI	DP	Status
1	0.685	0.333	Accepted	21	0.6111	0.333	Accepted
2	0.648	0.407	Accepted	22	0.574	0.481	Accepted
3	0.666	0.518	Accepted	23	0.592	0.370	Accepted
4	0.592	0.444	Accepted	24	0.481	0.444	Accepted
5	0.666	0.370	Accepted	25	0.611	0.407	Accepted
6	0.574	0.333	Accepted	26	0.592	0.370	Accepted
7	0.555	0.666	Accepted	27	0.629	0.518	Accepted
8	0.574	0.333	Accepted	28	0.574	0.407	Accepted
9	0.666	0.370	Accepted	29	0.518	0.370	Accepted
10	0.611	0.407	Accepted	30	0.296	-0.148	Rejected
11	0.592	0.370	Accepted	31	0.648	0.407	Accepted
12	0.574	0.407	Accepted	32	0.444	0.370	Accepted
13	0.685	0.333	Accepted	33	0.685	0.481	Accepted
14	0.629	0.370	Accepted	34	0.648	0.555	Accepted
15	0.574	0.407	Accepted	35	0.666	0.518	Accepted
16	0.574	0.185	Rejected	36	0.425	0.333	Accepted
17	0.407	0.370	Accepted	37	0.481	0.370	Accepted
18	0.648	0.407	Accepted	38	0.648	0.407	Accepted
19	0.518	0.370	Accepted	39	0.518	0.370	Accepted
20	0.648	0.333	Accepted	40	0.444	-0.148	Rejected

Selection of Item

Based on the difficulty index and discriminating power the items were selected. In the present study, the items having a difficulty index between 0.3 and

0.8 and a discriminating power of 0.3 and more than 0.3 were selected. Thus, the investigator prepared a final test with 37 multiple-choice items from the draft test. The final Test of Problem solving ability in mathematics with three items was discarded from the draft test, resulting in the final Test with 37 items.

Validity of the Test

The most important quality of a test is its ability to measure what it is intended to measure. That is the purpose of the objective for which it is being constructed. The following types of validity were established for the test of problem solving ability in mathematics.

Content Validity. To ensure the content validity of the test of problem solving ability in mathematics, the investigator subjected the test items to expert criticism. As per the evaluation of the experts, the test covers the selected significant concepts and is comprehensive enough in terms of problem solving ability in mathematics. Hence it has content validity.

Face Validity. For establishing face validity, items of the test of problem solving ability were subjected to expert evaluation. The experts confirmed that the items were able to measure problem solving ability in mathematics of Standard VIII pupils.

Reliability of the Test

The reliability of the test of problem solving ability in mathematics was established using the test-retest method. The same test was again administered on the same sample after 3 weeks. Thus, two sets of scores, the original score and the retest scores were obtained. The correlation coefficient of the two sets of scores was calculated using the Pearson product-moment formula. The coefficient of correlation was found to be 0.718. Thus the validity and reliability were established to the test

which made it an appropriate tool to measure the test of problem solving ability in mathematics of standard VIII students.

A copy of the Malayalam and English versions of the draft and final Test of problem solving ability in mathematics and its response sheet are given as Appendix I, Appendix II, Appendix III, Appendix IV and Appendix XIV respectively.

Test of Perceptual Speed (Aruna & Lisheetha, 2019)

Perceptual speed refers to the rate of the power of the act of perceiving. It reflects the speed of apprehension, nature of thought, perception and learning, but some of the highly indefinable and abstract variables that contribute to our human ability to succeed, conquer and excel in the tasks we encounter every day.

In the present study perceptual speed is the ability to quickly and accurately compare numbers, symbols, arithmetic operations, pictures or patterns. The test is prepared to measure the perceptual speed in mathematics of standard VIII students. In the present study, the test was used as the pretest and post-test. The procedures the investigator took in each stage of the preparation of the test are described as follows

Planning of the Test

At this stage the investigator gives importance to the aspects like what to test, what kind of questions to be included, how many questions to be included, the duration of the test etc. The investigator decided to include objective-type items like multiple choice to assess perceptual speed in mathematics. In this stage, the investigator analyzed thoroughly the textbook and teacher's handbook for the years 2019-2020. Apart from the textbook, the investigator made use of available source books for framing the items for the test. The main theory behind the source of perceptual speed was Greory's (1970) top down approach and Gibson's (1966) bottom of approach in perception. With the help of literature, suggestions from experts and a supervising teacher, various subtests of perceptual speed were identified.

Preparation of the Test

The investigator reviewed many related literature and consulted with the subject experts and experienced teachers in mathematics, the investigator with the help of the supervising teacher finalized the components of the perceptual speed test. The components selected for assessing perceptual speed include four sub-tests. which is Number comparison, Geometrical shape comparison, symbol comparison and basic arithmetic operation.

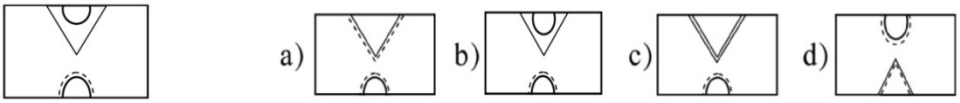
Number Comparison. Number comparison tests include questions related to decimal numbers, the Indian system of numbers and the international system of numbers. The Indian number system is a writing system adapted in India for expressing numbers. The international number system is a method of representing numbers where numbers are split into groups or periods helps us in reading large numbers accurately.

Example. Circle the given number which is written in the form of the Indian system of numbers.

(a) 9635 18 27 (b) 9, 63, 51, 827 (c) 96, 351, 827 (d) 9635, 1827

Geometrical Shape Comparison. The geometrical Shape comparison test includes questions related to different two-dimensional and three-dimensional shapes, figures with shapes and designs with a basic shape unit.

Example. Circle the right figure which is the same as the given geometrical figure with different geometric shapes.



Symbol Comparison. Mathematical symbols are used to perform various operations. The symbols make it easier to refer to mathematical quantities. It helps

to represent the relationship between two quantities. Symbol comparison includes questions related to different mathematical symbols like greater than, less than, equal to, percentage, power of numbers, etc.

Example. How to write the fraction 75/100 by using the symbol

Basic Arithmetic Operation. Arithmetic is the fundamental of mathematics that includes the operations of numbers. These operations are addition, subtraction, multiplication and division. Arithmetic is one of the important branches of mathematics that lays the foundation of the subject of maths for students. Basic arithmetic operation tests consist of addition, subtraction, multiplication and division of natural numbers and decimal numbers.

Example. Circle the correct answer

34.532 + 1.324	a)	34.532 + 1.324	b)	34.532 + 1.324	c)	34.532 + 1.324	d)	34.532 + 1.324
		35.856		3585.6		3.5856		358.56

The Weightage given to each subtest of the perceptual speed test is given below in Table 6.

Table 6

Weightage is given to Sub-test

Sl. No.	Subtest	Item Number	Mark	Percentage
1	Number comparison	4, 5, 7, 8, 9, 16, 17, 28, 30	9	21.43
2	Geometrical shape comparison	1, 2, 3, 12, 15, 18, 19, 20, 41, 42	10	23.81
3	Symbol comparison	6, 21, 22, 23, 24, 25, 26, 27, 29	9	21.43
4	Basic Arithmetic operations	10, 11, 13, 14, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40	14	33.33

Scoring Key

A scoring key was prepared and it was used for scoring the answer sheets. The items in the present test were objective type. The investigator decided to give one score for each correct answer and zero score for each wrong answer. The window was prepared as per the scoring key and all the response sheets were scored.

Try Out

The draft test with forty-two Multiple choice items was tried out on a sample of 149 pupils of standard VIII, other than the experimental and control groups. The students were given the necessary guidelines for the test. The question paper and separate answer sheets were given to the sample. The question paper contained all the necessary instructions and additional information was provided by the investigator. All 149 response sheets were scored as per the scoring key. The response sheets were selected for item analysis.

Item Analysis

The procedure suggested by Ebel (1972) was used. After the administration of the draft test, the scored answer sheets were arranged in the order of scores from high to low. The lowest 27% and the highest 27 % were selected for calculations. For the selection of items in the final Test, the difficulty index and discriminating power of each item were found.

The difficulty index and discriminating power for 42 items of test of perceptual speed test in mathematics are given in Table 7.

Table 7

Difficulty Index and Discriminating Power of Items in the Test of Perceptual Speed in Mathematics

Item No.	DI	DP	Status	Item No.	DI	DP	Status
1	0.388	0.407	Accepted	22	0.666	0.370	Accepted
2	0.685	0.555	Accepted	23	0.685	0.407	Accepted
3	0.666	0.370	Accepted	24	0.648	0.333	Accepted
4	0.611	0.333	Accepted	25	0.648	0.407	Accepted
5	0.592	0.444	Accepted	26	0.592	0.370	Accepted
6	0.648	0.407	Accepted	27	0.537	0.407	Accepted
7	0.629	0.370	Accepted	28	0.629	0.444	Accepted
8	0.574	0.333	Accepted	29	0.6111	0.407	Accepted
9	0.611	0.481	Accepted	30	0.592	0.370	Accepted
10	0.518	0.148	Rejected	31	0.592	0.444	Accepted
11	0.666	0.444	Accepted	32	0.648	0.333	Accepted
12	0.685	0.555	Accepted	33	0.537	0.407	Accepted
13	0.555	0.370	Accepted	34	0.518	0.370	Accepted
14	0.685	0.333	Accepted	35	0.685	0.407	Accepted
15	0.574	0.481	Accepted	36	0.481	0.370	Accepted
16	0.537	0.407	Accepted	37	0.518	0.444	Accepted
17	0.555	0.444	Accepted	38	0.444	0.518	Accepted
18	0.481	0.518	Accepted	39	0.388	0.185	Rejected
19	0.537	0.333	Accepted	40	0.481	0.444	Accepted
20	0.629	0.370	Accepted	41	0.666	0.518	Accepted
21	0.6111	0.333	Accepted	42	0.537	0.407	Accepted

Selection of Item

Based on the difficulty index and a discriminating power, the items were selected. In the present study, the difficulty index is between 0.3 and 0.8 and discriminating power 0.3 and more than 0.3 were selected. Thus the investigator prepared a final Test with 40 multiple-choice items from the draft test. The time

duration of the test was 40 minutes. The final Test of perceptual speed with two items was discarded from the draft test, resulting in the final Test with 40 items.

Validity

Content Validity and Face Validity. To ensure the content validity of the test of perceptual speed, the investigator subjected the test item to expert criticism. As per the evaluation of the subject experts, the test covers the selected significant concepts. This is comprehensive enough in terms of perceptual speed. Hence it has Content validity. For establishing face validity, items of perceptual speed were subjected to the subject expert's evaluation. The experts confirmed that the items were able to measure the perceptual speed of standard VIII pupils.

Reliability

The reliability of the test was established using the test re-test method. The same test was again administered on the same sample after three weeks. Thus two sets of scores, the original score and the retest scores were obtained and tabulated and their statistical correlation was found by using the Pearson product-moment correlation formula. The reliability of the test was found to be 0.737. Thus, the obtained value of validity and reliability indicates that the test is an appropriate and acceptable tool for the final Test.

A copy of the Malayalam and English versions of the draft and final Test of perceptual speed and its response sheet are given as Appendix V, Appendix VI, Appendix VII, Appendix VIII and Appendix XV respectively.

Mathematics Anxiety Scale (Aruna & Lisheetha, 2019)

The Mathematics Anxiety Scale was developed and standardized by the investigator with the help of supervising teacher and various subject experts.

Planning

The investigator thoroughly reviewed the literature related to mathematics anxiety to clarify the construct. Various researchers have defined mathematics anxiety in different ways and there are many theories related to mathematics anxiety, but the investigator was not able to find a commonly accepted constructive model. A major source of mathematics anxiety is the teaching approach of "explain-practice -memorize (Steele and Alfred, 1998) and with the help of literature, after many discussions with the supervising teacher and experts in the field, five sub-components were finalized.

Preparation of Items

The Mathematics Anxiety Scale is a five-point Likert scale. It has 30 items in total. The statement used in the scale is intended to measure the components, namely; Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Classroom performance anxiety and Mathematics Test anxiety.

Topics Related Anxiety. Topic-related anxiety refers to the Worries of the learner towards some specific topic or lesson in the Mathematics Text Book.

Example. I feel so empty when teachers teach money transfer, simple interest, compound interest, etc in mathematics class.

Concern About Learning Mathematics. Students perceive mathematics as a very hard subject and very confusing to learn. They quickly lost their interest and motivation to learn mathematics. Concern about learning mathematics refers to the challenges faced by the learner while learning mathematics.

Example. I wish mathematics were removed from the school subjects.

Resolving Problems in Mathematics. Resolving problems in mathematics refers to the worries a learner takes to establish the means of achieving a mathematical goal or solving a mathematical problem.

Example. I got frustrated because I couldn't solve the problem by imagining the three-dimensional figures in my mind and finding solutions.

Classroom Performance Anxiety. Classroom performance anxiety refers to the fear of the learner, making mistakes in front of teachers and peers leads to embarrassment or feeling of inferiority.

Example. My hands get cold and sweaty when I do maths problems in my notebook from the class.

Mathematics Test Anxiety. Mathematics test anxiety refers to the feeling of apprehension and physiological reactivity of a learner towards mathematics tests.

Example. While sleeping by dreamed failing of the maths exam before the exam and waking up with shock.

The Weightage given to each component of the mathematics anxiety scale is given below in the Table 8.

Table 8

Weightage is Given to the Components

Sl. No.	Component	Item No.	Total	Percentage
1	Topic related anxiety	4, 8, 16, 18, 24, 29	6	20
2	Concern about learning mathematics	9, 10, 14, 15, 25, 30	6	20
3	Resolving problems in mathematics	2, 11, 12, 20, 22, 24	6	20
4	Classroom performance anxiety	1, 5, 17, 21, 26, 28	6	20
5	Mathematics test anxiety	3, 7, 13, 19, 23, 27	6	20

Scoring Procedure

The draft scale of mathematics anxiety consisted of 30 statements. The draft scale consists of 18 negative statements and 12 positive statements. The scale was prepared in the form of a five-point Likert scale following a response pattern of Always, Most of the Time, Sometimes, Occasionally and Never. The score for each item will be in a sequence of 5, 4, 3, 2, 1 for positive items and 1, 2, 3, 4, 5 for negative Items. All the item scores for each student are to be submitted to obtain a total measure of mathematics anxiety.

Try Out

The draft scale with thirty items was tried out on a sample of 149 pupils of standard VIII, other than the experimental and control groups. Before the administration of the scale, its purpose was made clear to the students. The scale includes all necessary guidelines about the scale and additional information required was given by the investigator. The response sheet is collected from the students and the score of each student is calculated. Arrange the response sheets in the ascending order of total scores obtained by the pupil. The score obtained by the highest 27 percent and lowest 27 percent was selected for the calculation. The t values were calculated for each item by using the formula

$$t=\frac{\overline{X}_H-\overline{X}_L}{\sqrt{\frac{\left(X_H-\overline{X}_H\right)^2+\left(X_L-\overline{X}_L\right)^2}{N(N-1)}}}$$

Where

$\overline{X}_H$ = the mean response score on a given statement for the high group

$\overline{X}_L$ = the mean response score on a given statement for the low group

N = Size of high group and low group

The t value for each item was calculated. Items having a value above 2.58 were selected for the final Test. The details of the item Analysis of the draft of Mathematics Anxiety are presented below Table 9.

Table 9

Details of the Item Analysis of Draft Scale of Mathematic Anxiety

Item No.	t-value	Status	Item No.	t-value	Status
1	1.326	Rejected	16	3.646	Accepted
2	3.134	Accepted	17	4.934	Accepted
3	4.288	Accepted	18	3.508	Accepted
4	3.170	Accepted	19	5.287	Accepted
5	3.737	Accepted	20	7.060	Accepted
6	4.433	Accepted	21	3.308	Accepted
7	4.590	Accepted	22	5.850	Accepted
8	3.972	Accepted	23	3.137	Accepted
9	3.709	Accepted	24	1.620	Rejected
10	4.374	Accepted	25	4.211	Accepted
11	3.114	Accepted	26	3.489	Accepted
12	3.426	Accepted	27	3.982	Accepted
13	4.091	Accepted	28	5.014	Accepted
14	3.600	Accepted	29	3.570	Accepted
15	5.255	Accepted	30	3.273	Accepted

Selection of Item

Items having a t value above 2.58 were selected for the final Test. Two items were deleted from the draft scale after item analysis. The final form of the scale of Mathematics Anxiety consists of 28 items.

Validity

Construct Validity and Face Validity. The construct validity and face validity methods have validated the present scale of mathematics anxiety. The method followed in the construction of the scale, the criteria considered for writing statements, and the mode of selection of the scale's dimension all show that the scale has construct validity. Face validity is established for the scale by seeking help from supervising teachers and experts in the field to confirm that the statements in the scale can assess the mathematical anxiety of standard VIII students. Hence, the scale has face validity.

Reliability

The reliability of the Scale was established using the test re-test method. The same scale was again administered on the same sample after three weeks. Thus, two sets of scores, the original score and the readministered scores were obtained and tabulated and their statistical correlation was found by using the Pearson product-moment correlation formula. The reliability of the scale was found to be 0.713. Thus, the obtained value of validity and reliability indicates that the scale is an appropriate and acceptable tool for the final Test.

A copy of the Malayalam and English versions of the draft and the final Mathematics Anxiety Scale are presented as Appendix IX, Appendix X, Appendix XI, Appendix XII and Appendix XVI respectively.

Standard Progressive Matrices Test (Raven 1958)

To measure the nonverbal intelligence for testing the homogeneity of the groups, the Standard Progressive Matrices Test (Raven, 1958) was used. It was further divided into another five subsets (A, B, C, D, E) of diagrammatic puzzles with a missing part. The students were asked to find the most appropriate and logical part among the given six to eight options. Forty- minutes was the duration of the test. The maximum score one can obtain was 60, as there were five sets each with 12 questions and each correct answer carried 1 mark. Each nonverbal intelligence score was the total score obtained by the student.

Raven reported that the validity estimated varied from 0.50 to 0.80 and the reliability coefficient varied from 0.80 to 0.90.

A copy of the response sheet of Standard progressive matrices tests is given in Appendix XV.

Classroom Environment Inventory (Aruna, Sureshan & Unnikrishnan, 1998)

The investigator adopted the Classroom Environment Inventory constructed and standardized by (Aruna et al., 1998). The Classroom Environment inventory was mainly based on the Dimensions in the Classroom Environment instrument developed by Fraser & Fischer (1982). The individual dimensions used for the construction of the classroom environment inventory are Material environment, Cohesiveness, Task orientation, Innovation, participation, Teacher support, personalization, Independence, Order and organization, Teacher control, Friction and competition.

The validity of the inventory was estimated by criterion-related technique, which was found to be 0.5364. Finding the reliability of the inventory test-retest method was adopted and the reliability coefficient was found. It would be 0.859 as reported by the authors. Yes /No options are given as the response and score" 1" for yes and "0" for no response.

A copy of the Malayalam and English versions of the classroom Environment Inventory and its response sheet are given as Appendix XXI, Appendix XXII and Appendix XXIII respectively.

Socio-Economic Status Scale (Aruna & Sumi, 2010)

Equating groups the socioeconomic status scale developed by Aruna and Sumi (2010) was used. It is an expanded form of a general datasheet. The general data sheet is divided into 5 sections. The first section consists of information about the subject regarding the name of the pupil, age, sex, locality of school and place of residence. The second part calls for information regarding the level of education of

parents, siblings and other occupants of the family. The third section is used to elicit information regarding the type of occupation of the family members. The details about the income of the family members are collected through the fourth section. The investigator depends on the education, occupation and income of the mother and father or guardian to fix up the socioeconomic status score of the family.

Table 10

Weightage is Given for Parental Education, Parental Occupation and Monthly Income of Parents

Sl. No.	Parental Education	Weightage	Parental Occupation	Weightage	Monthly income level of parents	Weightage
1	Illiterate	5	Unemployed	5	Below 5000	5
2	Standard I-IV	10	Unskilled	10	5000-10000	10
3	Standard V-VII	15	Semiskilled	15	100001-20000	15
4	Standard VIII-X	20	Skilled	20	20001-30000	20
5	PreUniversity/ Predegree/ TTC/ Intermedium	25	Semi Professional	25	300001-40000	25
6	BA/BSc/BCom/ BEd/ NTTC/ Engineering/ Diploma	30	Professional	30	40001-50000	30
7	MA/ MSc/ Med/ BL, BSc(Tec), PhD etc	35	Highly professional	35	500001 and above	35

A copy of the Socioeconomic Status Scale is given in the Appendix XXIV.

Data Collection Procedure

Data collection was conducted through the preliminary surveys and experiment. The preliminary survey on problem solving ability, perceptual speed and mathematics anxiety of secondary school students from the coastal area and non-coastal area of Standard VIII students. The purpose of the preliminary survey on variables of secondary school was to find out whether there exists any significant

difference in the mean scores of problem solving ability, perceptual speed and mathematics anxiety component-wise between the Coastal area and the Non-coastal area. The data was collected from a sample of 400 students, of which 149 were from coastal areas secondary school students and 251 were from non-coastal areas secondary school students in Kozhikode district. From the results of the survey, the investigator with the help of the supervising teacher decided to conduct an experimental study on Coastal area secondary school students.

The investigator also conducted a preliminary survey of Secondary School mathematics teachers through a questionnaire to understand the usage of prevailing strategies and methods in secondary School mathematics classes and what are the constraints faced by them and their suggestions for improvement in teaching mathematics at the secondary level. The data were collected from 30 mathematics teachers from Kozhikode district. From the preliminary survey of secondary school mathematics teachers, the investigator with the help of a supervising teacher decided to select Brain compatible learning Strategy for experimentation among coastal areas secondary school students.

After the preliminary surveys the experimental study was conducted using a quasi-experimental design with a pre-test post-test non-equivalent group design were utilized. In the experimental study, the two intact classes of Standard VIII were selected from two different coastal area secondary schools from the Kozhikode district. Two intact classes from Umbichy Hajee Higher Secondary School with 54 students from standard VIII were selected as the experimental group and two intact classes from Government Vocational Higher Secondary School from Payyanakkal with 54 students were selected as the control group respectively. The experimental group was taught through Brain Compatible

learning strategy and the control group was taught through the Existing method of teaching. Before starting the experiments, the Problem solving ability, perceptual speed test and mathematics anxiety scale were administered to the experimental group and control group as a pre-test to measure the pre-experimental status in terms of problem solving ability, perceptual speed and mathematics anxiety and the response sheet was collected. The experiment treatment was done in the experimental group. For the preparation of lesson transcript for the experimental group the seven-stage brain-based lesson planning outline by Jenson 2008 was used. In the control group, existing methods of teaching were employed to teach the selected topic. The topic selected for treatment and the time duration were the same for the experimental group and control group.

After the completion of the treatment post-tests on problem solving ability, perceptual speed and mathematics anxiety scale were administered to experimental and control groups as post-tests. Which were already used as pre-tests to measure the pre-experimental status. This test was again administered to measure the post-treatment status of the subject in terms of problem solving ability, perceptual speed and mathematics anxiety. The data on the other control variables; Non-verbal intelligence, classroom environment inventory and socioeconomic status scale were collected from both the experimental group and control group. Before the administration of the test, the purpose was made clear to the students and all necessary guidelines were given to the subject. When administering the standardized test, the instructions given in the manual were strictly followed and explained to the subject before taking the tool. A uniform procedure was adopted for the experimental group and control group. All tests were administered by the investigator personally.

Scoring and Consolidation

Specific directions given in the respective test manual were strictly followed for scoring the response sheets collected. Initially, response sheets of the test of problem solving ability, the test of perceptual speed and the mathematics anxiety scale of the coastal area and non-costal area secondary school students were scored component-wise. After that questionnaire of secondary school mathematics teachers was scored. After that, the response sheet of the test of problem solving ability, the test of perceptual speed and mathematics anxiety scale, non-verbal intelligence, classroom environment inventory, social economic status scale, etc were scored according to the scoring keys provided. Response sheets that were correct in all respects were only taken into consideration. After scoring the response sheets the scores obtained in each tool were tabulated and consolidated separately for the experimental group and control group.

Statistical Techniques Employed for the Study

Mean Difference Analysis

In the preliminary survey on problem solving ability, perceptual speed and mathematics anxiety of secondary school students, the mean difference analysis was used to compare coastal area and non-coastal area secondary school students in terms of problem solving ability, perceptual speed and mathematics anxiety in total and component-wise.

Percentage Analysis

The percentage analysis was used in the preliminary survey of secondary school mathematics teachers to identify the prevailing strategies, methods and constraints faced by the mathematics teachers and their suggestive measures to

overcome the constraints for the improvement of teaching mathematics at the secondary level.

The following major Statistical Techniques were used to compare the experimental and control group

Basic Descriptive Statistics

Preliminary analysis was done to find out the nature of the distribution of variables for the selected sample in the experiment. For this purpose, mean, median, mode, standard deviation, skewness, and kurtosis corresponding to each variable were calculated for total samples and relevant sub-samples.

Test of Significance of Difference between Means

A test of the significance of the difference between means was used to compare the relevant variables of the Experimental and control groups.

Mean difference analysis was used to compare the relevant variables between the control group and the experimental group. Independent 't' test scores were calculated to compare the mean pretest scores, mean post-test scores and mean gain scores of problem solving ability, perceptual speed, and mean change scores of mathematics anxiety of coastal area secondary school students between the control and experimental groups.

Effect Size (Cohen's *d*)

Effect size is a measure that describes the magnitude of difference between the control group and the experimental group. It is an important tool in reporting and interpreting effectiveness.

Cohen's *d* is the standardized mean difference between two independent samples. To interpret this effect size the benchmark proposed by Cohen (1988) is

0.2 indicates small effect, 0.5 indicates medium effect and 0.8 indicates large effect.

ANCOVA

Analysis of covariance is a statistical technique used to control or adjust the effects of one or more uncontrolled variables and permit thereby a valued evaluation of the effectiveness of the experiment (Ferguson, 1996). This technique is applied when there are one or more correlated variables exist with the dependent variable.

The statistical technique represents an extension of the Analysis of Variance to allow for the correlation between initial and final scores. Co-variance analysis is especially useful to control statistically the effects of one or more covariates. Through co-variance analysis, it is possible to effect adjustments in final terminal scores which allow for differences in the same initial variable.

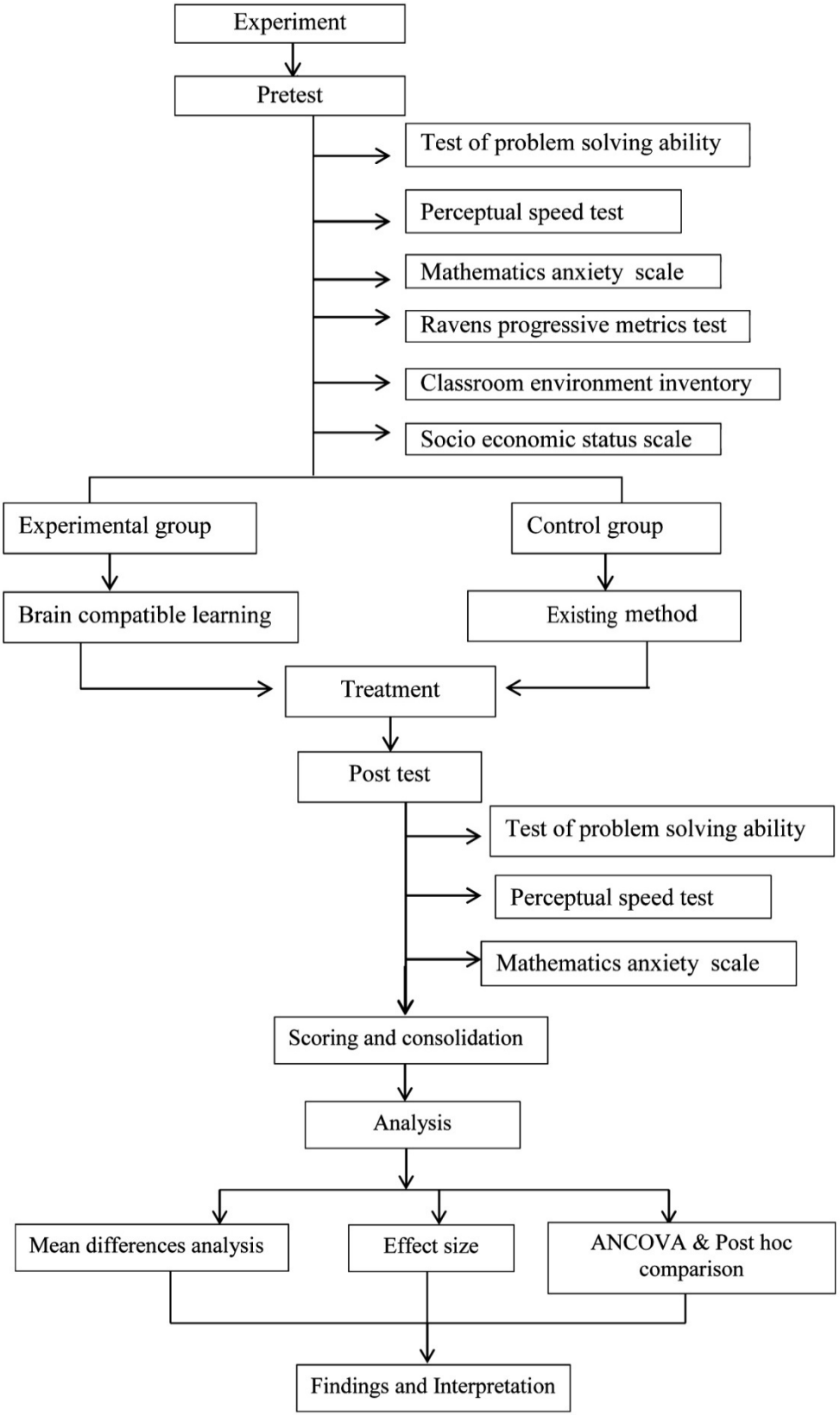
Since the experiment was carried out using non-equated intact class groups, to statistically control for the initial differences between experimental and control groups, if any in terms of Pre-problem solving ability, pre-perceptual speed, pre - mathematics anxiety, Non-Verbal Intelligence, Classroom Environment, Socio-Economic Status, one-way ANCOVA was used. This helped in better comparison of the two groups to study the relative effectiveness of Brain Compatible learning strategy in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety.

Bonferroni's Test for Post-Hoc Comparison

After ANCOVA Bonferroni's test was used to compare the adjusted criterion mean scores of the problem solving ability, perceptual speed and mathematics anxiety of the control group and experimental group

Figure 3

Flow Chart Showing the Summary of the Execution of the Experiment



Chapter 4

ANALYSIS AND INTERPRETATION

- *Results of the preliminary survey*
- *Preliminary analysis*
- *Statistical constant of the Variables.*
- *Mean difference analysis*
- *One way ANCOVA*
- *Bonferroni's post hoc comparison*

ANALYSIS

The present study was conducted to compare the effect of Braincompatible learning approach with the Existing method of teaching mathematics in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety of coastal area secondary school students. The design used in the study was quasi-experimental design with pretest posttest non-equivalent group design. The result of the present study was analyzed in three major steps. A preliminary survey of secondary school students was conducted to compare the coastal area and non-coastal area secondary school students in terms of Problem solving ability, perceptual speed and mathematics anxiety and a preliminary survey of mathematics teachers was conducted to identify the prevailing strategies and methods adopted for teaching mathematics and the constraints faced by the teachers at secondary school level and suggestive measures to overcome the limitations. After the execution of preliminary surveys, the experimental study was conducted to find out the effectiveness of Brain compatible learning strategy over existing method of teaching in terms of problem solving ability, perceptual speed and mathematics anxiety of coastal area secondary school students for total sample and sub-sample based on gender were analyzed.

The collected and tabulated data were analyzed using statistical techniques like, basic descriptive statistics, mean difference analysis, percentage analysis, one-way analysis of covariance (ANCOVA), and Bonferroni's post hoc comparison. The statistical analysis was conducted based on the objectives set for the study using SPSS software (statistical package for social science). The entire analysis of the data was completed and interpreted as follows.

Results of Preliminary Survey

Analysis of data from the preliminary survey is described under the following headings

- Comparison of the mean scores of problem solving ability, perceptual speed, mathematics anxiety and its subcomponents of secondary school students between the Coastal area and Non-coastal area secondary schools.
- Estimation of the Result of a preliminary survey of secondary school mathematics teachers on Prevailing Strategies and methods of Teaching mathematics, its Constraints and the Suggestive Measures to Overcome the Constraints of Teaching Mathematics at the Secondary Level.

Important Statistical Constants of the Variables

- Pretest scores of the variables of the experimental group for the total sample, Boys and Girls.
- Pretest scores of the variable of the control group for the total sample, Boys and Girls.
- Posttest score of the variables of the experimental group for the total sample, Boys and Girls.
- Posttest score of the variables of the control group for the total sample, Boys and Girls.

Mean Difference Analysis

- Comparison of the mean pre-test scores of problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment, and socio-economic status of Experimental and Control groups for the total sample, Boys and Girls.

- Comparison of the mean pre-test and posttest scores of problem solving ability, perceptual speed and mathematics Anxiety of the Experimental group and control group for the total sample, Boys and Girls.
- Comparison of the mean posttest scores of problem solving ability, perceptual speed and mathematics anxiety of experimental and control groups for the total sample, Boys and Girls.
- Comparison of the mean gain scores of problem solving ability, perceptual speed and change scores of mathematics anxiety of Experimental and Control groups for the total sample, Boys and Girls.

Analysis of Effect Size

- The effect size of the mean gain score of problem solving ability, perceptual speed and change scores of mathematics anxiety of the Experimental and control groups for the total sample, Boys and Girls.

Analysis of Co-variance of the Dependent Variable

- Comparison of adjusted mean scores of the problem solving ability of experimental and control groups by considering pretest scores of perceptual speed, pretest scores of mathematics anxiety, Nonverbal Intelligence, Classroom Environment and Socio-Economic Status as covariates.
- Comparison of adjusted mean scores of the perceptual speed of experimental and control groups by considering pretest scores of problem solving ability, pretest scores of mathematics anxiety, Nonverbal Intelligence, Classroom Environment and Socio-Economic Status as covariates.
- Comparison of adjusted mean scores of mathematics anxiety of experimental and control groups by considering pretest scores of problem

solving ability, pretest scores of perceptual speed, Nonverbal Intelligence, Classroom Environment and socioeconomic status as covariates.

Objectives of the Study

1. To study whether there exist any significant differences in the mean scores of problem solving ability and its sub-components (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. To study whether there exist any significant differences in the mean scores of perceptual speed and its sub-components (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithmetic operation test) between the coastal area and non-coastal area secondary school students.
3. To study whether there exist any significant differences in the mean scores of mathematics anxiety and its sub-components (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Classroom performance anxiety and Mathematics test anxiety) between the coastal area and non-coastal area secondary school students.
4. To identify the prevailing strategies and methods in teaching mathematics and measure to overcome the constraints in implementing the strategies in teaching mathematics at the secondary level.
5. To compare the mean pre-test scores, posttest scores and gain scores of the experimental group and control group in problem solving ability for the total sample, Boys and Girls.
6. To compare the mean pre-test scores, posttest scores and gain scores of the experimental group and control group in perceptual speed for the total sample, Boys and Girls.

7. To compare the mean pre-test scores, posttest scores and change scores of the experimental group and control group in mathematics anxiety for the total sample, Boys and Girls.
8. To find out the effectiveness of Brain compatible learning strategy with that of the Existing method of teaching in problem solving ability, perceptual speed, and mathematics anxiety among coastal area secondary school students.

Hypotheses of the Study

1. There will be significant differences in the mean scores of problem solving ability and its subcomponents (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. There will be significant differences in the mean scores of Perceptual speed and its subcomponents (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithmetic operation test) between the coastal area and non-coastal area secondary school students.
3. There will be significant differences in the mean scores of mathematics anxiety and its subcomponents (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Classroom performance anxiety and Mathematics test anxiety) between the coastal area and non-coastal area secondary school students.
4. There will be no significant difference in the mean pretest scores of the Problem Solving ability of the experimental group and control group for the Total sample, Boys and Girls.

5. There will be no significant difference in the mean pretest scores of Perceptual Speed of the experimental group and control group for the Total sample, Boys and Girls.
6. There will be no significant difference in the mean pretest scores of mathematics anxiety of the experimental group and control group for the Total sample, Boys and Girls.
7. There will be significant difference in the mean pretest and posttest scores of problem solving ability of the experimental group for the Total sample, Boys and Girls.
8. There will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the experimental group for the Total sample, Boys and Girls.
9. There will be significant difference in the mean pretest and posttest scores of Mathematics anxiety of the experimental group for the Total sample, Boys and Girls.
10. There will be significant difference in the mean pretest and posttest scores of Problem solving ability of the control group for the Total sample, Boys and Girls.
11. There will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the control group for the Total sample, Boys and Girls.
12. There will be significant difference in the mean pretest and posttest scores of mathematics anxiety of the control group for the Total sample, Boys and Girls.

13. There will be significant difference in the mean posttest scores of Problem solving ability of the experimental group and control group for the Total sample, Boys and Girls.
14. There will be significant difference in the mean posttest scores of Perceptual Speed of the experimental group and control group for the Total sample, Boys and Girls.
15. There will be significant difference in the mean posttest scores of mathematics anxiety of the experimental group and control group for the Total sample, Boys and Girls.
16. There will be significant difference in the mean gain scores of problem solving ability of the experimental group and control group for the Total sample, Boys and Girls.
17. There will be significant difference in the mean gain scores of perceptual speed of the experimental group and control group for the Total sample, Boys and Girls.
18. There will be significant difference in the mean change scores of mathematics anxiety of the experimental group and control group for Total sample, Boys and Girls.
19. There will be significant difference in the adjusted mean scores of problem solving ability of Experimental and Control groups by considering, Pretest Perceptual Speed, Pretest mathematics anxiety, Nonverbal Intelligence, Classroom environment and Socio-Economic Status as covariates for the Total sample, Boys and Girls.
20. There will be significant difference in the adjusted mean scores of Perceptual Speed of Experimental and Control groups by considering Pretest problem

solving ability, Pretest mathematics anxiety, Nonverbal Intelligence, Classroom environment and Socio-Economic Status as covariates for the Total sample, Boys and Girls.

21. There will be significant difference in the adjusted mean scores of mathematics anxiety between the Experimental and control groups by considering Pretest problem solving ability, Pretest Perceptual Speed, Nonverbal Intelligence, Classroom environment and Socio-Economic Status as covariates for the Total sample, Boys and Girls.

Results of the Preliminary Survey

Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

The objective of the preliminary survey was to find out whether there exists any significant difference between the mean scores of the variables, problem solving ability, perceptual speed and mathematics anxiety and its sub-components between the coastal area and non-coastal area Secondary school students.

Comparison of Mean Scores of Problem Solving Ability Test and its Sub-Components between Coastal Area and Non-coastal Area Secondary School Students

To find whether there exists any significant difference in the mean scores of the Problem solving ability test and its sub-components between Coastal area and Non-coastal area secondary school students; the investigator used an independent sample *t*-test. The result of the statistical analysis is presented in the Table 11.

Table 11

Data and Results of Test of Significance of the Difference between Mean Scores of Problem Solving Ability Test and its Sub-components between the Coastal Area and Non-coastal Area

Variable	Group	N	Mean	SD	t-value	p-value	Significance
Sensing the problem	Coastal area school	149	4.853	1.402	2.647	0.008	< 0.01, significant at 0.05 level
	Non-coastal area school	251	5.248	1.468			
Collect and classifies data	Coastal area school	149	3.940	1.362	8.144	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	5.232	1.631			
Analysis	Coastal area school	149	3.600	1.326	3.758	0.001	< 0.01, significant at 0.01 level
	Non-coastal area school	251	4.228	1.770			
Evaluation	Coastal area school	149	5.220	2.145	3.447	0.001	< 0.01, significant at 0.01 level
	Non-coastal area school	251	5.896	1.735			
Generalisation	Coastal area school	149	2.540	1.267	5.049	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	3.368	1.752			
Problem solving ability	Coastal area school	149	20.153	4.256	6.918	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	23.972	5.900			

Table No. 11 reveals that the mean difference analysis of the Problem solving ability and its components between students from coastal area and non-coastal area secondary schools. For the component sensing the problems from coastal area secondary schools (N=149), the mean score is 4.853 with a standard

deviation of 1.402. In comparison, among students from non-coastal area secondary schools (N=251), the mean score is 5.248 with a standard deviation of 1.468. The *t*-value for this comparison is 2.647, with a p-value of 0.008, indicating a statistically significant difference at the 0.05 level. This suggests that students from non-coastal area secondary schools have a slightly higher ability to sense problems compared to students from coastal area secondary schools.

The data on the ability to collect and classify data shows the mean score is 3.940 with a standard deviation of 1.362 for coastal area students, while for students from non-coastal area schools, the mean score is 5.232 with a standard deviation of 1.631. The *t*-value is 8.144, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. Therefore, students from non-coastal area schools have significantly higher abilities to collect and classify data compared to students from coastal area secondary schools.

The comparison of the ability to analyze between students from coastal and non-coastal area secondary schools gives the *t*-value is 3.758, with a p-value of 0.001, indicating a statistically significant difference at the 0.01 level. Hence, students from non-coastal area schools exhibit significantly higher abilities in analysis compared to students from coastal area secondary schools.

On the ability to evaluate information among students from coastal and non-coastal area secondary schools, the *t*-value is 3.447, with a p-value of 0.001, indicating a statistically significant difference at the 0.01 level. Therefore, students from non-coastal area secondary schools show significantly higher abilities in evaluation compared to students from coastal area secondary schools.

The table compares the ability to generalisation between students from coastal and non-coastal area secondary schools. Students from coastal area

secondary schools have a mean generalisation score of 2.540 with a standard deviation of 1.267, while students from non-coastal area secondary schools have a mean score of 3.368 with a standard deviation of 1.752. The *t*-value is 5.049, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. Thus, students from non-coastal area secondary schools demonstrate significantly higher abilities in generalisation compared to students from coastal area secondary schools.

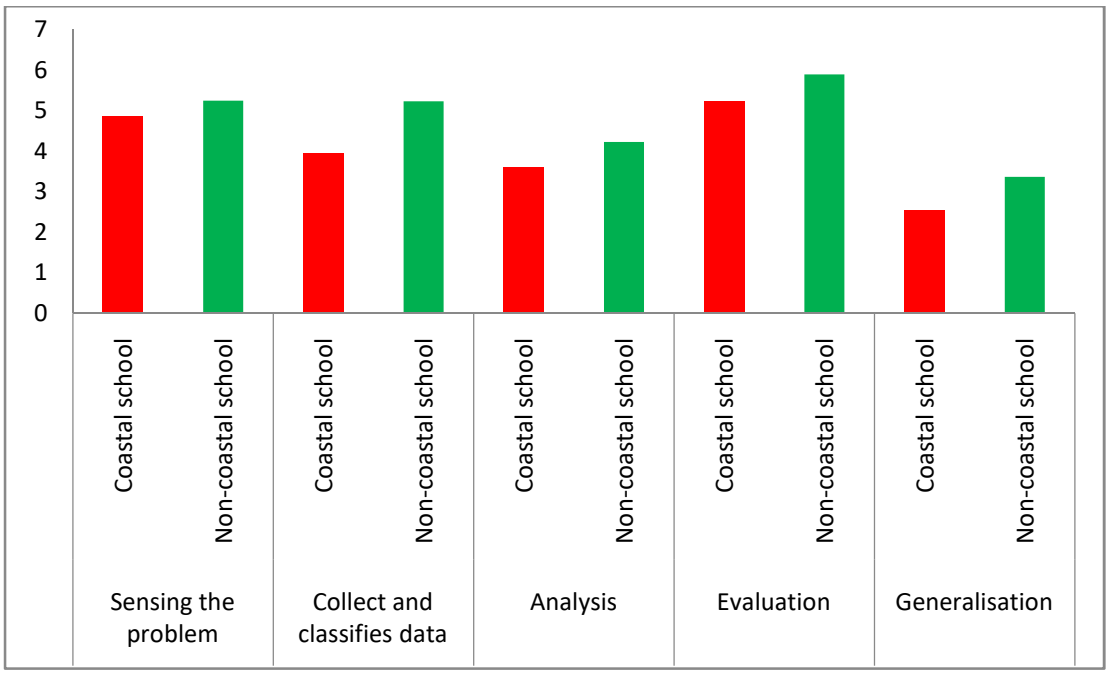
Lastly, compares the overall Problem solving ability scores between students from coastal and non-coastal area secondary schools. Students from coastal area schools have a mean score of 20.153 with a standard deviation of 4.256, while students from non-coastal area schools have a mean score of 23.972 with a standard deviation of 5.900. The *t*-value is 6.918, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. Thus, students from non-coastal area secondary schools demonstrate significantly higher problem solving abilities compared to students from coastal area secondary schools.

The performance of the coastal area and non-coastal area secondary school students on problem solving ability and its components for the total sample were examined graphically.

The graphical representation of mean scores of problem solving ability (component-wise) of the coastal area and non-coastal area secondary schools is shown in Figure 4.

Figure 4

The Graphical Representation of Mean Scores of Problem Solving Ability (Component-wise) of Coastal Area and Non-coastal Area Secondary School Students

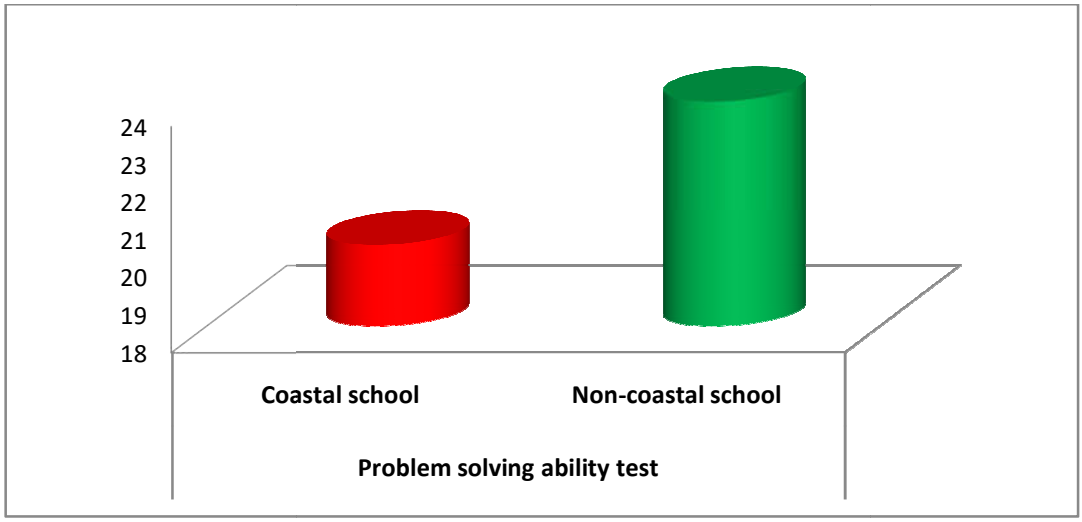


From Figure 4, it is evident that the bar plots are used to compare differences in mean scores among two groups; coastal area students and non-coastal area students. The X-axis of the graph represents the components of the variable problem solving ability (sensing the problem, collect and classifies data, analysis, evaluation and generalisation) of the two groups. The Y-axis represents the mean scores of the components of the variable problem solving ability of the two groups. The mean scores of the Non-coastal area samples were higher than those of the coastal area sample for the components of the variable problem solving ability so it can be concluded that Non-coastal area secondary students have higher problem solving ability in component-wise as compared to the coastal area secondary students.

The graphical representation of mean scores of problem solving ability (total sample) of coastal area and non-coastal area secondary schools was shown in figure 5.

Figure 5

The Graphical Representation of Mean Scores of Problem Solving Ability (Total Sample) of Coastal Area and Non-coastal Area Secondary School Students



From Figure 5, it is evident that the bar chart was used to compare the difference in the mean scores of the two groups, coastal area students and Non-coastal area students for the variable problem solving ability for the total sample. The X-axis of the graph represents the variable problem solving ability of two groups. The Y-axis represents the mean scores of the problem solving ability of two groups for the total sample. So it can be concluded that Non-coastal area secondary students have higher problem solving ability as compared to the coastal area secondary school students.

Comparison of Mean Scores of Perceptual Speed and its Sub-components between Coastal area and Non-coastal Area Secondary School Students

To find whether there exists any significant difference in the mean scores of the Perceptual Speed and its sub-components between Coastal area and Non-coastal area secondary school, the investigator used an independent sample *t*-test. The result of the statistical analysis is presented in Table 12.

Table 12

Data and Results of Test of Significance of the Difference between Mean Scores of Perceptual Speed and its Sub-components between the Coastal Area and Non-Coastal Area

Variable	Group	N	Mean	Std. Deviation	t	p value	Significance
Geometric Shape Comparison	Coastal area school	149	3.913	1.959	22.103	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	7.672	1.427			
Number Comparison Test	Coastal area school	149	3.820	1.776	18.488	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	6.892	1.500			
Symbol Comparison Test	Coastal area school	149	3.393	1.609	11.565	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	5.808	2.232			
Basic Arithmetic Operation Test	Coastal area school	149	5.987	1.768	13.044	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	8.720	2.170			
Perceptual Speed	Coastal area school	149	17.113	3.775	26.010	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	29.092	4.823			

Table No.12, represents data comparing the performance of students from coastal area secondary schools and non-coastal area secondary schools on the Perceptual Speed and its components. For students from coastal area secondary schools, the mean score of geometric shape comparison is 3.913 with a standard deviation of 1.959, while for students from non-coastal area secondary schools, the mean score is 7.672 with a standard deviation of 1.427. The calculated *t*-value for this comparison is 22.103, indicating a substantial difference in means between the two groups. The associated p-value is 0.000, which is less than 0.01, indicating a statistically

significant difference. Therefore, students from coastal area secondary schools perform significantly low on the geometric shape comparison test compared to students from non-coastal area secondary schools.

On the number comparison test Students from coastal area secondary schools have a mean score of 3.820 with a standard deviation of 1.776, whereas students from non-coastal area secondary schools have a mean score of 6.892 with a standard deviation of 1.500. The calculated *t*-value is 18.488 and the associated p-value is 0.000, indicating a statistically significant difference at the 0.01 level.

Symbol comparison test performance of students from coastal and non-coastal area schools shows the calculated *t*-value is 11.565 and the associated p-value is 0.000, indicating a statistically significant difference at the 0.01 level. Thus, students from coastal area secondary schools exhibit significantly lower performance on the symbol comparison test compared to students from non-coastal area secondary schools.

The comparison of students' performance on a basic arithmetic operation test between coastal and non-coastal area secondary schools shows students from coastal area secondary schools have a mean score of 5.987 with a standard deviation of 1.768, while students from non-coastal area secondary schools have a mean score of 8.720 with a standard deviation of 2.170. The calculated *t*-value is 13.044, and the associated p-value is 0.000, indicating a statistically significant difference at the 0.01 level. Therefore, students from coastal area secondary schools perform significantly lower on the basic arithmetic operation test compared to students from non-coastal area secondary schools.

Finally, the table presents data on the Perceptual Speed performance of students from coastal and non-coastal area secondary schools. Students from coastal area secondary schools have a mean score of 17.113 with a standard deviation of 3.775, whereas students from non-coastal area schools have a mean score of 29.092

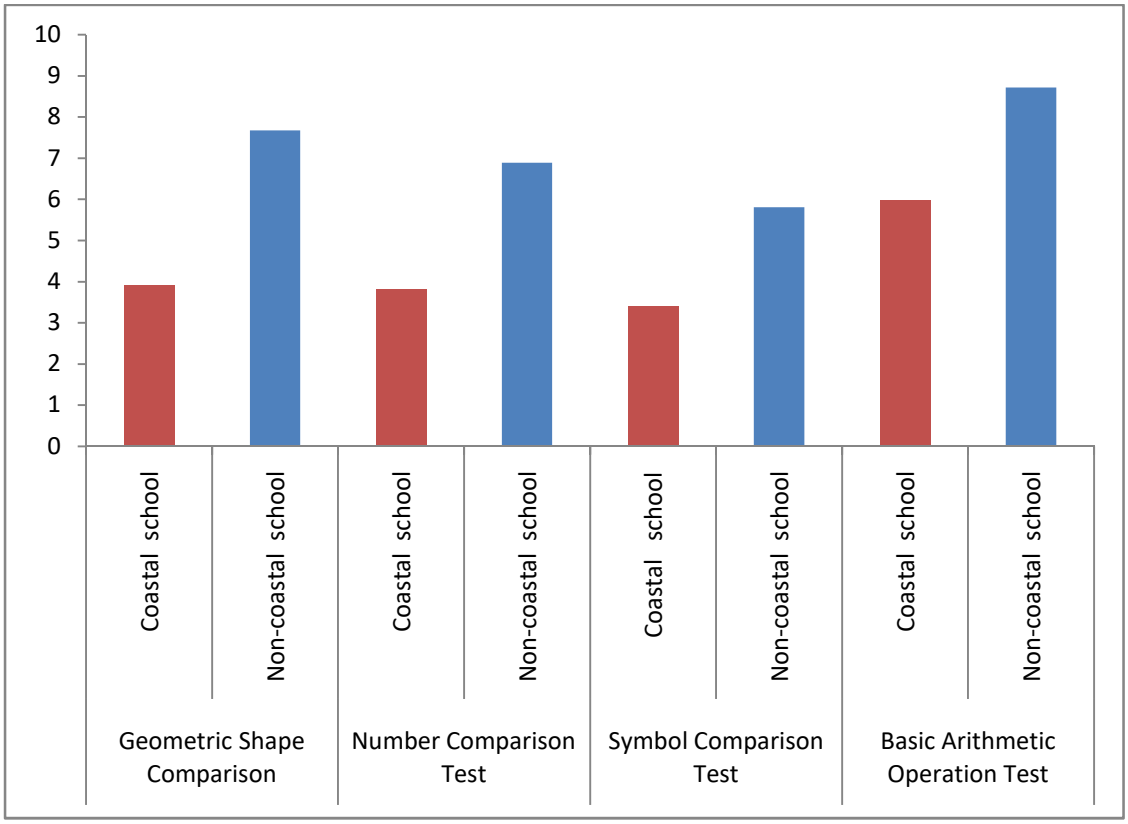
with a standard deviation of 4.823. The calculated *t*-value is 26.010, and the associated p-value is 0.000, indicating a statistically significant difference at the 0.01 level. Hence, students from coastal area secondary schools demonstrate significantly lower performance on the Perceptual Speed compared to students from non-coastal area secondary schools.

The performance of the coastal area and non-coastal area secondary school students on perceptual speed and its components for the total sample were examined graphically.

The graphical representation of mean scores of perceptual speed (component-wise) of coastal area and non-coastal area secondary schools was shown in Figure 6.

Figure 6

The Graphical Representation of Mean Scores of Perceptual Speed (Component-wise) of Coastal Area and Non-coastal Area Secondary School Students

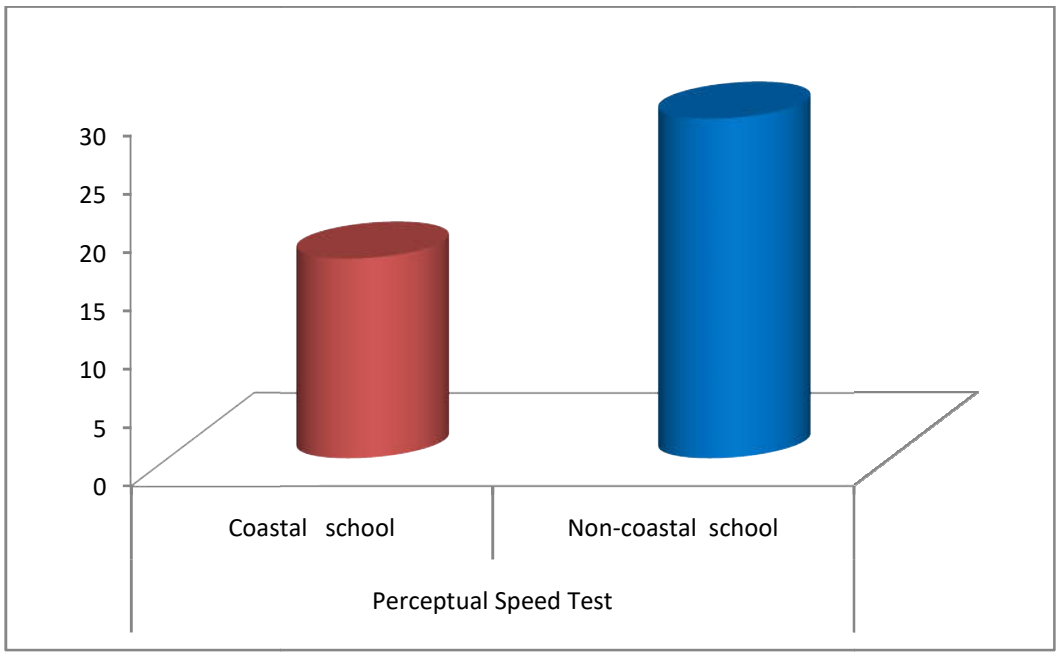


From figure 6, it is evident that the bar plots are used to compare differences in mean scores among two groups; coastal area and non-coastal area secondary school students. The X-axis of the graph represents the components of the variable perceptual speed (shape comparison test, number comparison test, symbol comparison test, basic arithmetic operation test) of two groups. The Y-axis represents the mean scores of the components of the variable perceptual speed of the two groups. The mean scores of the Non-coastal area samples were higher than those of the coastal area sample for the components of the variable perceptual speed so it can be concluded that Non-coastal area secondary students have higher perceptual speed component-wise as compared to the coastal area secondary students.

The graphical representation of mean scores of perceptual speed (total sample) of coastal area and non-coastal area secondary schools were shown in figure 7.

Figure 7

The Graphical Representation of Mean Scores of Perceptual Speed (Total Sample) of the Coastal Area and Non-coastal Area Secondary School Students



From Figure 7, it is evident that the bar chart was used to compare the difference in the mean scores of the two groups, coastal area students and Non-coastal area students for the variable perceptual speed for the total sample. The X-axis of the graph represents the variable perceptual speed of the two groups. The Y-axis represents the mean scores of perceptual speed of two groups for the total sample. So it can be concluded that Non-coastal area secondary students have higher perceptual speed as compared to coastal area secondary students.

Comparison of Mean Scores of Mathematics Anxiety and its Sub-components between Coastal Area and Non-coastal Area Secondary School Students

To find whether there exists any significant difference in the mean scores of mathematics anxiety and its sub-components between Coastal area and Non-coastal area secondary school, the investigator used an independent sample *t*-test. The result of the statistical analysis is presented in Table 13.

Table 13

Data and Results of Test of Significance of the Difference between Mean Scores of Mathematics Anxiety and its Sub-components between the Coastal Area and Non-Coastal Area

Variable	Group	N	Mean	Std. Deviation	t	p-value	Significance
Topics related anxiety	Coastal area school	149	18.613	4.010	4.526	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	16.872	3.544			
Concern about learning mathematics	Coastal area school	149	20.253	5.260	3.330	0.001	< 0.01, significant at 0.01 level
	Non-coastal area school	251	18.680	4.111			
Resolving Problems in mathematics	Coastal area school	149	20.513	2.465	2.881	0.004	< 0.01, significant at 0.01 level
	Non-coastal area school	251	19.628	3.243			
Classroom Performance anxiety	Coastal area school	149	22.660	3.141	6.581	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	20.436	3.348			
Mathematics test anxiety	Coastal area school	149	21.307	3.354	2.121	0.035	< 0.05, significant at 0.05 level
	Non-coastal area school	251	20.552	3.499			
Mathematics anxiety scale	Coastal area school	149	103.347	14.120	5.376	0.000	< 0.01, significant at 0.01 level
	Non-coastal area school	251	96.168	12.163			

Table No.13, This part of the table compares the mathematics anxiety and its components. Among students from coastal area secondary schools (N=149), the mean topics-related anxiety score is 18.613 with a standard deviation of 4.010. For non-coastal area secondary schools (N=251), the mean anxiety score is 16.872 with

a standard deviation of 3.544. The *t*-value is 4.526, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. This means that students from coastal area secondary schools experience significantly higher levels of topics-related anxiety compared to students from non-coastal area secondary schools.

Data on concern about learning mathematics shows for students from coastal area secondary schools, the mean score is 20.253 with a standard deviation of 5.260, while from non-coastal area secondary schools, the mean score is 18.680 with a standard deviation of 4.111. The *t*-value is 3.330 and the p-value is 0.001, indicating a statistically significant difference at the 0.01 level. Hence, students from coastal area secondary schools exhibit significantly higher levels of concern about learning mathematics compared to students from non-coastal area secondary schools.

The comparison of Resolving problems in mathematics with mean score of 20.513 and standard deviation of 2.465 for coastal area secondary schools and for non-coastal area secondary schools mean score is 19.628 with a standard deviation of 3.243. The *t*-value is 2.881, with a p-value of 0.004, indicating a statistically significant difference at the 0.01 level. Therefore, students from coastal area secondary schools experience significantly higher levels of resolving problems in mathematics compared to students from non-coastal area secondary schools.

The classroom performance anxiety levels among students from coastal area secondary schools and non-coastal area secondary schools have mean scores of 22.660 with a standard deviation of 3.141 and mean score of 20.436 with a standard deviation of 3.348 respectively. The *t*-value is 6.581, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. Thus,

students from coastal area secondary schools exhibit significantly higher levels of classroom performance anxiety compared to students from non-coastal area secondary schools.

The comparison of the level of mathematics test anxiety shows that coastal area secondary schools have a mean score of 21.307 with a standard deviation of 3.354, while students from non-coastal area secondary schools have a mean score of 20.552 with a standard deviation of 3.499. The *t*-value is 2.121, with a p-value of 0.035, indicating a statistically significant difference at the 0.05 level. Therefore, students from coastal area secondary schools experience significantly higher levels of mathematics test anxiety compared to students from non-coastal area secondary schools.

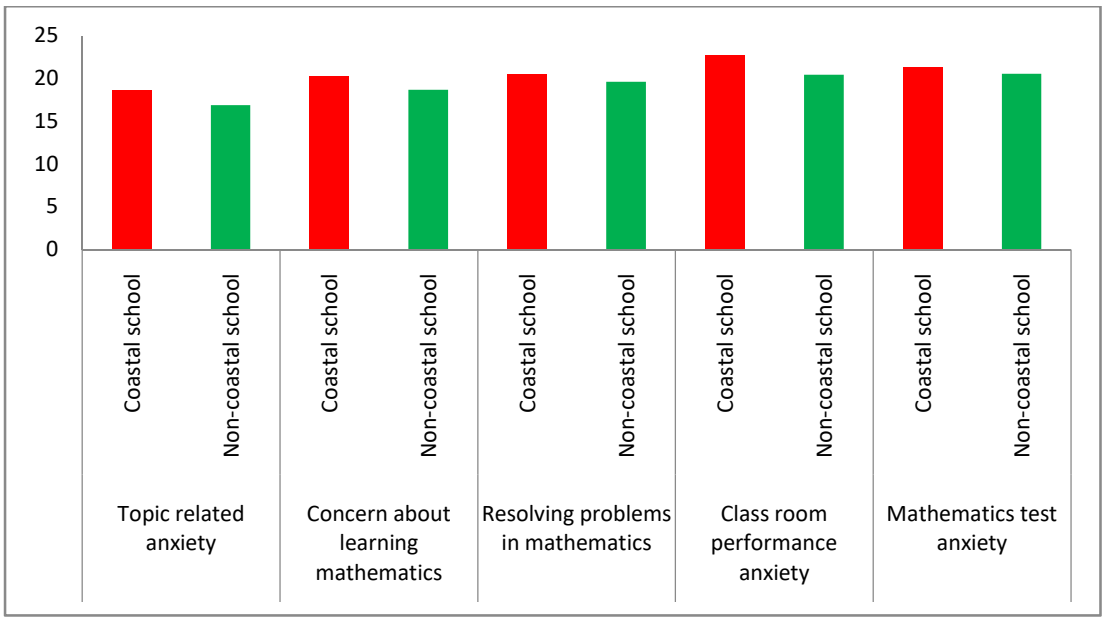
Lastly, the overall mathematics anxiety scores between students from coastal area and non-coastal area secondary schools show mean mathematics anxiety score of 103.347 with a standard deviation of 14.120 for coastal area secondary school students, while students from non-coastal area secondary schools have a mean score of 96.168 with a standard deviation of 12.163. The *t*-value is 5.376, with a p-value of 0.000, indicating a statistically significant difference at the 0.01 level. Thus, students from coastal area secondary schools show significantly higher overall mathematics anxiety compared to students from non-coastal area secondary schools.

The mathematics anxiety and its components of coastal area and non-coastal area secondary school students on mathematics anxiety and its components for total sample were examined graphically.

The graphical representation of mean scores of mathematics anxiety (component-wise) of the coastal area and non-coastal area secondary schools was shown in figure 8.

Figure 8

The Graphical Representation of Mean Scores of Mathematics Anxiety (Component-wise) of Coastal Area and Non-coastal Area Secondary School Students

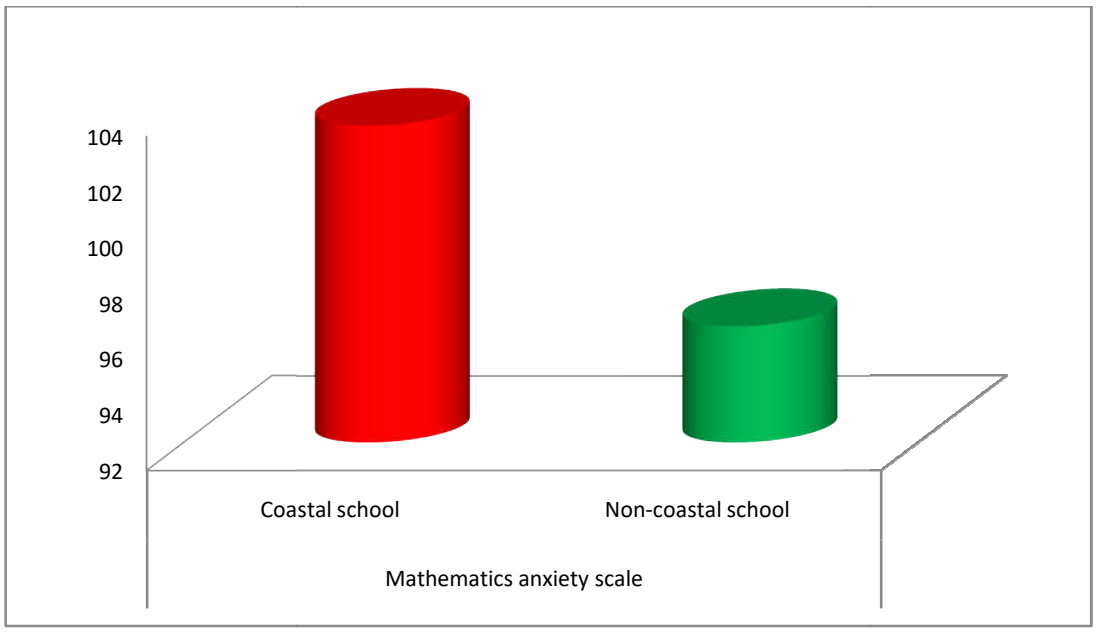


From Figure 8, it is evident that the bar plots are used to compare differences in mean scores among two groups; coastal area students and non-coastal area students. The X-axis of the graph represents the components of the variable mathematics anxiety (Topics related anxiety, concern about learning mathematics, resolving problems in mathematics, classroom performance anxiety, mathematics test anxiety) of the two groups. The Y-axis represents the mean scores of the components of the variable mathematics anxiety of the two groups. The mean scores of the Non-coastal area samples were lower than those of the coastal area sample for the components of the variable mathematics anxiety so it can be concluded that Non-coastal area secondary students have lower mathematics anxiety in component-wise as compared to the coastal area secondary students.

The graphical representation of mean scores of mathematics anxiety (total sample) of coastal area and non-coastal area secondary schools is shown in Figure 9.

Figure 9

The Graphical Representation of Mean Scores of Mathematics Anxiety (Total Sample) of the Coastal Area and Non-coastal Area Secondary School Students



From Figure 9, it is evident that the bar chart was used to compare the difference in the mean scores of the two groups, coastal area and Non-coastal area secondary school students for the variable mathematics anxiety for the total sample. The X-axis of the graph represents the variable mathematics anxiety of the two groups. The Y-axis represents the mean scores of mathematics anxiety of two groups for the total sample. So it can be concluded that Non-coastal area secondary students have lower mathematics anxiety as compared to coastal area secondary students.

Discussion

By observing the data by comparing the mean difference analysis of the performance of students in the coastal area and non-coastal area secondary schools, From the preliminary survey on problem solving ability, perceptual speed and mathematics anxiety of secondary school students; it can be concluded that

the students from coastal area secondary school shows significantly low performance in problem solving ability and perceptual speed in mathematics and shows significantly higher mathematics anxiety while comparing to the overall performance of students from non-coastal area secondary school. Hence the investigator decided to conduct the experimental study in the coastal area secondary schools.

Results of the Preliminary Survey of Secondary School Mathematics Teachers

The main objective of the preliminary survey of secondary school mathematics teachers was to identify the Prevailing Strategies and methods of Teaching mathematics, its Constraints and the Suggestive Measures to Overcome the Constraints of Teaching Mathematics at the Secondary Level.

Mathematics teaching puts a lot of pressure on mathematics teachers as it's a difficult subject for most of the students in the classroom and it is one of the most important ingredients in the students' career growth in the future and daily life. Since mathematics learners have to process a huge amount of basics of mathematics which will be helpful for their higher studies and which is mainly obtained from the mathematics classroom in school. Teachers and learners use different learning and teaching strategies in achieving the tasks and processing the new input the learners face. Mathematics teaching strategies show how well the teachers can succeed in tasks or problems encountered during mathematics learning classrooms. It can be achieved only through carefully selecting strategies by a teacher. A teacher must identify and analyze the constraints in front of her and find proper corrective measures to rectify them most effectively.

To identify these, the investigator explored the prevailing strategies and methods followed by the teachers to cater to the needs of the mathematics learners.

For this, the investigator with the guidance of the supervising teacher constructed a questionnaire intending to find out the perception of mathematics teachers at the secondary level.

The questionnaire was focused on three main areas namely:

a. The prevailing strategies and methods in teaching mathematics.

b. The constraints experienced by the teachers in adopting the prevailing strategies and methods in teaching mathematics.

c. The suggestive measures to rectify or overcome the constraints in implementing the prevailing strategies and methods to teach mathematics at the secondary school level.

Analysis of the perception of mathematics teachers regarding the prevailing strategies and methods in teaching mathematics at the secondary level. The primary session of the questionnaire was to emphasise on the Perception of mathematics teachers regarding the prevailing strategies and methods in teaching mathematics at Secondary level. The reactions of the respondents were carefully sorted and analyzed using percentage analysis. The details of the prevailing strategies and methods used by the mathematics teachers at the secondary level are given below in Table 14.

Table 14

Teachers' Perceptions on Prevailing Strategies and Methods Practiced for Teaching Mathematics at Secondary School Level

No.	Strategies and methods practiced for teaching mathematics	% of teachers practicing
1	Problem-based learning	77%
2	Brain- compatible learning	0%
3	Blended learning	30%
4	Computer-assisted learning instruction	67%
5	Assignments	97%
6	Co-operative learning	60%
7	Collobarative learning	13%
8	Activity oriented	87%
9	Seminars	77%
10	Mentoring	53%
11	Team teaching	30%
12	Group instruction	80%
13	Individualized instruction	67%
14	Inclusive instruction	50%
15	Mind maps	17%
16	Graphic organizers	13%
17	Explicit instruction	13%
18	Integrated instruction	17%
19	Inductive -deductive	80%
20	Heuristic	53%
21	Discovery	50%
22	Analytic -Synthetic	77%
23	Problem solving	93%
24	Laboratory	77%
25	Project	90%

It is clear from Table No. 14, that the majority of secondary school mathematics teachers practiced teaching strategies and methods like Assignments (97%), Problem solving (93%), Projects (90%), Activity-oriented (87%), Inductive -deductive (80%), Group instruction (80%), Problem-based learning (77%), Seminars (77%), Analytic -synthetic (77%), Laboratory (77%), Computer-assisted learning instruction (67%), Individualized instruction (67%), Co-operative learning (60%), Mentoring (53%), Heuristic (53%), Inclusive instruction (50%), Discovery (50%),

According to the secondary school mathematics teachers, it is found out that, the less used methods are Blended learning (30%), Team teaching (30%), Mind maps (17%), Integrated instruction (17%) Graphic organizers (13%), Explicit instruction (13%), Collobarative learning (13%), and Brain compatible learning (0%). are not used much by secondary school mathematics teachers.

Constraints Experienced by the Mathematics Teachers at the Secondary Level

In this session, the investigator examined the response of mathematics teachers at secondary level regarding the constraints experienced while adopting various strategies for teaching mathematics. The constraints were focused on three main areas:

a) Constraints faced by students.

b) Constraints faced by the teachers.

c) General constraints in teaching mathematics.

The details are given below table 15.

Table 15

Constraints Faced by the Mathematics Teachers for Teaching Mathematics at Secondary Level

No.	Constraints experienced	% of teachers
1	Lack of pre-requisite skills of students	87%
2	Time of reflection	83%
3	Lack of effort by students	83%
4	Lack of interest by students	83 %
5	Learning experiences and resources	43%
6	Self motivation	33%
7	Expert teachers	37%
8	Lack of training	17%

Table No. 15 clearly shows that 87% of teachers pre-requisite skills of students is the most important constraint they face in implementing innovative instructional strategies and methods. In mathematics prerequisite skills are one of the most important factor of effective use of new strategies of teaching. Time of reflection (83%), lack of effort and interest by students (83%), learning experience and resources (43%), expert teachers (37%), self motivation (33%) and lack of training (17%) are also the significant issues while practicing different innovative strategies and methods of teaching.

Suggestive Measures to Overcome the Constraints and Alternative Solutions for Effective Teaching of Mathematics at the Secondary Level

In this session, the investigator obtained responses regarding the measures to overcome the constraints in implementing strategies and alternative solutions for effective teaching from mathematics teachers at the secondary level. The details are given below

- After covid pandemic lot of changes happened in children so bringing them back to education is a very difficult task for teachers. So we need to adopt different strategies and methods for teaching.
- For learning mathematics it is necessary to have some basic qualities like attention, interest, patience and basics of mathematics. In this generation very few children have these minimum qualities, most of the children lack these basic qualities of learning mathematics so it is necessary to give importance to building such basic qualities among children of this generation.
- Restrict the class strength to 1:15 or 1:20.
- Reduce the syllabus and textbook content.
- Do not get enough time for teaching so increase the duration of the class period from 40 minutes to one hour
- Revise the mathematics textbook, while revising the textbook give more importance to the exercise part of the textbook, give more problems based on the same models explained in the lesson; which will help the learners to understand the methods of solving the problems, learn the content thoroughly and students can improve their problem solving ability.
- Provide proper training to teachers in new instructional strategies and ICT-based education.

The different teaching strategies and methods follow a particular structure. Teachers suggested the following measures to overcome the constraints they experienced for improving Teaching mathematics at Secondary school such as more time for teaching, student interest, attention, patience, motivation, and basics of mathematics, syllabus, and textbook content also play a vital role in accomplishing each instructional strategy.

From the preliminary survey it is concluded that most of the secondary school teachers were aware of different teaching strategies used for teaching mathematics at the secondary school level but they face some constraints in adopting them successfully. From the survey, the investigator decided to select Brain-compatible learning strategy as an instructional strategy because it includes many of the above mentioned instructional strategies and methods in the classroom for teaching and learning.

Preliminary Analysis of Experiment

The statistical constants of the variables in the study and establishing the equivalence of the groups by the comparison of mean scores of relevant variables for the experimental group and the control group for the total sample, Boys and Girls.

Statistical Constants of the Variables

Preliminary analysis was done to identify the basic properties of the distributions of the dependent variable and the covariates. Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis of the pre-test and posttest scores of the dependent variables problem solving ability, perceptual speed, and mathematics anxiety, and the pre-test scores of the covariates Nonverbal Intelligence, Classroom Environment and Socio-Economic Status of the students were computed separately for experimental and control groups (Total Sample, Boys and Girls).

To collect data on problem solving ability, Test of problem solving ability (Aruna & Lisheetha, 2019) was used to collect data on problem solving ability in mathematics, and the sum of the scores of the student's Problem solving ability in mathematics namely, Sensing the problem, collect and classify data, Analysis, Evaluation, and generalisation were considered. The minimum possible Score for

the test as well as the components is zero. The maximum possible score for the test as well as the components is 40.

To collect data on perceptual speed, Test of perceptual speed (Aruna & Lisheetha, 2019) was used to collect data on perceptual speed in mathematics. The sum of scores of the student's perceptual speed namely, the Number comparison test, the Geometric shape comparison test, the Symbol comparison test and the Basic arithmetic operation test were taken. The minimum possible score for the test as well as the components is zero. maximum possible scores for the test as well as the component is 42.

To collect data on Mathematics anxiety, the Scale of Mathematics Anxiety (Aruna & Lisheetha, 2019) was used. The components of the scale of mathematics anxiety were topic-related anxiety, Concern about learning mathematics, Resolving problems in Mathematics, Classroom Performance anxiety and Mathematics Test anxiety. The possible minimum and maximum scores of mathematics anxiety are 30 and 150 respectively.

For equating the groups in nonverbal Intelligence, the Standard Progressive Matrices Test (Raven, 1958) was used, to measure the nonverbal Intelligence of Coastal area secondary school students belonging to experimental and control groups, for testing the homogeneity of the groups. The maximum possible score of Nonverbal Intelligence is 60 and the minimum is Zero. The Classroom Environment was measured using the Classroom Environment Inventory (Aruna et al., 1998). Socio-Economic Status Scale (Aruna & Sumi, 2010) was used to measure the Socio-Economic Status of the student. The minimum and maximum possible scores of the Classroom Environment inventory are zero and forty-seven respectively and the minimum and maximum scores of Socio-Economic status are 5 to 105 respectively.

Normal P-P plots of the pretest scores of the variables were also utilized to check the normality of the pretest scores of the experimental group and control group.

Figure 10

Normal P-P Plots of the Pretest Scores of the Variables in Control Group

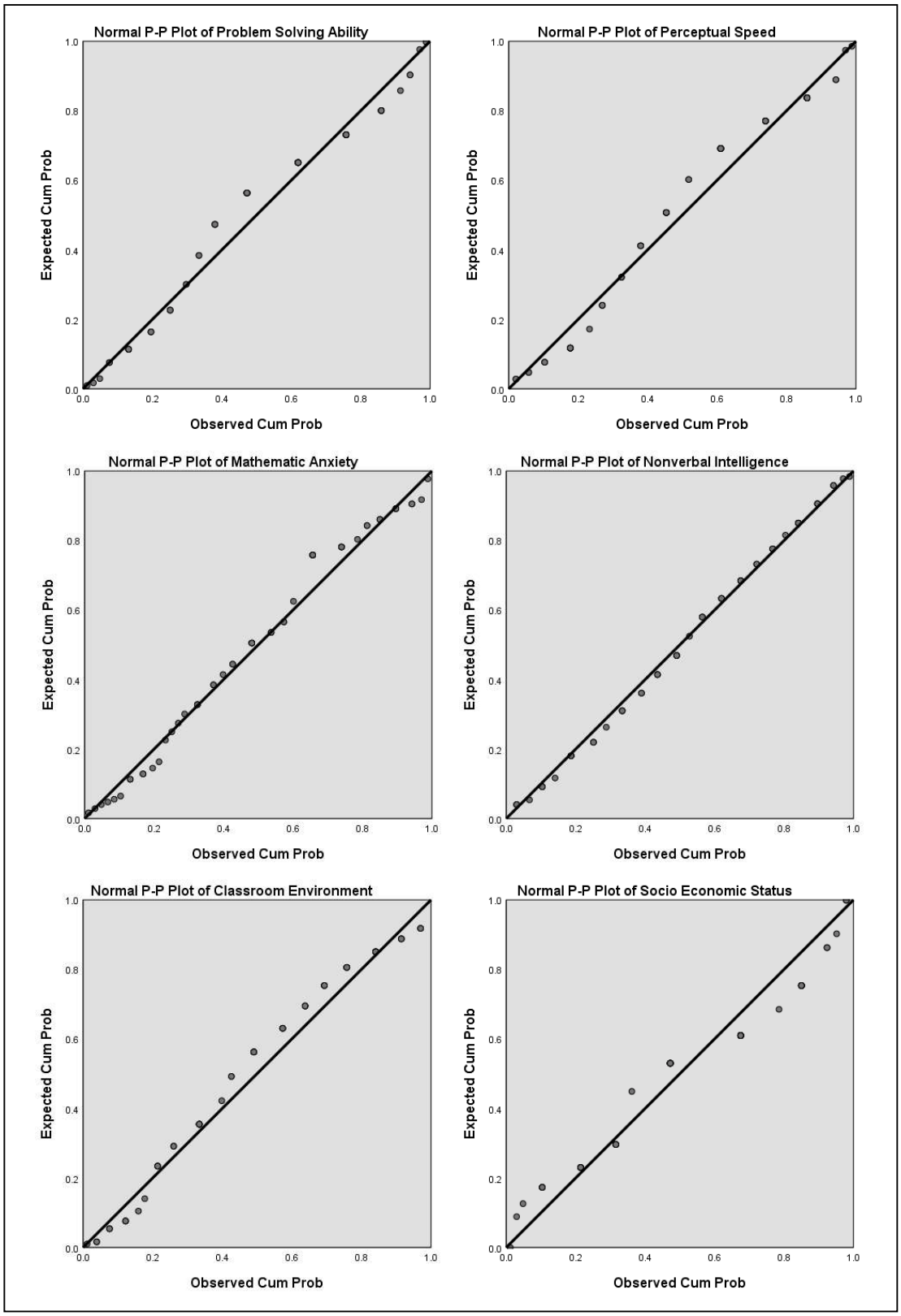
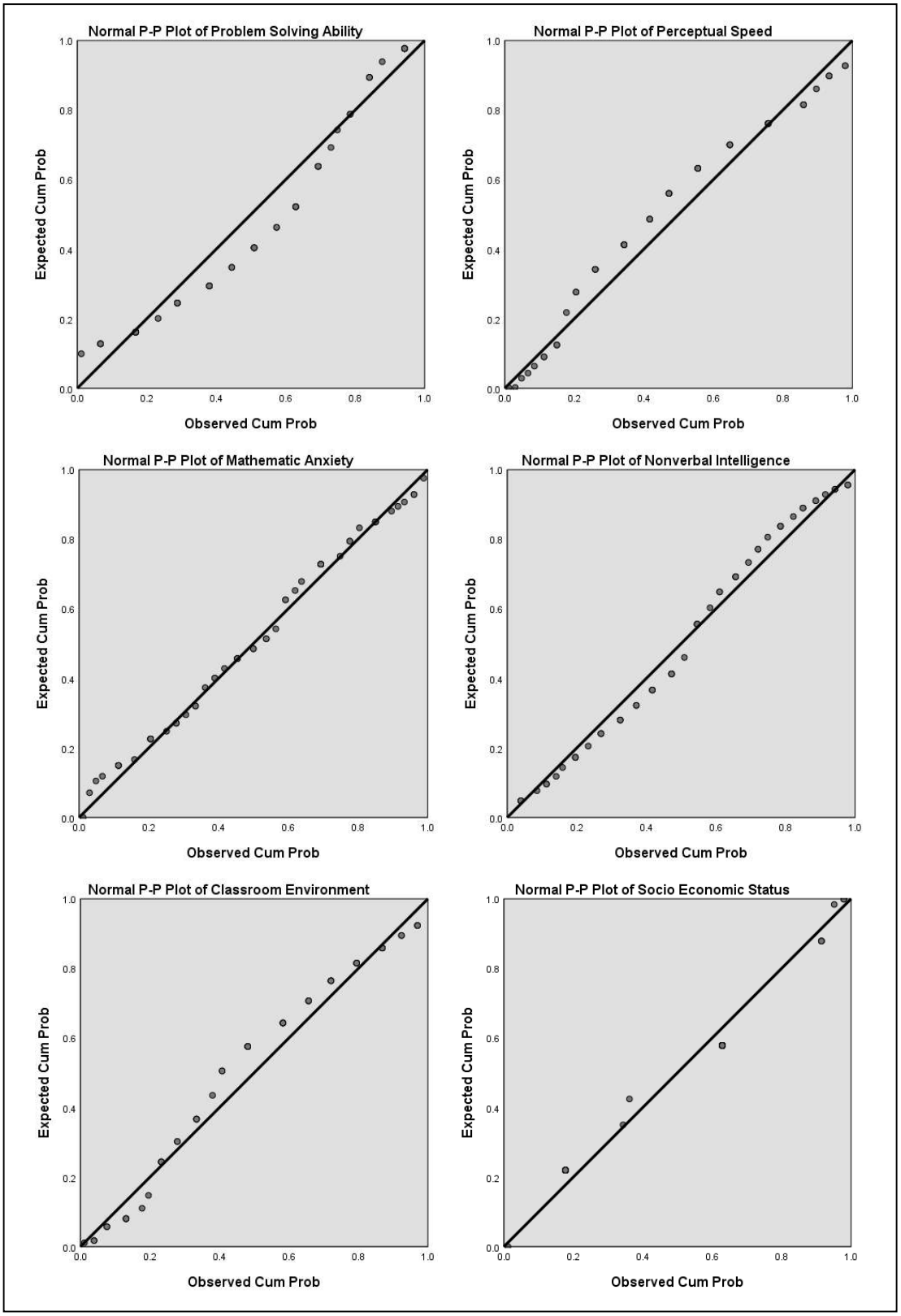


Figure 11

Normal P-P Plots of the Pretest Scores of the Variables in Experimental Group



Pretest Scores of the Variables for the Experimental Group

The statistical constants of the pre-test scores of the variables problem solving ability, perceptual speed, mathematics anxiety, Nonverbal Intelligence, Classroom Environment and Socio-Economic Status for the Total sample, Boys and Girls of the experimental group are presented in the following tables.

Table 16

Statistical Constants of the Pretest Scores of the Variables for the Experimental Group - Total Sample

Variables	N	Mean	Median	Mode	Standard Deviation	skewness	kurtosis
Problem solving ability	54	16.6296	16.0000	16.00	2.81704	.079	-.384
Perceptual speed	54	26.1852	26.0000	27.00	2.74772	-.076	.157
Mathematics anxiety	54	91.5185	92.0000	90.00	6.72012	-.373	.207
Nonverbal Intelligence	54	43.8333	42.5000	30.00	8.30265	.044	-1.083
Classroom environment	54	33.9259	35.0000	32.00	5.42479	-.628	-.326
Socio economic status	54	43.9815	45.0000	45.00	6.89405	-.067	.181

Table No.16, shows the descriptive statistics of the experimental group across various variables is given in the table In terms of problem solving ability, the mean score is 16.6296, with a slight positive skewness and a platykurtic distribution. For perceptual speed, the mean score was 26.1852, showing a nearly symmetrical distribution with a slightly positive skewness. Mathematics anxiety scores averaged 91.5185, exhibiting a slightly negatively skewed distribution with a slightly normal distribution. Nonverbal Intelligence scores had a mean of 43.8333, showing a near-symmetrical distribution but with a platykurtic shape. The Classroom Environment

and Socio-Economic Status displayed similar characteristics, with means of 33.9259 and 43.9815 respectively, showing slight negative skewness and platykurtic distributions. These statistics provide a detailed insight into the distributional properties of each variable within the experimental group and from the properties, it can be observed that all the pre-test scores of the variables in the experimental group show near symmetrical normal distribution.

Table 17

Statistical Constants of the Pretest Scores of the Variable for the Experimental Group - Boys

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	26	16.5385	16.0000	16.00	2.59585	.168	.084
Perceptual speed	26	24.6154	25.0000	26.00	2.38457	-.366	-.906
Mathematics anxiety	26	93.4231	93.0000	93.00	5.13165	-.529	.525
Nonverbal intelligence	26	43.2308	42.0000	30.00	8.25740	.074	-1.105
Classroom environment	26	29.7692	30.5000	32.00	4.47489	-.314	-.490
Socio economic status	26	43.8462	45.0000	45.00	6.67947	-.414	-.160

Table No.17, shows the experimental group of boy's pre-test scores indicate their baseline performance across different variables. For problem solving ability, the mean pre-test score was 16.5385, with a median of 16.0000 and a mode of 16.00. The standard deviation of 2.59585 suggests a moderate level of variability in scores. The distribution appears slightly positively skewed with a skewness value of 0.168 and exhibits a kurtosis of 0.084 indicating a relatively normal distribution. Regarding perceptual speed the mean pre-test score was 24.6154 with a median

and mode of 25.0000 and 26.00 respectively. The standard deviation of 2.38457 suggests a relatively consistent spread of scores. The distribution appears moderately negatively skewed with a skewness value of -0.366 and exhibits a kurtosis of -0.906 indicating a slightly normal distribution. Concerning mathematics anxiety the mean pre-test score was 93.4231 with a median of 93.0000 and a mode of 93.00. The standard deviation of 5.13165 suggests a moderate level of variability in scores. The distribution appears moderately negatively skewed with a skewness value of -0.529 and exhibits a kurtosis of 0.525. These statistics provide insights into the variables of boys in the experimental group and show a normal distribution.

Table 18

Statistical Constants of the Pretest Scores of the Variable for the Experimental Group - Girls

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	28	16.7143	16.5000	16.00	3.05332	.006	-.584
Perceptual speed	28	27.6429	27.0000	27.00	2.23133	.464	.069
Mathematics anxiety	28	89.7500	90.0000	90.00	7.58471	.030	.047
Nonverbal intelligence	28	44.3929	44.0000	30.00	8.45616	.012	-1.046
Classroom environment	28	37.7857	38.0000	39.00	2.67162	-.418	-.504
Socio economic status	28	44.1071	45.0000	45.00	7.20771	.176	.575

The table No.18 reveals the descriptive statistics for the experimental group of girls in terms of problem solving ability, the mean pre-test score was 16.7143 with a median of 16.5000 and a mode of 16.00. The standard deviation of 3.05332

indicates a moderate level of variability in scores. The distribution appears relatively symmetrical with a skewness value close to zero (0.006) and exhibits a kurtosis of -0.584. Regarding perceptual speed the mean pre-test score was 27.6429 with a median of 27.0000 and a mode of 27.00. The standard deviation of 2.23133 suggests a relatively consistent spread of scores. The distribution appears moderately positively skewed with a skewness value of 0.464 and exhibits a kurtosis of 0.069 indicating a slightly symmetrical distribution. Concerning mathematics anxiety the mean pre-test score was 89.7500 with a median of 90.00 and a mode of 90.00. The standard deviation of 7.58471 and the distribution appears approximately symmetrical with a skewness value close to zero (0.030) and exhibits a kurtosis of 0.047, suggesting a relatively normal distribution. The statistics provide the variables under study exhibit a normal distribution.

Pretest Scores of the Variables for the Control Group

The statistical constants for the pretest scores of the variables problem solving ability, perceptual speed, mathematics anxiety, Nonverbal Intelligence, Classroom Environment and Socio-Economic Status for the Total sample, Boys and Girls of the control group are presented in the following tables.

Table 19

Statistical Constants of the Pretest Scores of the Variables for the Control Group - Total Sample

Variables	N	Mean	Median	Mode	Standard Deviation	skewness	kurtosis
Problem solving ability	54	16.2963	16.0000	15.00	2.76521	-.220	-.091
Perceptual speed	54	25.9259	26.0000	26.00	2.20507	-.166	-.126
Mathematics anxiety	54	88.8333	89.0000	89.00	7.65223	.186	-.276
Nonverbal Intelligence	54	43.5556	43.0000	37.00	7.17876	.145	-.621
Classroom environment	54	34.1111	35.0000	31.00	4.59149	-.272	-.776
Socio economic status	54	44.6296	45.0000	45.00	6.05415	.345	.132

Table No.19 indicates descriptive statistics for the control group's pretest scores provide valuable insights into their initial performance and characteristics. For problem solving ability, the mean pretest score was 16.2963 indicating a moderate level of proficiency among participants before any method. The distribution appears to be slightly negatively skewed and exhibits a near-normal kurtosis. In terms of perceptual speed, the mean pretest score was 25.9259. The distribution seems to be fairly symmetrical with skewness and kurtosis values close to zero. For mathematics anxiety, the mean pretest score was 88.8333 indicating a relatively high level of anxiety among participants before the method. The distribution appears to be slightly positively skewed and exhibits positive slight kurtosis indicating a slightly normal distribution.

Table 20

Statistical Constants of the Pretest Scores of the Variable for the Control Group - Boys

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	24	16.0833	16.0000	15.00	3.63458	-.115	-1.010
Perceptual speed	24	25.0417	25.0000	25.00	2.31214	-.055	-.629
Mathematics anxiety	24	91.3750	91.0000	89.00	6.81949	.140	-.086
Nonverbal intelligence	24	42.8333	42.5000	31.00	7.37603	.298	-.464
Classroom environment	24	31.2500	31.0000	31.00	4.62742	.693	.048
Socio economic status	24	45.4167	45.0000	45.00	6.41274	.641	.632

Table No.20 shows the control group of boys pretest scores regarding problem solving ability the mean score is 16.0833 with a median and mode of 16.0000, indicating a relatively consistent distribution. The standard deviation of 3.63458 suggests a moderate level of variability in scores. The distribution appears slightly negatively skewed (-0.115) and exhibits a negative kurtosis (-1.010). Concerning perceptual speed the mean score is 25.0417, with a median and mode of 25.0000 indicating a relatively consistent distribution. The standard deviation of 2.31214 suggests a moderate level of variability in scores. The distribution appears approximately symmetrical with a skewness value close to zero (-0.055) and exhibits a negative kurtosis (-0.629). Regarding mathematics anxiety the mean score is 91.3750 with a median and mode of 91.0000 indicating a relatively consistent distribution. The standard deviation of 6.81949 suggests a moderate level of variability in scores. The distribution appears slightly positively skewed

(0.140) and exhibits a negative kurtosis (-0.086), suggesting a slightly normal distribution. These statistics provide the details regarding symmetrical nature of the variables among the boys in the control group.

Table 21

Statistical Constants of the Pretest Scores of the Variable for the Control Group - Girls

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	30	16.4667	16.0000	16.00	1.85199	.126	-.330
Perceptual speed	30	26.6333	26.5000	26.00	1.86591	.236	-.104
Mathematics anxiety	30	86.8000	85.5000	85.00	7.77884	.449	.057
Nonverbal intelligence	30	44.1333	44.5000	37.00	7.08925	.042	-.565
Classroom environment	30	36.4000	37.0000	37.00	3.05806	-.291	-.565
Socio economic status	30	44.0000	45.0000	45.00	5.78345	-.011	-.630

Table No.21 indicate the control group of girls pretest scores we observe the problem solving ability the mean score is 16.4667 with a median of 16.0000 and a mode of 16.00, indicating a relatively consistent distribution. The standard deviation of 1.85199 suggests a low level of variability in scores. The distribution appears slightly positively skewed (0.126) and exhibits a negative kurtosis (-0.330). Regarding perceptual speed the mean score is 26.6333 with a median and mode of 26.5000 and 26.00 respectively indicating a relatively consistent distribution. The standard deviation of 1.86591 suggests a low level of variability in scores. The distribution appears slightly positively skewed (0.236) and exhibits a negative kurtosis (-0.104), indicating a slightly normal distribution. In terms of mathematics

anxiety, the mean score is 86.8000, with a median of 85.5000 and a mode of 85.00, indicating a relatively consistent distribution. The standard deviation of 7.77884 suggests a moderate level of variability in scores. The distribution appears positively skewed (0.449) and exhibits a positive kurtosis (0.057), indicating a slightly normal distribution. These statistics provide the details regarding symmetrical nature of the variables among girls in the control group before any method.

Posttest Scores of the Variables for the Experimental Group

In this section the statistical constants related to the posttest scores of the Experimental group is given bellow for the variables, problem solving ability, perceptual speed and mathematics anxiety. The details are shown in the following tables

Table 22

Statistical Constants of the Posttest Scores of the Variables for the Experimental Group - Total Sample

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	54	20.3333	20.0000	20.00	3.42025	.033	-.109
Perceptual speed	54	30.9630	31.0000	30.00	2.25675	.130	-.096
Mathematics anxiety	54	81.4074	81.0000	80.00	9.75650	-.293	.725

Table No.22 shows the descriptive statistics for the posttest scores of the experimental group provide further insight into their performance and experiences after the method. For problem solving ability the mean posttest score was 20.3333 indicating an improvement from the pretest scores. The distribution appears to be

fairly symmetrical as indicated by the skewness value close to zero and exhibits a slightly negative kurtosis suggesting somewhat a normal distribution. In terms of perceptual speed the mean posttest score was higher at 30.9630 and the distribution seems to be slightly positively skewed and exhibits a near-normal kurtosis. For mathematics anxiety the mean posttest score was 81.4074 the distribution appears to be slightly negatively skewed and exhibits positive slight kurtosis suggesting a normal distribution. These statistics provide a detailed insight into the distributional properties of each variable and from the properties it can be observed that all the posttest scores of the variables shows near symmetrical normal distribution among the experimental group.

Table 23

Statistical Constants of the Posttest Scores of the Variable for the Experimental Group – Boys

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	26	19.8846	20.0000	20.00	3.42143	.087	.241
Perceptual speed	26	30.4231	30.0000	30.00	2.54830	.537	.329
Mathematics anxiety	26	82.2308	82.0000	76.00	7.61739	.325	-.708

Table No.23 indicate the experimental group of boys problem solving ability, the mean posttest core was 19.8846, with a median of 20.0000 and a mode of 20.00. The standard deviation of 3.42143 suggests a moderate level of variability in scores. The distribution appears slightly positively skewed with a skewness value of 0.087 and exhibits a kurtosis of 0.241 indicating a relatively normal distribution. For perceptual speed the mean posttest score was 30.4231 with a median of 30.00 and a mode of 30.00. The standard deviation of 2.54830. The distribution appears moderately positively skewed with a skewness value of 0.537 and exhibits a

kurtosis of 0.329 indicating a slightly flattened distribution. Regarding mathematics anxiety the mean posttest score was 82.2308 with a median of 82.0000 and a mode of 76.00. The standard deviation of 7.61739 suggests a moderate level of variability in scores. The distribution appears moderately positively skewed with a skewness value of 0.325 and exhibits a kurtosis of -0.708. These statistics provide insights into the boys performance and the variables of interest shows a symmetrical distribution nature.

Table 24

Statistical Constants of the Posttest Scores of the Variable for the Experimental Group - Girls

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	28	20.7500	21.0000	21.00	3.42783	-.014	-.162
Perceptual speed	28	31.4643	31.0000	31.00	1.85557	-.033	-.557
Mathematics anxiety	28	80.6429	81.0000	68.00	11.48337	-.332	.443

Table No.24 shows the experimental group of girls posttest scores we observe problem solving ability, the mean posttest score increased to 20.7500 the standard deviation of 3.42783 suggests a moderate level of variability in scores. The distribution appears approximately symmetrical with a skewness value close to zero (-0.014) and exhibits a slightly negative kurtosis (-0.162), indicating a relatively normal distribution. Regarding perceptual speed the mean posttest score increased to 31.4643. The standard deviation of 1.85557 suggests a relatively consistent spread of scores. The distribution appears approximately symmetrical with a skewness value close to zero (-0.033), and exhibits a negative kurtosis (-0.557), suggesting a slightly flattened distribution. Concerning mathematics anxiety the mean posttest

score decreased to 80.6429. The standard deviation of 11.48337 suggests a moderate level of variability in scores. The distribution appears approximately symmetrical with a skewness value close to zero (-0.332) and exhibits a positive kurtosis (0.433). These statistics provide the details regarding symmetrical nature of the variables among the girls in the experimental group.

Posttest Scores of the Variables for the Control Group

The statistical constants of the posttest scores of the variables problem solving ability, perceptual speed and mathematics anxiety of the control group for the total sample, Boys and Girls are presented in tables respectively.

Table 25

Statistical Constants of the Posttest Scores of the Variable for the Control Group - Total Sample

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	54	17.4259	18.0000	20.00	3.60085	-.348	.020
Perceptual speed	54	27.1852	27.5000	28.00	3.62421	-.210	-.112
Mathematics anxiety	54	87.4259	87.0000	100.00	9.96144	-.084	-.719

Table no.25 indicate the descriptive statistics for the control group's posttest scores reveal their performance and changes following the method. For problem solving ability the mean post- test score was 17.4259. The distribution appears to be slightly negatively skewed indicating a tail to the left and exhibits a near-normal kurtosis. Regarding perceptual speed, the mean post- test score was 27.1852. The distribution seems to be fairly symmetrical with skewness and kurtosis values close to zero. For mathematics anxiety the mean post- test score was 87.4259. The

distribution appears to be relatively symmetrical with skewness and kurtosis values close to zero. These statistics provide the posttest scores in the control group's performance shows a symmetrical nature.

Table 26

Statistical Constants of the Posttest Scores of the Variables for the Control Group - Boys

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	24	17.0000	18.0000	14.00	4.40356	-.060	-.557
Perceptual speed	24	26.7917	27.0000	25.00	3.87836	.162	-.179
Mathematics anxiety	24	87.9167	89.0000	89.00	8.61201	-.149	-1.498

From table No.26. In the control group of boys posttest scores, we examine problem solving ability the mean score is 17.0000, with a median of 18.0000 and a mode of 14.00. The standard deviation of 4.40356 suggests a moderate level of variability in scores. The distribution appears slightly negatively skewed (-0.060) and exhibits a negative kurtosis (-0.557), indicating a relatively symmetrical distribution. Regarding perceptual speed, the mean score is 26.7917 with a median and mode of 27.0000 and 25.00 respectively, indicating a relatively consistent distribution. The standard deviation of 3.87836 suggests a moderate level of variability in scores. The distribution appears slightly positively skewed (0.162) and exhibits a negative kurtosis (-0.179), indicating a slightly symmetrical distribution. In terms of mathematics anxiety, the mean score is 87.9167 with a median of 89.0000 and a mode of 89.00 indicating a relatively consistent distribution. The standard deviation of 8.61201 suggests a moderate level of variability in scores. The distribution appears slightly negatively skewed (-0.149)

and exhibits a negative kurtosis (-1.498). These statistics provide the details regarding symmetrical nature of the variables among the boys in the control group.

Table 27

Statistical Constants of the Posttest Scores of the Variables for the Control Group – Girls

Variables	N	Mean	Median	Mode	Standard Deviation	Skewness	Kurtosis
Problem solving ability	30	17.7667	18.0000	20.00	2.83675	-.630	.577
Perceptual speed	30	27.5000	28.0000	27.00	3.44163	-.566	.458
Mathematics anxiety	30	87.0333	86.00	100.0	11.05311	-.016	-.625

Table No.27 shows the control group of girls posttest scores for problem solving ability, the mean score is 17.7667 with a median of 18.0000 and a mode of 20.00 indicating a slightly right-skewed distribution. The standard deviation of 2.83675 suggests a moderate level of variability in scores. The distribution exhibits a negative kurtosis (0.577). Regarding perceptual speed the mean score is 27.5000 with a median of 28.0000 and a mode of 27.00 indicating a relatively consistent distribution. The standard deviation of 3.44163 suggests a moderate level of variability in scores. The distribution appears slightly left-skewed (-0.566) and exhibits a positive kurtosis (0.458) indicating a slightly peaked distribution. In terms of mathematics anxiety the mean score is 87.0333 with a median of 86.0000 and a mode of 100.00. The standard deviation of 11.05311 suggests a high level of variability in scores. The distribution appears approximately symmetrical and exhibits a negative kurtosis (-0.625). These statistics provide the details regarding the symmetrical nature of the variables among girls in the control group after the method.

Discussion

By observing the above statistical Constants of pretest and posttest scores of problem solving ability, perceptual speed and mathematics anxiety of the experimental and control groups. The inferences which can be derived as following; The data can be used to carry out parametric testing as the distribution of scores follow normal distribution as it is uncovered by the statistical constants of the variables.

Mean Difference Analysis

Before controlling the effects of covariates the differences in mean scores of pretest problem solving ability, perceptual speed and mathematics anxiety of the Experimental and Control groups, difference in mean pretest and posttest scores of the dependent variables for Control and Experimental groups and the differences in mean gain and change scores between the Experimental and Control groups were thoroughly examined. The level of significance was fixed in between 0.05 and 0.01 levels and the mean difference analysis was used for comparison.

Comparison of the Mean Pretest Scores of Problem Solving Ability, Perceptual Speed, Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment and Socio Economic Status of Experimental and Control Groups

To compare the existing status of the control group and Experimental group, the comparisons of the means were undertook on problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socio economic status before the intervention.

Comparison of the mean pretest scores of problem solving ability in mathematics of Experimental and Control groups. Test of significance of difference between two means were utilized to compare the status before intervention of both

control and experiments groups with respect to the problem -solving ability. To check whether there exists any statistically significant difference between means of the problem solving ability scores of the groups prior to the experiment, mean pretest scores of the two groups were calculated and these values were subjected to test of significance of difference between means for Total Sample, Boys and Girls are given in the following sections.

Comparison of the Mean Pretest Scores of Problem Solving Ability Between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean scores of Pretest scores of Problem solving ability between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 28.

Table 28

Result of Test of Significance of Difference in the Mean Pretest Scores of Problem Solving Ability between Experimental Group and Control Group-Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem - Solving Ability	Experimental group	54	16.630	2.817	.621	.536^{NS}
	Control group	54	16.296	2.765		

NS: Not significant at 0.05 level of significance.

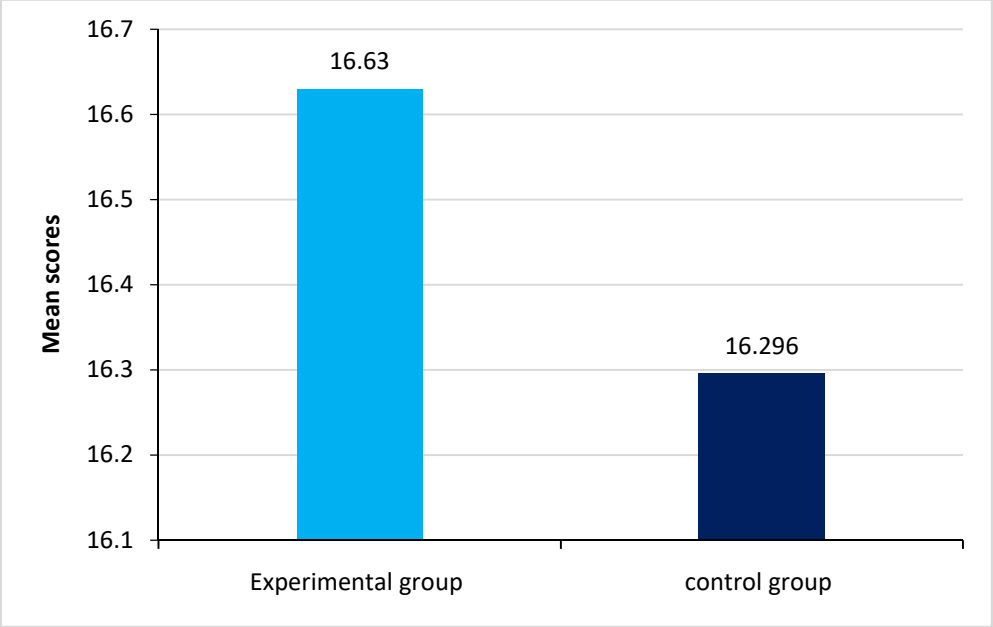
The table no.28 compares the pretest scores of problem solving ability between participants in experimental group and control group using the two independent sample *t*-test method. Both groups, each comprising 54 participants, had similar mean pretest scores: the experimental group had a mean pretest score of 16.630 with a standard deviation of 2.817, while the control group had a mean pretest score of 16.296 with a standard deviation of 2.765. The statistical analysis indicated no

statistically significant difference between the two groups, as evidenced by a *t*-value of 0.621 and a p-value of 0.536. These results suggest that there is no significant difference in the problem solving ability of participants between the experimental and control groups at the beginning of the study.

The mean pre--test scores of problem -solving ability of experimental and control groups for Total sample are represented graphically in Figure 12.

Figure 12

Mean Pretest Scores of Problem Solving Ability of Experimental and Control Group-Total Sample



From Figure 12, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable problem solving ability for total sample. The X axis of the graph represents the variable problem- solving ability of two groups. The Y axis represents the mean pretest scores of the variable problem solving ability of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of problem solving ability of experimental and control groups shows that there is no

significant difference in the mean pretest scores of problem solving ability between the groups. Hence the performance in the problem solving ability of coastal area secondary school students in the two groups are almost equal for Total sample.

Comparison of the Mean Pretest Scores of Problem Solving Ability Between Experimental Group and Control Group Among Boys

To find whether there exists any significant difference in the mean pretest scores of Problem solving ability between Experimental group and Control group among the boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 29.

Table 29

Result of the Test of Significance of Difference in the Mean Pretest Scores of Problem Solving Ability between Experimental Group and Control Group - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Experimental group`	26	16.539	2.596	.513	.611^{NS}
	Control group	24	16.083	3.635		

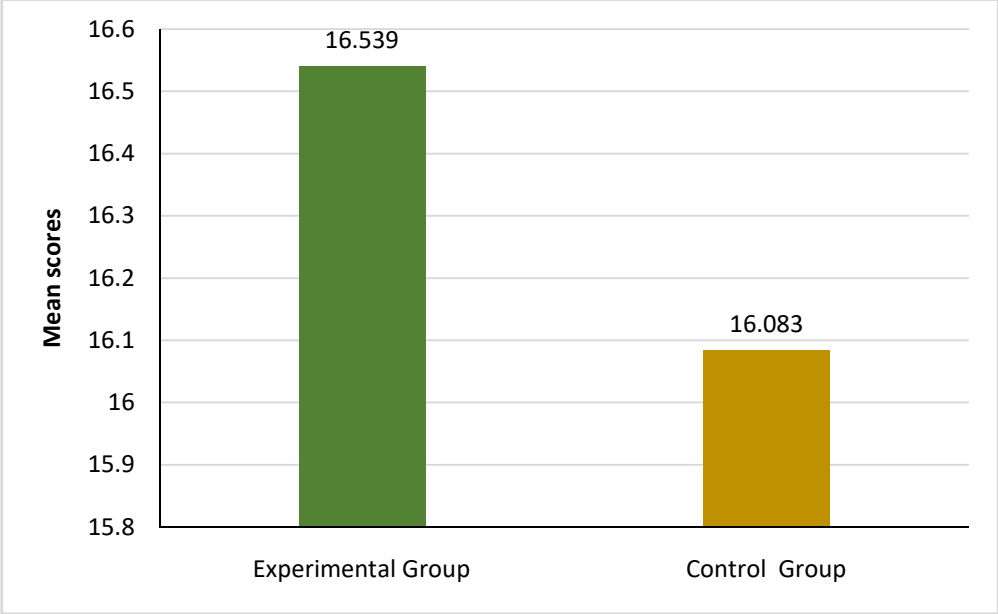
NS: Not significant at 0.05 level of significance

The table No.29 presents the pretest scores of problem solving ability for boys in experimental group and control group. In the experimental group, comprising 26 boys, the mean pretest score of problem solving ability is 16.539, with a standard deviation of 2.596. Conversely, the control group, consisting of 24 boys, has a slightly lower mean pretest score of 16.083, with a standard deviation 3.635. Using the two independent sample *t*-test method, no significant difference is observed between the two groups, with a *t*-value of 0.513 and a p-value of 0. 611 (NS), indicating a lack of statistical significance. These findings suggest that the pretest scores of problem solving ability for boys in the experimental and control groups are similar and any differences observed are not statistically meaningful.

The mean pre--test scores of problem solving ability of experimental and control groups for Boys are represented graphically in Figure 13.

Figure 13

Mean Pretest Scores of Problem Solving Ability of Experimental and Control Group-Boys



From Figure 13, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable problem solving ability of Boys. The X axis of the graph represents the variable problem solving ability of boys of two groups. The Y axis represents the mean pretest scores of the variable problem solving ability of two groups of Boys. So it can be conclude that the graphical representation of mean pretest scores of problem solving ability of experimental and control groups shows that there is no significant difference in the mean pretest scores of problem solving ability between the groups. Hence the performance of problem solving ability of coastal area secondary school students in the two groups are almost same for Boys.

Comparison of the Mean Pretest Scores of Problem Solving Ability between Experimental Group and Control Group Among Girls

To find whether there exists any significant difference in the mean pretest scores of Problem solving ability between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 30.

Table 30

Result of the Test of Significance of Difference in the Mean Pretest Scores of Problem Solving Ability between Experimental Group and Control Group among Girl

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Experimental group`	28	16.714	3.053	.376	.708^{NS}
	Control group	30	16.467	1.852		

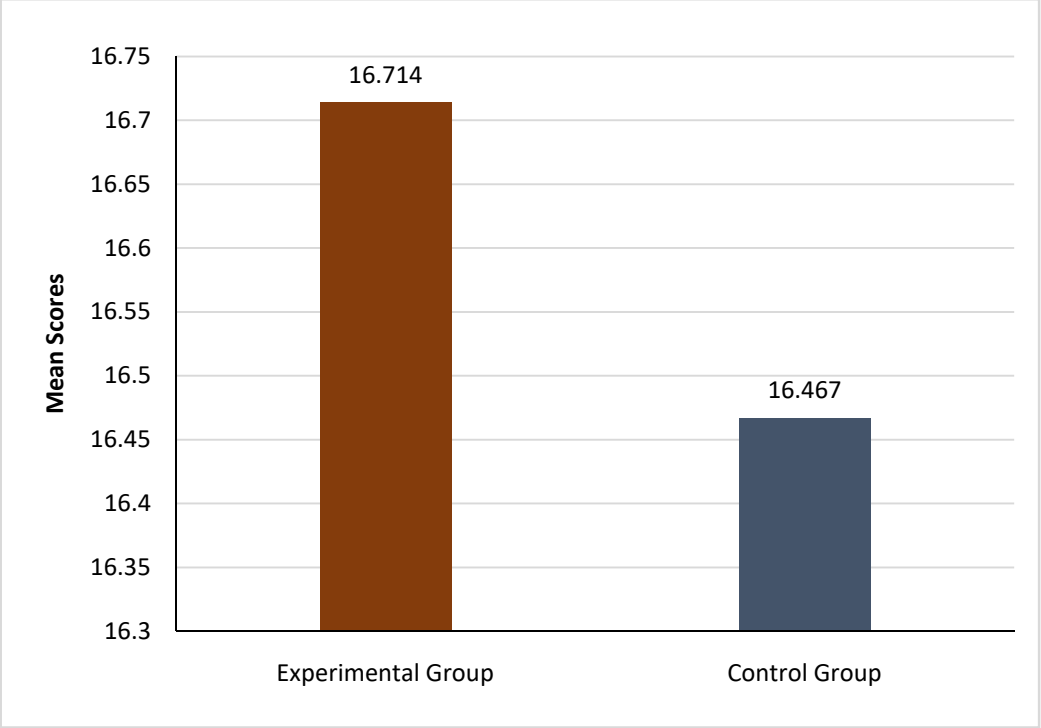
NS: Not significant at 0.05 level of significance

The table no.30 compares the pretest scores of problem solving ability for girls in experimental group and control group. In the experimental group, comprised of 28 girls, the mean pretest score of problem solving ability is 16.714 (SD = 3.053). Conversely, the control group consisting of 30 girls shows a mean pretest score of 16.467 (SD = 1.852). Utilizing the independent sample *t*-test method no significant difference is found between the two groups, with a *t*-value of 0.376 and a p-value of .708 (NS), indicating a lack of statistical significance. These results suggest that the pretest scores of problem solving ability for girls in the experimental and control groups are similar.

The mean pre--test scores of Problem solving ability of experimental and control groups for Girls are represented graphically in Figure 14.

Figure 14

Mean Pretest Scores of Problem Solving Ability of Experimental and Control Group-Girls



From Figure 14, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable problem solving ability for Girls. The X axis of the graph represents the variable problem solving ability of Girls of two groups. The Y axis represents the mean pretest scores of the variable problem solving ability of two groups for Girls. So it can be conclude that the graphical representation of mean pretest scores of problem solving ability of experimental and control groups shows that there is no significant difference in the mean pretest scores of problem solving ability between the groups. Hence the problem -solving ability of coastal area secondary school students in the two groups are almost equal for Girls.

Comparison of the Mean Pretest Scores of Perceptual Speed between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores of Perceptual Speed between Experimental group and Control group the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 31.

Table 31

Result of the Test of Significance of Difference in the mean Pretest Scores of Perceptual Speed between Experimental Group and Control group-Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Experimental group`	54	26.185	2.748	.541	$.590^{NS}$
	Control group	54	25.926	2.205		

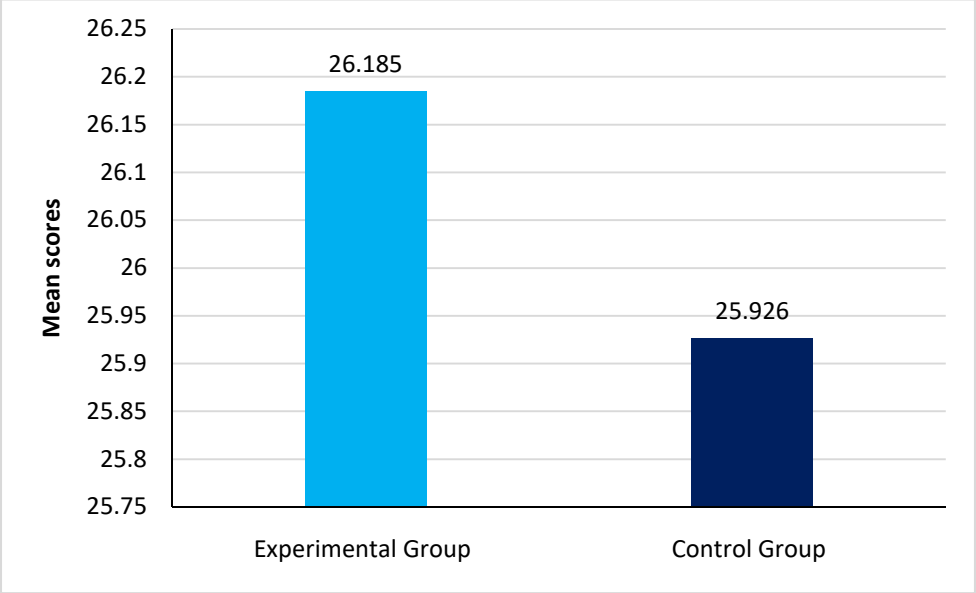
NS: Not significant at 0.05 level of significance.

The table no.31, compares the pretest scores of perceptual speed between participants in experimental group and control group using the two independent sample *t*-test method. Both groups, each comprising 54 participants, exhibited similar mean pretest scores: the experimental group had a mean pretest score of 26.185 with a standard deviation of 2.748, while the control group had a mean pretest score of 25.926 with a standard deviation of 2.205. The statistical analysis revealed that no statistically significant difference between the two groups, as indicated by a *t*-value of 0.541 and a p-value of 0.590. These results suggest that there is no significant distinction in the pretest scores of perceptual speed between participants in the experimental and control groups at the beginning of the study.

The mean pre--test scores of perceptual speed of experimental and control groups for Total sample are represented graphically in Figure 15.

Figure 15

Mean Pretest Scores of Perceptual speed of Experimental and Control Group-Total Sample



From Figure 15, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable perceptual speed for total sample. The X axis of the graph represents the variable perceptual speed of two groups. The Y axis represents the mean pretest scores of the variable perceptual speed of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of perceptual speed of experimental and control groups shows that there is no significant difference in the mean pretest scores of perceptual speed between the groups. Hence the performance in the perceptual speed of coastal area secondary school students in the two groups are almost same for Total sample.

Comparison of the the Mean Pretest Scores of Perceptual Speed between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean pretest scores of Perceptual Speed between Experimental group and Control group of boys,

the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 32.

Table 32

Result of the Test of Significance of Difference in the Mean Pretest Scores of Perceptual Speed between Experimental Group and Control Group among Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*P*
Perceptual Speed	Experimental group`	26	24.615	2.385	.641	.525^{NS}
	Control group	24	25.042	2.312		

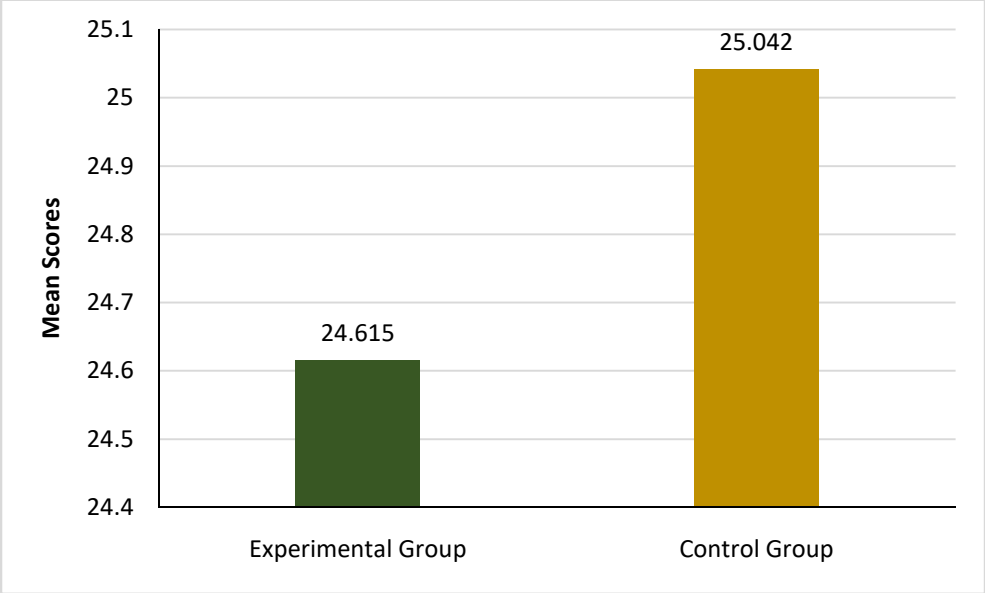
NS: Not significant at 0.05 level of significance

The Table No. 32 compares the pretest scores of perceptual speed for boys in experimental group and control group. In the experimental group comprising 26 boys, the mean pretest score of perceptual speed is 24.615 with a standard deviation of 2.385. Conversely, the control group consisting of 24 boys exhibits a slightly higher mean pretest score of 25.042 with a standard deviation 2.312. Utilizing the two independent sample *t*-test method no significant difference is found between the two groups with a *t*-value of 0.641 and a p-value of 0.525 (NS), indicating a lack of statistical significance. These results suggest that the pretest scores of perceptual speed for boys in the experimental and control groups are comparable and any observed differences are not statistically significant.

The mean pre--test scores of perceptual speed of experimental and control groups among Boys are represented graphically in Figure 16.

Figure 16

Mean Pretest Scores of Perceptual Speed of Experimental and Control Group- Boys



From Figure 16, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups Experimental and control group for the variable perceptual speed for Boys. The X axis of the graph represents the variable perceptual speed of boys of two groups. The Y axis represents the mean pretest scores of the variable perceptual speed of two groups of Boys. So it can be conclude that the graphical representation of mean pretest scores of perceptual speed of experimental and control groups shows that there is no significant difference in the mean pretest scores of perceptual speed between the groups. Hence the performance of perceptual speed of coastal area secondary school students in the two groups are almost same for Boys

Comparison of the Mean Pretest Scores of Perceptual Speed between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean pretest scores of Perceptual Speed between Experimental group and Control group among

girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 33.

Table 33

Result of the Test of Significance of Difference in the Mean Pretest Scores of Perceptual Speed between Experimental Group and Control Group among Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Experimental group`	28	27.643	2.231	1.874	.066[NS]
	Control group	30	26.633	1.866		

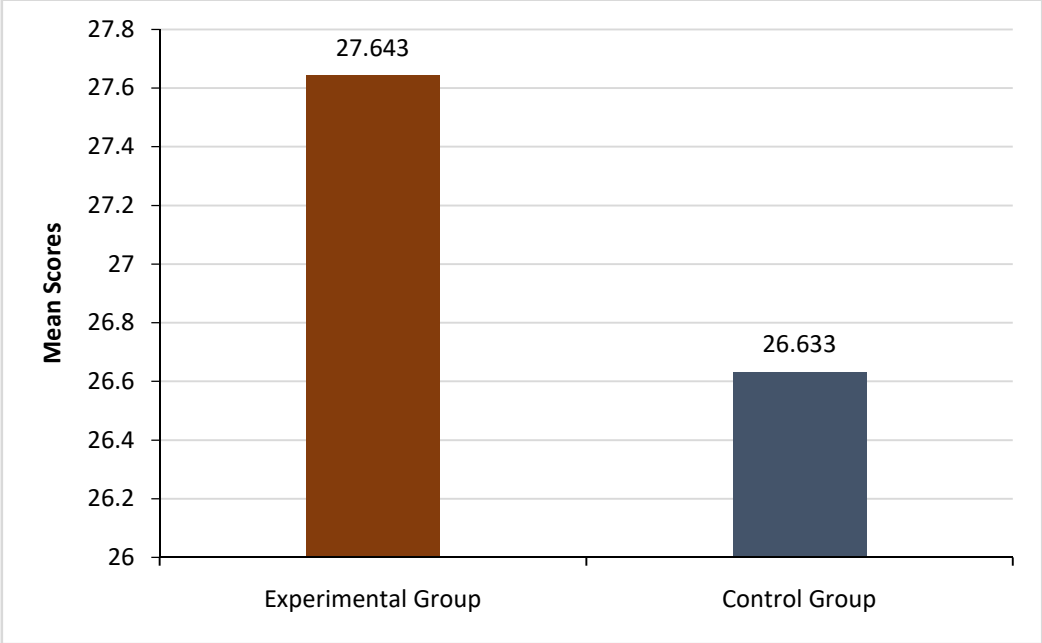
NS: Not significant at 0.05 level of significance

The table no.33 compares the pretest scores of perceptual speed for girls in experimental group and control group. In the experimental group consisting of 28 girls, the mean pretest score of perceptual speed is 27.643 (SD = 2.231). Conversely the control group comprising 30 girls shows a mean pretest score of 26.633 (SD = 1.866). Utilizing the independent sample *t*-test method, no significant difference is found between the two groups with a *t*-value of 1.874 and a p-value of .066 indicating a lack of statistical significance. These results suggest that the pretest scores of perceptual speed for girls in the experimental and control groups are similar.

The mean pre--test scores of Perceptual speed of experimental and control groups for Girls are represented graphically in Figure 17.

Figure 17

Mean Pretest Scores of Perceptual Speed of Experimental and Control Group- Girls



From Figure 17, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable perceptual speed for Girls. The X axis of the graph represents the variable perceptual speed of Girls of two groups. The Y axis represents the mean pretest scores of the variable perceptual speed of two groups for Girls. So it can be conclude that the graphical representation of mean pretest scores of perceptual speed of experimental and control groups shows that there is no significant difference in the mean pretest scores of perceptual speed between the groups. Hence the perceptual speed of coastal area secondary school students in the two groups are almost equal for Girls.

Comparison of the Mean Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores of Mathematics anxiety between Experimental group and Control group, the

investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 34

Table 34

Result of the Test of Significance of Difference in the Mean Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group-Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Experimental group`	54	91.519	6.720	1.938	.055[NS]
	Control group	54	88.833	7.652		

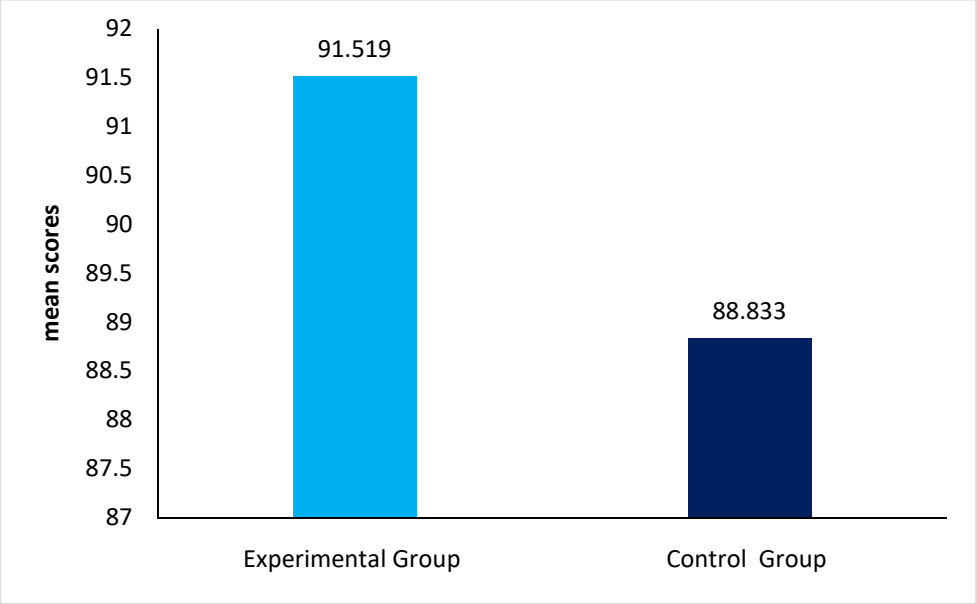
NS: Not significant at 0.05 level of significance.

The table No.34, compares the pretest scores of mathematics anxiety between participants in experimental group and control group. Using the two independent sample *t*-test method, it is observed that the experimental group consisting of 54 participants had a mean pretest score of 91.519 (SD = 6.720) while the control group also comprising 54 participants had a mean pretest score of 88.833 (SD = 7.652). The statistical analysis showed no significant difference between the two groups with a *t*-value of 1.938 and a p-value of .055 indicating a trend towards non significance. Hence there is no difference in the pretest scores of mathematics anxiety between the two groups.

The mean pre--test scores of Mathematics anxiety of experimental and control groups for Total sample are represented graphically in Figure 18.

Figure 18

Mean Pretest Scores of Mathematics anxiety of Experimental and Control Group-Total Sample



From Figure 18, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups Experimental and control group for the variable Mathematics anxiety for total sample. The X axis of the graph represents the variable mathematics anxiety of two groups. The Y axis represents the mean pretest scores of the variable mathematics anxiety of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of mathematics anxiety of experimental and control groups shows that there is no significant difference in the mean pretest scores of mathematics anxiety between the groups. Hence the mathematics anxiety of coastal area secondary school students in the two groups are almost same for Total sample.

Comparison of the Mean Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean pretest scores of Mathematics anxiety between Experimental group and Control group

among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 35.

Table 35

Result of the Test of Significance of Difference in the Mean Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Experimental group	26	93.423	5.132	1.206	.234^{NS}
	Control group	24	91.375	6.819		

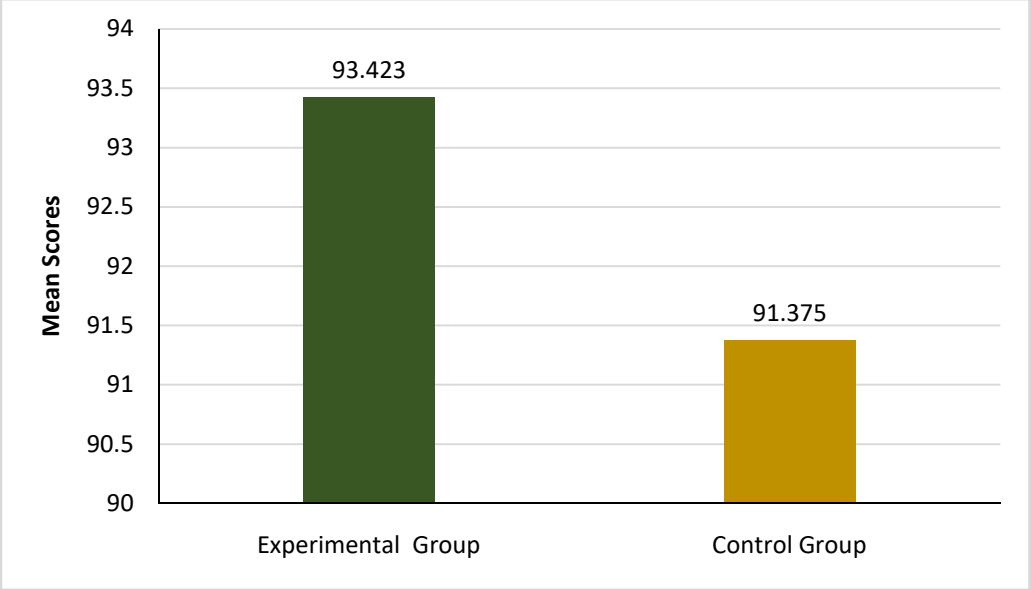
NS: Not significant at 0.05 level of significance

The table no. 35 compares the pretest scores of mathematics anxiety for boys in experimental group and control group. In the experimental group consisting of 26 boys the mean pretest scores of mathematics anxiety is 93.423 with a standard deviation of 5.132. Conversely, the control group comprising 24 boys has a slightly lower mean pretest score of 91.375 with a standard deviation 6.819. With a *t*-value of 1.206 and a p-value of 0.234 (NS), indicating a lack of statistical significance there's no substantial difference observed between the two groups. These findings suggest that the pretest scores of mathematics anxiety for boys in the experimental and control groups are similar.

The mean pre--test scores of Mathematics anxiety of experimental and control groups for Boys are represented graphically in Figure 19.

Figure 19

Mean Pretest Scores of Mathematics Anxiety of Experimental and Control Group-Boys



From Figure 19, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups Experimental and control group for the variable mathematics anxiety for Boys. The X axis of the graph represents the variable mathematics anxiety of boys of two groups. The Y axis represents the mean pretest scores of the variable mathematics anxiety of two groups for Boys. So it can be conclude that the graphical representation of mean pretest scores of mathematics anxiety of experimental and control groups shows that there is no significant difference in the mean pretest scores of mathematics anxiety between the groups. Hence the mathematics anxiety of coastal area secondary school students in the two groups are almost equal for Boys.

Comparison of the Mean Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean pretest scores of Mathematics anxiety between Experimental group and Control group

among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 36.

Table 36

Result of the Test of Significance of Difference in the Mean Scores of Pretest Scores of Mathematics Anxiety between Experimental Group and Control Group -Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Experimental group`	28	89.750	7.585	1.461	.150[NS]
	Control group	30	86.800	7.779		

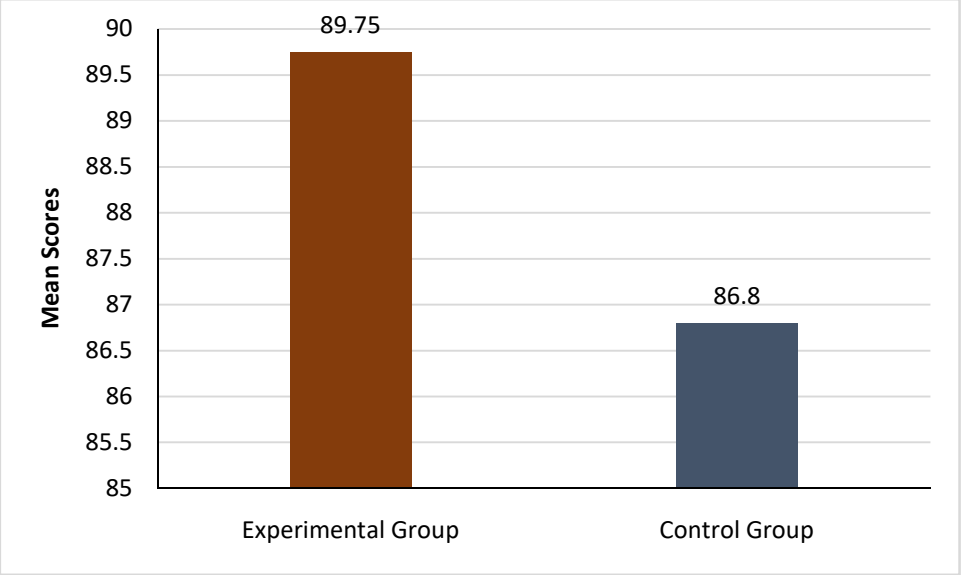
NS: Not significant at 0.05 level of significance

The table no. 36 compares the pretest scores of mathematics anxiety for girls in experimental group and control group. In the experimental group consisting of 28 girls, the mean pretest score of mathematics anxiety is 89.750 (SD = 7.585). Conversely the control group comprising 30 girls shows a mean pretest score of 86.800 (SD = 7.779). Utilizing the independent sample *t*-test method no significant difference is found between the two groups with a *t*-value of 1.461 and a p-value of 0.150 indicating a lack of statistical significance. These results suggest that the pretest scores of mathematics anxiety for girls in the experimental and control groups are similar.

The mean pre--test scores of Mathematics anxiety of experimental and control groups for Girls are represented graphically in Figure 20.

Figure 20

Mean Pretest Scores of Mathematics anxiety of Experimental and Control Group-Girls



From Figure 20, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups Experimental and control group for the variable mathematics anxiety for Girls. The X axis of the graph represents the variable mathematics anxiety of Girls of two groups. The Y axis represents the mean pretest scores of the variable mathematics anxiety of two groups for Girls. So it can be conclude that the graphical representation of mean pretest scores of mathematics anxiety of experimental and control groups shows that there is no significant difference in the mean pretest scores of mathematics anxiety between the groups. Hence the mathematics anxiety of coastal area secondary school students in the two groups are almost equal for Girls

Comparison of the Mean Pretest Scores of Nonverbal Intelligence between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean pretest scores of nonverbal Intelligence between Experimental group and Control group, the

investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 37.

Table 37

Result of the Test of Significance of Difference in the Mean Pretest Scores of Nonverbal Intelligence between Experimental Group and Control Group- Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Nonverbal Intelligence	Experimental group`	54	43.833	8.303	.186	.853[NS]
	Control group	54	43.556	7.179		

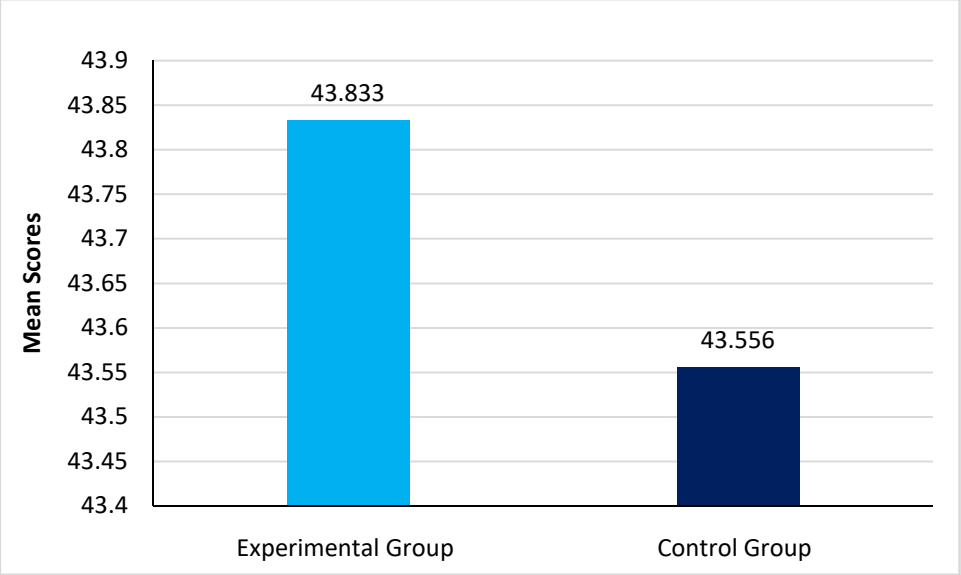
NS: Not significant at 0.05 level of significance.

The table No.37. compares Nonverbal Intelligence test scores between participants in experimental group and control group. Utilizing the two independent sample *t*-test method, it is observed that the experimental group consisting of 54 participants had a mean score of nonverbal intelligence 43.833 (SD = 8.303), while the control group, also comprising 54 participants had a mean score of nonverbal intelligence 43.556 (SD = 7.179). The statistical analysis revealed no significant difference between the two groups, with a *t*-value of 0.186 and a p-value of 0.853, indicating a lack of statistical significance (NS). These findings suggest that there is no substantial discrepancy in Nonverbal Intelligence scores between participants in the experimental and control groups.

The mean pre--test scores of Nonverbal Intelligence of experimental and control groups for Total sample are represented graphically in Figure 21.

Figure 21

Mean Pretest Scores of Nonverbal Intelligence of Experimental and Control Group-Total Sample



From Figure 21, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable nonverbal intelligence for total sample. The X axis of the graph represents the variable Nonverbal Intelligence of two groups. The Y axis represents the mean pretest scores of the variable Nonverbal Intelligence of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of Nonverbal intelligence of experimental and control groups shows that there is no significant difference in the mean pretest scores of Nonverbal Intelligence between the groups. Hence the performance in the Nonverbal Intelligence of coastal area secondary school students in the two groups are almost same for Total sample.

Comparison of the Mean Pretest Scores of Nonverbal Intelligence between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean pretest scores of nonverbal Intelligence between Experimental group and Control group

among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 38.

Table 38

Result of the Test of Significance of Difference in the Mean Pretest Scores of Nonverbal Intelligence between Experimental Group and Control Group among Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*
Nonverbal Intelligence	Experimental group	26	43.231	8.257	.179	.859^{NS}
	Control group	24	42.833	7.376		

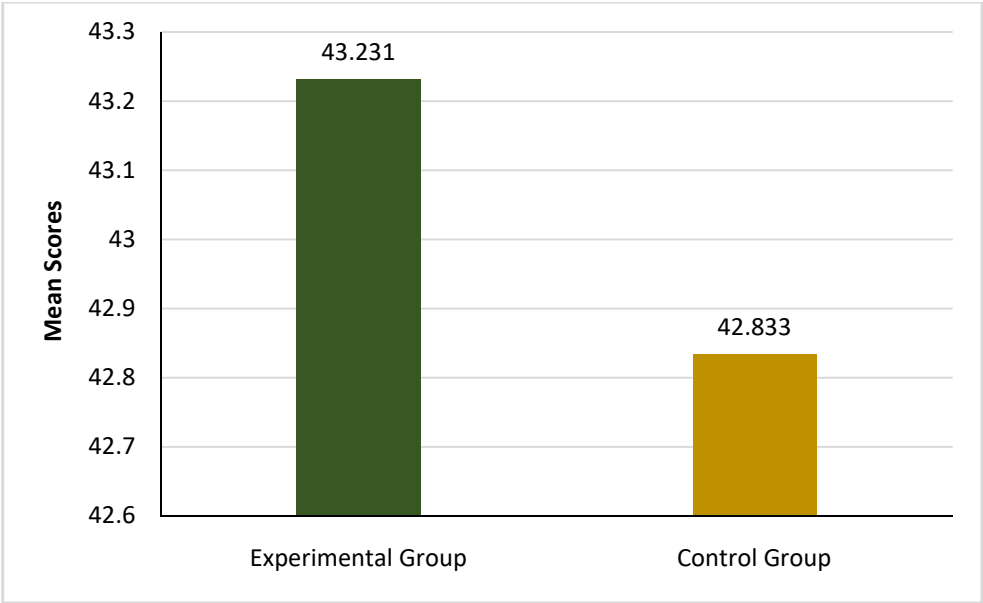
NS: Not significant at 0.05 level of significance

The table no. 38 compares nonverbal Intelligence scores for boys in experimental group and control group. In the experimental group, comprised of 26 boys, the mean pretest score is 43.231 (SD = 8.257). Conversely, the control group consisting of 24 boys, shows a mean pretest score of 42.833 (SD = 7.376). With a *t*-value of 0.179 and a p-value of 0.859 (NS), indicating no significant difference, the results suggest that the nonverbal intelligence scores of boys in the experimental and control groups are comparable.

The mean pre--test scores of Nonverbal Intelligence of experimental and control groups for Boys are represented graphically in Figure 22.

Figure 22

Mean Pretest Scores of Nonverbal Intelligence of Experimental and Control Group-Boys



From Figure 22, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable Nonverbal Intelligence for Boys. The X axis of the graph represents the variable Nonverbal Intelligence of boys of two groups. The Y axis represents the mean pretest scores of the variable Nonverbal Intelligence of two groups for Boys. So it can be conclude that the graphical representation of mean pretest scores of Nonverbal Intelligence of experimental and control groups shows that there is no significant difference in the mean pretest scores of Nonverbal Intelligence between the groups. Hence the Nonverbal Intelligence of coastal area secondary school students in the two groups are almost equal for Boys.

Comparison of the Mean Pretest Scores of Nonverbal Intelligence between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of pretest scores of nonverbal Intelligence between Experimental group and Control

group among the sub sample girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 39.

Table 39

Result of the Test of Significance of Difference in the Mean Scores of Nonverbal Intelligence between Experimental Group and Control Group among Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*
Nonverbal Intelligence	Experimental group	28	44.393	8.456	.127	.899[NS]
	Control group	30	44.133	7.089		

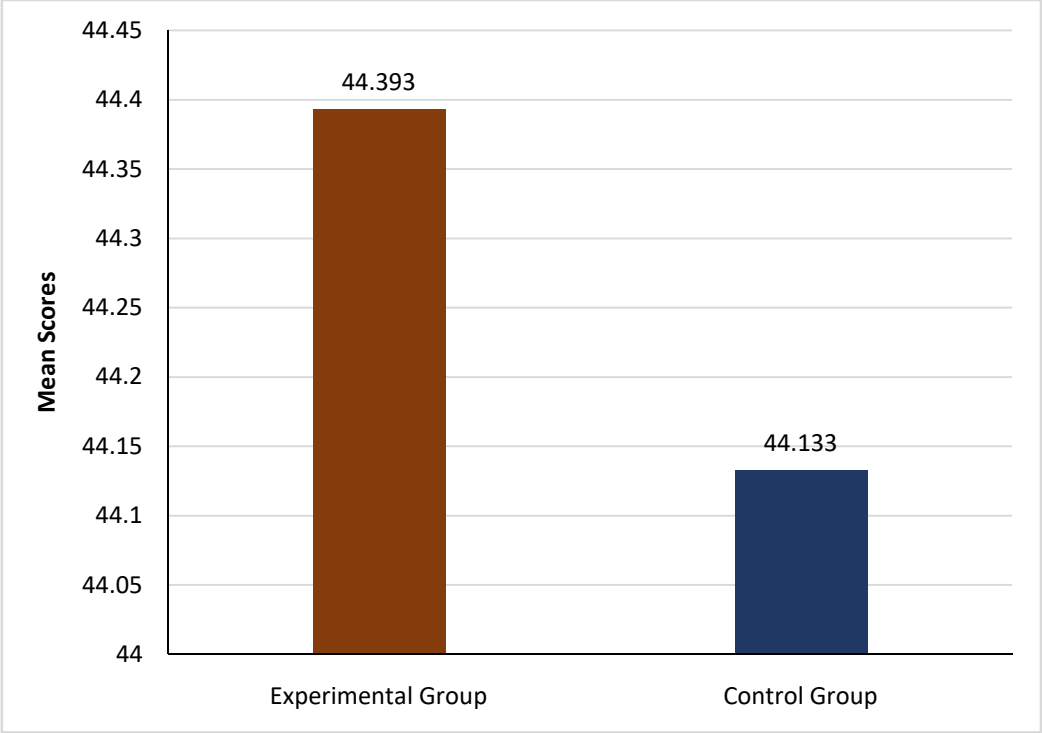
NS: Not significant at 0.05 level of significance

The table no.39 compares Nonverbal Intelligence scores for girls in experimental group and control group. In the experimental group, consisting of 28 girls, the mean score is 44.393 (SD = 8.456). Conversely, the control group comprising 30 girls shows a mean score of 44.133 (SD = 7.089). Utilizing the independent sample *t*-test method, no significant difference is found between the two groups with a *t*-value of 0.127 and a p-value of 0.899 indicating a lack of statistical significance. These results suggest that the intelligence scores of girls in the experimental and control groups are comparable.

The mean pretest scores of Nonverbal Intelligence of experimental and control groups for Girls are represented graphically in Figure 23.

Figure 23

Mean Pretest Scores of Nonverbal Intelligence of Experimental and Control Group-Girls



From Figure 23, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable Nonverbal Intelligence for Girls. The X axis of the graph represents the variable Nonverbal intelligence of Girls of two groups. The Y axis represents the mean pretest scores of the variable nonverbal intelligence of two groups of Girls. So it can be conclude that the graphical representation of mean pretest scores of Nonverbal Intelligence of experimental and control groups shows that there is no significant difference in the mean pretest scores of Nonverbal intelligence between the groups. Hence the Nonverbal intelligence of coastal area secondary school students in the two groups are almost equal for Girls

Comparison of the Mean Pretest Scores of Classroom Environment between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean pretest scores of Classroom Environment between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 40.

Table 40

Result of the Test of Significance of Difference in the Mean Scores of Classroom Environment between Experimental Group and Control Group – Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Classroom Environment	Experimental group	54	33.926	5.425	-.191	.849^{NS}
	Control group	54	34.111	4.591		

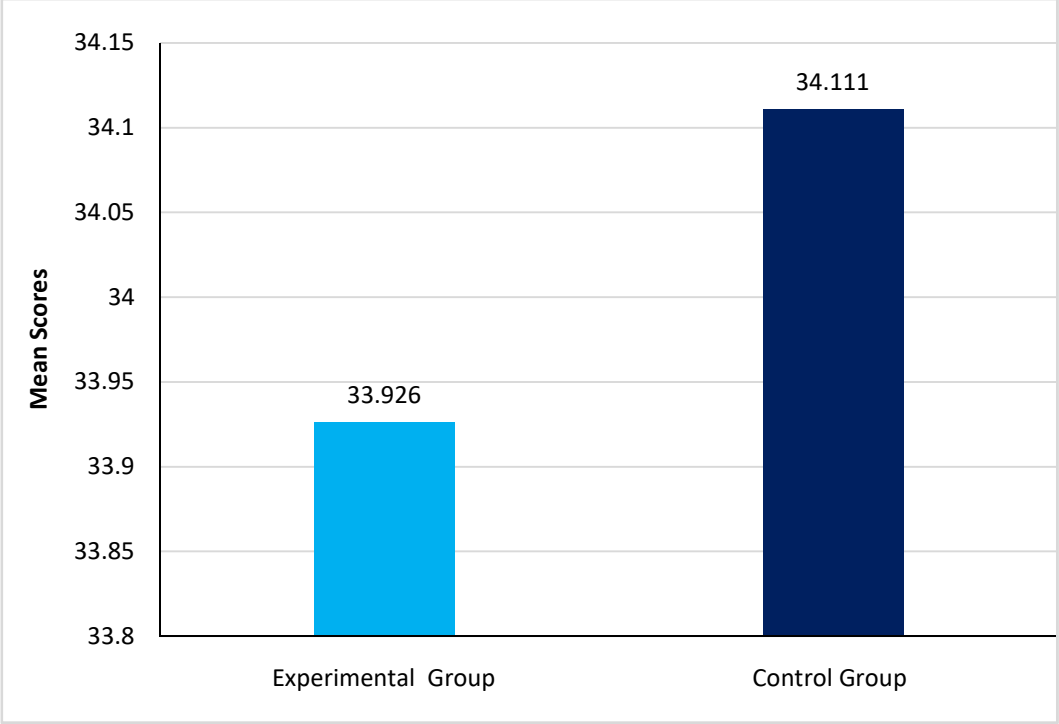
NS: Not significant at 0.05 level of significance.

The table No.40 compares the Classroom Environment scores between participants in experimental group and control group. Employing the two independent sample *t*-test method, it is observed that the experimental group consisting of 54 participants had a mean score of 33.926 with a standard deviation of 5.425, while the control group also comprising 54 participants had a mean score of 34.111 with a standard deviation of 4.591. The statistical analysis revealed that no significant difference between the two groups with a *t*-value of -0.191 and a p-value of 0.849 indicating a lack of statistical significance. These findings suggest that there is no substantial discrepancy in the Classroom Environment scores between participants in the experimental and control groups.

The mean pre--test scores of Classroom environment of experimental and control groups for Total sample are represented graphically in Figure 24.

Figure 24

Mean Pretest Scores of Classroom Environment of Experimental and Control Group-Total Sample



From Figure 24, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable classroom environment for total sample. The X axis of the graph represents the variable classroom Environment of two groups. The Y axis represents the mean pretest scores of the variable classroom environment of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of Classroom environment of experimental and control groups shows that there is no significant difference in the mean pretest scores of Classroom Environment between the groups. Hence the performance in the Nonverbal Intelligence of coastal area secondary school students in the two groups are almost same for Total sample.

Comparison of the Mean Pretest Scores of Classroom Environment between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of Classroom Environment between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 41.

Table 41

Result of the Test of Significance of Difference in the Mean Scores of Classroom Environment between Experimental Group and Control Group - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*
Classroom Environment	Experimental group	26	29.769	4.475	1.150	.256^{NS}
	Control group	24	31.250	4.627		

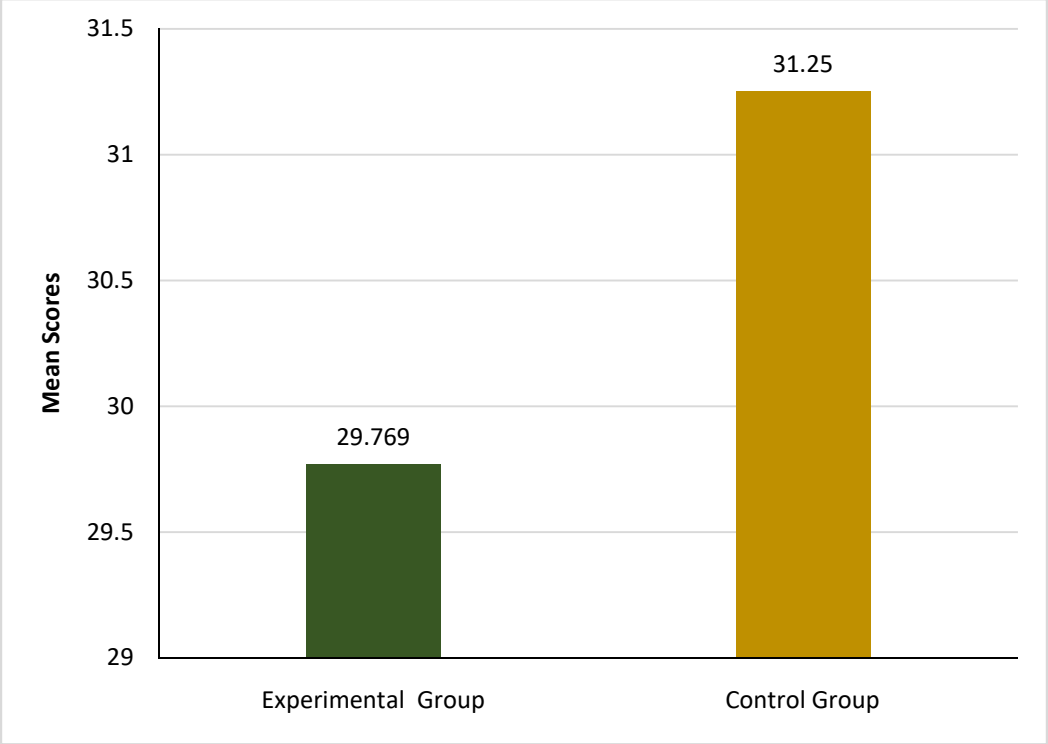
NS: Not significant at 0.05 level of significance

The table no.41 compares the Classroom Environment scores for boys in experimental group and control group. In the experimental group consisting of 26 boys, the mean score is 29.769 (SD = 4.475). Conversely the control group comprising 24 boys shows a mean score of 31.250 (SD = 4.627). With a *t*-value of 1.150 and a p-value of 0.256 (NS) indicating no significant difference, the results suggest that the classroom environment inventory scores of boys in the experimental and control groups are comparable.

The mean pre--test scores of Classroom Environment of experimental and control groups for Boys are represented graphically in Figure 25.

Figure 25

Mean Pretest Scores of Classroom Environment of Experimental and Control Group-Boys



From Figure 25, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable Classroom Environment for Boys. The X axis of the graph represents the variable classroom environment of boys of two groups. The Y axis represents the mean pretest scores of the variable classroom environment of two groups of Boys. So it can be conclude that the graphical representation of mean pretest scores of classroom environment of experimental and control groups shows that there is no significant difference in the mean pretest scores of classroom environment between the groups. Hence the Classroom environment of coastal area secondary school students in the two groups are almost equal for Boys.

Comparison of the Mean Pretest Scores of Classroom Environment between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of Classroom Environment between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 42.

Table 42

Result of the Test of Significance of Difference in the Mean Scores of Classroom Environment between Experimental Group and Control Group among Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*
Classroom Environment	Experimental group	28	37.786	2.672	1.832	.072[NS]
	Control group	30	36.400	3.058		

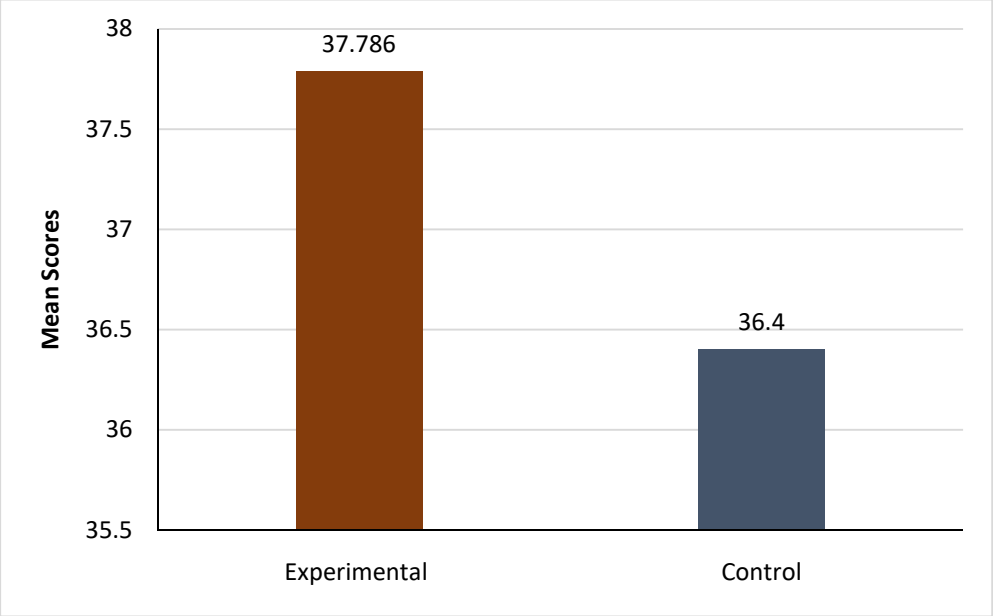
NS: Not significant at 0.05 level of significance

The table no.42 compares the Classroom Environment scores for girls in experimental group and control group. In the experimental group, consisting of 28 girls, the mean score is 37.786 (SD = 2.672). Conversely, the control group comprising 30 girls shows a mean score of 36.400 (SD = 3.058). Utilizing the independent sample *t*-test method, no significant difference is found between the two groups with a *t*-value of 1.832 and a p-value of .072 indicating a lack of statistical significance. These results suggest that the classroom environment scores of girls in the experimental and control groups are similar.

The mean pre--test scores of Classroom Environment of experimental and control groups for Girls are represented graphically in Figure 26.

Figure 26

Mean Pretest Scores of Classroom Environment of Experimental and Control Group- Girls



From Figure 26, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable classroom environment for Girls. The X axis of the graph represents the variable classroom environment of Girls of two groups. The Y axis represents the mean pretest scores of the variable classroom environment of two groups of Girls. So it can be conclude that the graphical representation of mean pretest scores of classroom environment of experimental and control groups shows that there is no significant difference in the mean pretest scores of classroom environment between the groups. Hence the classroom environment of coastal area secondary school students in the two groups are almost equal for Girls

Comparison of the Mean Pretest Scores of Socio Economic Status between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean scores of Socio Economic Status between Experimental group and Control group, the

investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 43.

Table 43

Result of the Test of Significance of Difference in the Mean Scores of Socio Economic Status between Experimental Group and Control Group -Total Sample.

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Socio Economic Status	Experimental group	54	43.982	6.894	-.519	.605^{NS}
	Control group	54	44.630	6.054		

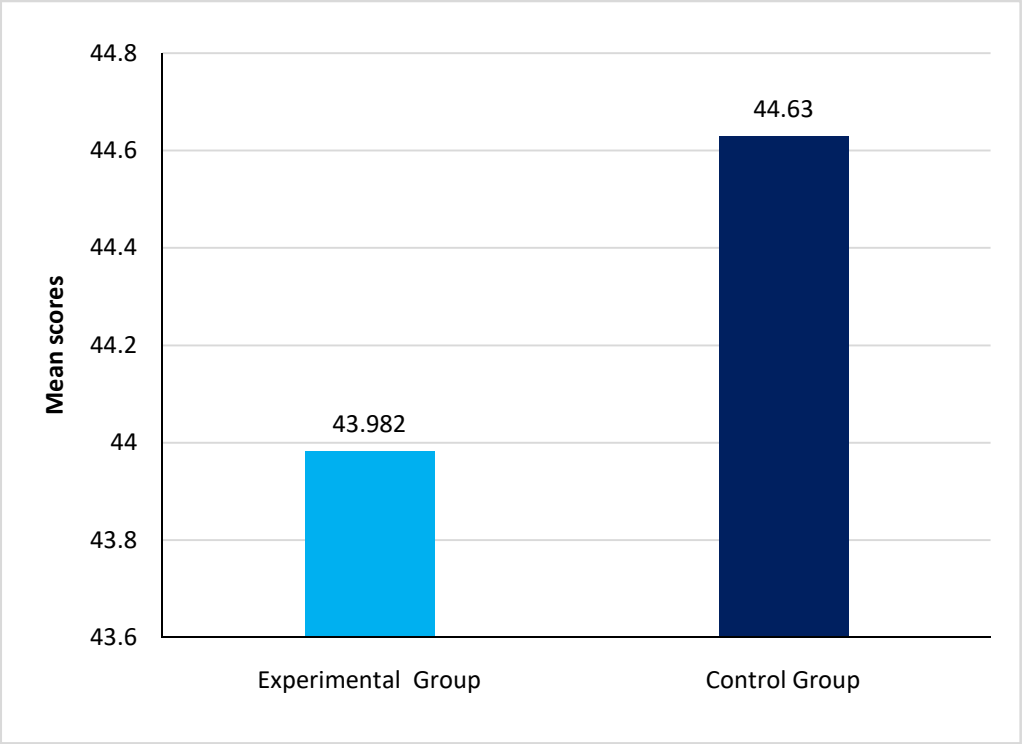
NS: Not significant at 0.05 level of significance.

The table No.43 compares the Socio Economic Status scores between participants in experimental group and control group. Using the two independent sample *t*-test method, it's found that the experimental group with 54 participants had a mean score of 43.982 and a standard deviation of 6.894, while the control group also with 54 participants had a mean score of 44.630 and a standard deviation of 6.054. The statistical analysis showed no higher difference between the groups with a *t*-value of -0.519 and a p-value of 0.605, meaning there is no significant difference. These results suggest that Socio Economic Status scores were similar in both groups.

The mean pre--test scores of Socio Economic Status of experimental and control groups for Total sample are represented graphically in Figure 27.

Figure 27

Mean Pretest Scores of Socio-Economic Status of Experimental and Control Group-Total Sample



From Figure 27, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable Socio Economic status for total sample. The X axis of the graph represents the variable Socio economic status of two groups. The Y axis represents the mean pretest scores of the variable socio economic status of two groups for total sample. So it can be conclude that the graphical representation of mean pretest scores of socio economic status of experimental and control groups shows that there is no significant difference in the mean pretest scores of Socioeconomic status between the groups. Hence the socioeconomic status of coastal area secondary school students in the two groups are almost same for Total sample.

Comparison of the Mean Pretest Scores of Socio Economic Status between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of Socio Economic Status between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 44.

Table 44

Result of the Test of Significant Difference in the Mean Scores of Socio Economic Status between Experimental Group and Control Group among Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*
Socio Economic Status	Experimental group	26	43.846	6.679	.847	.401[NS]
	Control group	24	45.417	6.413		

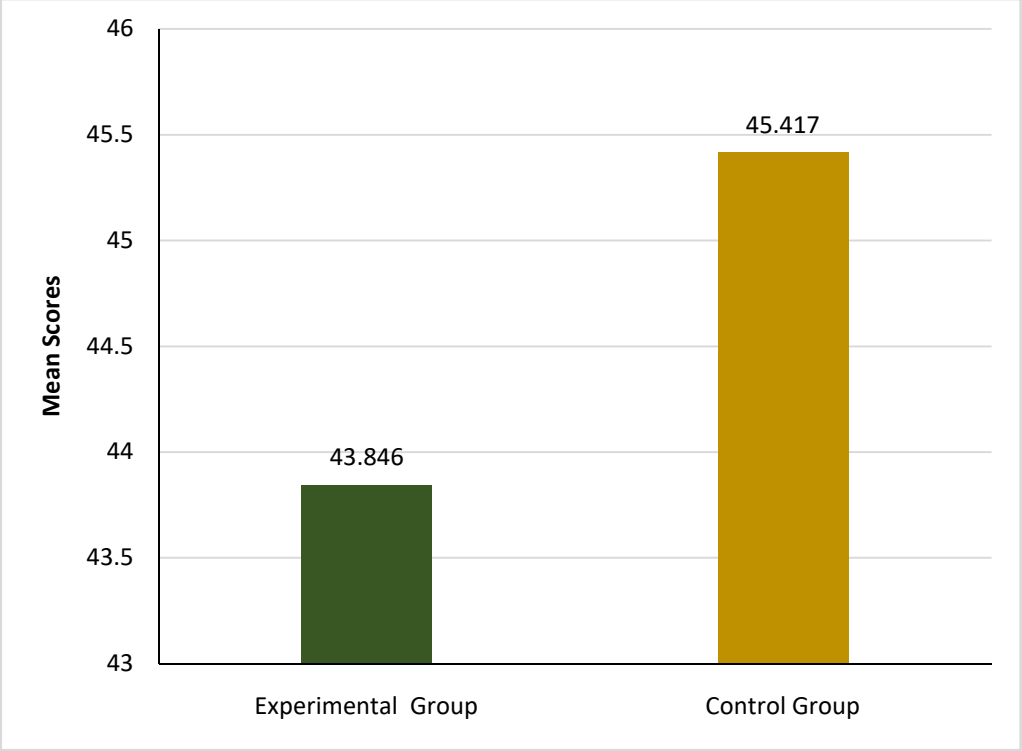
NS: Not significant at 0.05 level of significance

The table no.44 compares the Socio Economic Status scores for boys in experimental group and control group. In the experimental group comprised of 26 boys, the mean score is 43.846 with a standard deviation (SD) of 6.679. Conversely, the control group consisting of 24 boys shows a mean score of 45.417 with a SD of 6.413. With a *t*-value of 0.847 and a p-value of 0.401 (NS) indicating no significant difference, the results suggest that the Socio Economic Status scores of boys in the experimental and control groups are comparable.

The mean pre--test scores of Socio Economic status of experimental and control groups for Boys are represented graphically in Figure 28.

Figure 28

Mean Pretest Scores of Socio-Economic Status of Experimental and Control Group-Boys



From Figure 28, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variable Socio economic status for Boys. The X axis of the graph represents the variable socio economic status of boys of two groups. The Y axis represents the mean pretest scores of the variable socio economic status of two groups for Boys. So it can be conclude that the graphical representation of mean pretest scores of socio economic status of experimental and control groups shows that there is no significant difference in the mean pretest scores of socio economic status between the groups. Hence the socioeconomic status of coastal area secondary school students in the two groups are almost equal for Boys.

Comparison of the Mean Pretest Scores of Socio Economic Status between Experimental Group and Control Group Among Girls

To find whether there exists any significant difference in the mean scores of Socio Economic Status between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 45.

Table 45

Result of the Test of Significance of Difference in the Mean Scores of Socio Economic Status between Experimental Group and Control Group among Girls

Variable	Girls	*N*	*Mean*	*SD*	*T*	*P*
Socio Economic Status	Experimental group	28	44.107	7.208	.063	.950^{NS}
	Control group	30	44.000	5.783		

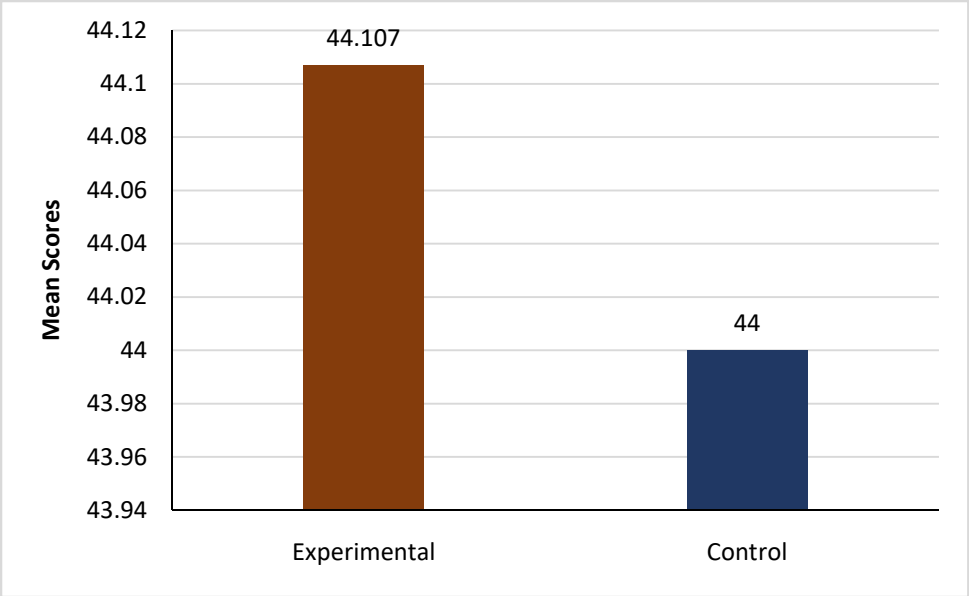
NS: Not significant at 0.05 level of significance

The table no.45 compares the Socio Economic Status scores for girls in experimental group and control group. In the experimental group consisting of 28 girls, the mean score is 44.107 (SD = 7.208). Conversely, the control group comprising 30 girls shows a mean score of 44.000 (SD = 5.783). Utilizing the independent sample *t*-test method no significant difference is found between the two groups with a *t*-value of 0.063 and a p-value of .950 indicating a lack of statistical significance. These results suggest that the Socio Economic Status scores of girls in the experimental and control groups are similar.

The mean pre--test scores of Socio Economic Status of experimental and control groups for Girls are represented graphically in Figure 29.

Figure 29

Mean Pretest Scores of Socio Economic Status of Experimental and Control Group-Girls



From Figure 29, it is evident that the bar chart used to compare the difference in the mean pretest scores of the two groups Experimental and control group for the variable socio economic status for Girls. The X axis of the graph represents the variable socioeconomic status of Girls of two groups. The Y axis represents the mean pretest scores of the variable socioeconomic status of two groups of Girls. So it can be conclude that the graphical representation of mean pretest scores of socio economic status of experimental and control groups shows that there is no significant difference in the mean pretest scores of socioeconomic status between the groups. Hence the socio economic status of coastal area secondary school students in the two groups are almost equal for Girls

Discussion

The mean difference analysis of pretest scores of problem solving ability, perceptual speed mathematics anxiety, nonverbal intelligence, classroom environment and socioeconomic status of experimental and control groups is shown above in

detail. The control and experimental groups don't differ significantly in the pre-intervention status of problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom, environment and socioeconomic status For total sample, boys and girls. Hence the experimental group and control group are comparable with regard to the variables; problem solving ability, perceptual speed and mathematics anxiety for the particular sample.

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Experimental Group

Experimental group given the treatment of Brain compatible learning strategy and the control group was taught through existing method of teaching. To test the effectiveness of brain compatible learning approach in enhancing problem solving ability, perceptual speed and to reduce mathematics anxiety of coastal area secondary school students. The mean scores before and after the intervention of the students belonging to the experimental group were compared for the total sample, boys and girls.

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability in the Experimental Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Problem solving ability in Experimental group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 46.

Table 46

Result of Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Problem Solving Ability in Experimental Group- Total Sample

Variable	Group	*N*	*Mean*	*SD*	*T*	*P*
Problem Solving Ability	Pretest	54	16.630	2.817	6.212	.000**
	Posttest	54	20.333	3.420		

**Significant at 0.01 level of significance

The Table No. 46 presents a comparison of pretest to posttest scores of variables within the Experimental group. For the variable "Problem solving ability ", data from both the pretest and posttest are provided. In the pretest there were 54 participants with a mean score of 16.630 and a standard deviation of 2.817. In the posttest the same 54 participants achieved a higher mean score of 20.333. A paired-sample *t*-test was conducted to assess the significance of the difference between the pretest and posttest scores. The results indicate a statistically significant increase in problem solving ability from the pretest to the posttest (t = 6.212, p = .000**), suggesting that the Brain-compatible learning strategy administered to the Experimental group is effective and had a positive impact on enhancing problem solving ability of coastal area secondary school students.

The mean pretest and posttest scores of problem solving ability for total sample in the experimental group are presented graphically in Figure 30.

Figure 30

Mean Pretest and Posttest Scores of Problem Solving Ability of Experimental Group-Total Sample

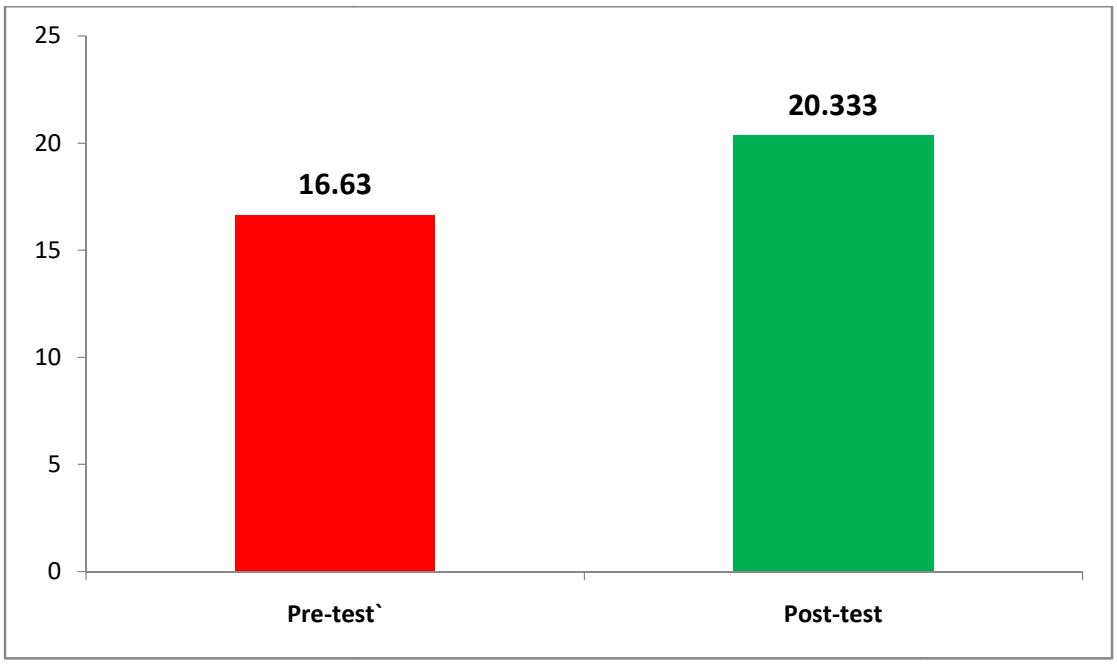


Figure 30, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable problem solving ability for total sample. The X axis of the graph represents the two tests of the variable problem -solving ability. The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of experimental group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Experimental group for the total sample

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability in the Experimental Group for Boys

To find whether there exists any significant difference in the mean scores of Pretest scores to posttest scores of Problem Solving ability in Experimental group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 47.

Table 47

Result of the Test of Significance of Difference in the Mean Pretest and Posttest Scores of Problem Solving Ability in Experimental Group-Boys

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving ability	Pretest	26	16.539	2.596	4.815	.000**
	Posttest	26	19.885	3.421		

**: Significant at 0.01 level of significance

The Table No. 47 presents the comparison of pretest to posttest scores for the Problem Solving ability within the experimental group. In pretest, the mean score was 16.539 with a standard deviation of 2.596. In posttest, the mean score increased to 19.885. A paired-samples *t*-test was conducted to assess the significance of this change. The analysis revealed a statistically significant difference between the pretest and posttest scores, t (26) = 4.815, p <. 001, indicating a notable improvement in problem solving ability. Hence Brain compatible learning strategy is effective in enhancing the problem solving ability of boys in the coastal area secondary school.

The mean pretest and posttest scores of problem -solving ability in the experimental group for boys are presented graphically in Figure 31.

Figure 31

Mean Pretest and Posttest Scores of Problem Solving Ability of Experimental Group - Boys.

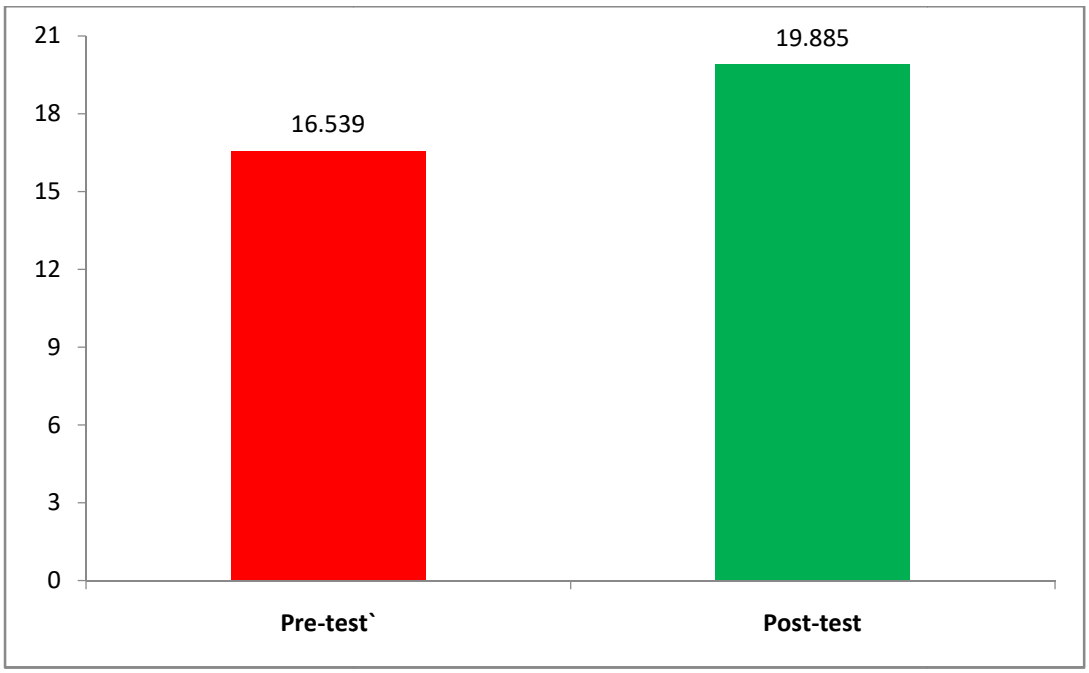


Figure 31, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable problem solving ability for boys. The X axis of the graph represents the two tests of the variable problem solving ability. The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of experimental group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Experimental group for Boys.

Comparison of the Mean Scores of Pretest and Posttest Scores of Problem Solving Ability in the Experimental Group among Girls

To find whether there exists any significant difference in the mean scores of Pretest scores to posttest scores of problem solving ability in the Experimental group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 48.

Table 48

Result of the Test of Significance of Difference in the Mean Scores of Pretest Scores and Posttest Scores of Problem Solving Ability in Experimental Group among Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Pretest	28	16.714	3.053	4.203	.000**
	Posttest	28	20.750	3.428		

**: Significant at 0.01 level of significance

The table no.48 displays data related to the Problem solving ability scores of 28 participants. Initially, the mean pretest score was 16.714, with a standard deviation of 3.053. Following the method, the mean posttest score increased to 20.750 with the standard deviation 3.428. A paired-samples *t*-test was conducted to compare pretest and posttest scores revealing a statistically significant difference t (28) = 4.203, p = .000. This result indicates a significant improvement in problem solving ability. Hence Brain compatible learning strategy is effective in enhancing problem solving ability of girls in the coastal area secondary school following the method.

The mean pretest and posttest scores of problem solving ability in the experimental group for girls are presented graphically in Figure 32.

Figure 32

Mean Pretest and Posttest Scores of Problem Solving Ability of Experimental Group - Girls

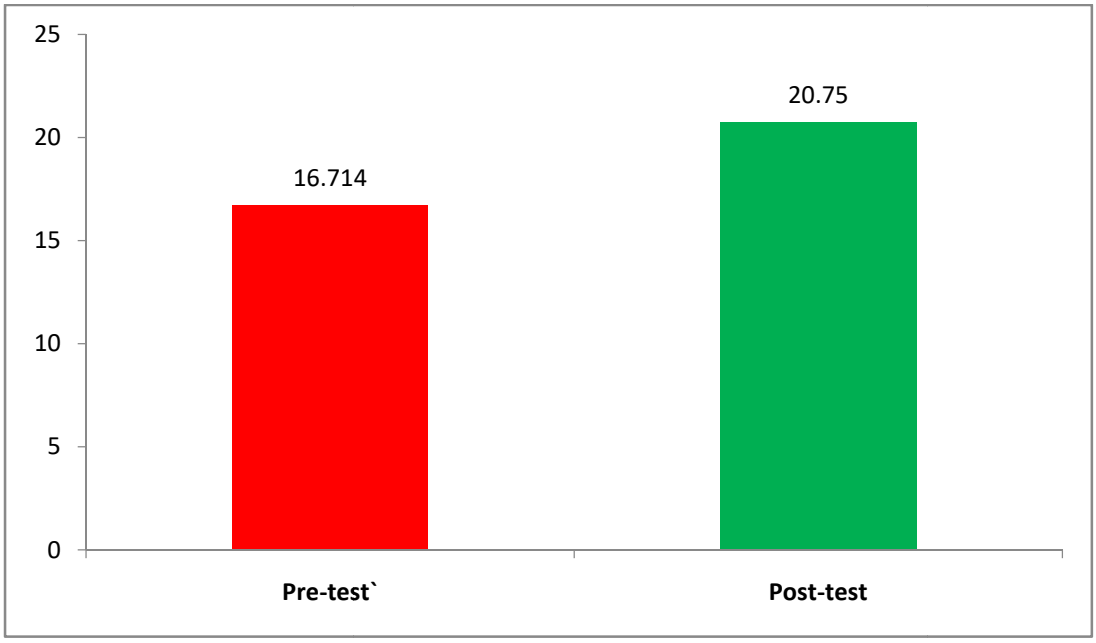


Figure 32, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable problem solving ability of girls. The X axis of the graph represents the two tests of the variable problem solving ability. The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of experimental group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Experimental group for girls.

Comparison of the Mean Pretest Scores and Posttest Scores of Perceptual Speed in the Experimental Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Perceptual Speed in Experimental group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 49.

Table 49

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Perceptual Speed in Experimental Group-Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Pretest	54	26.185	2.748	13.794	.000**
	Posttest	54	30.963	2.257		

**Significant at 0.01 level of significance

The table no.49 compares pretest to posttest scores of the variable "Perceptual Speed" within the Experimental group. In the pretest phase, 54 participants had a mean score of 26.185 with a standard deviation of 2.748. Following the method, the same 54 participants achieved a higher mean score of 30.963 in the posttest. A paired-sample *t*-test was conducted to examine the significance of the difference between the pretest and posttest scores. The results revealed a highly significant increase in perceptual speed from the pretest to the posttest (t = 13.794, p = .000**), indicating that the Brain compatible learning strategy administered to the Experimental group is effective and had a substantial positive effect on perceptual speed of coastal area secondary school students.

The mean pretest and posttest scores of perceptual speed for total sample in the experimental group are presented graphically in Figure 33.

Figure 33

Mean Pretest and Posttest Scores of Perceptual Speed of Experimental Group -Total Sample

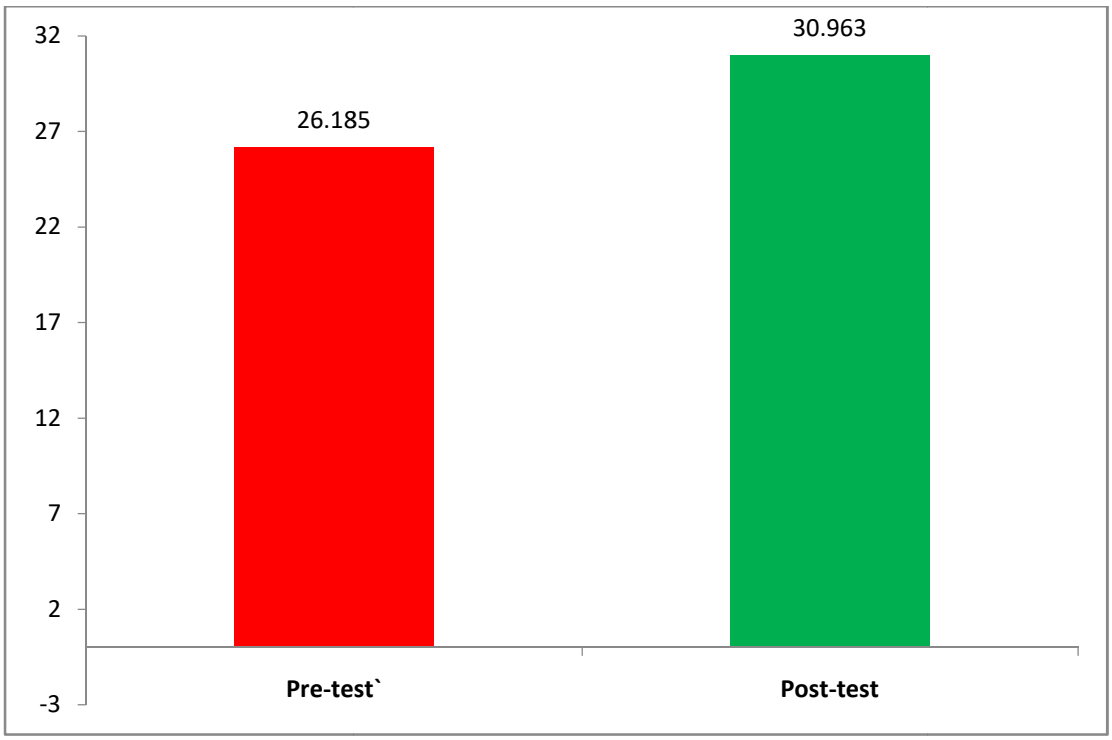


Figure 33, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable perceptual speed for total sample. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the two tests; of the variable perceptual speed of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of experimental group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the experimental group. The mean post-est scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Experimental group for the total sample.

Comparison of the Mean Pretest and Posttest Scores of Perceptual Speed in Experimental Group among Boys

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Perceptual Speed in Experimental group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 50.

Table 50

Result of the Test of Significance of Difference in the Mean Pretest and Posttest Scores of Perceptual Speed of Experimental Group - Boys

Variable	Group	*N*	*Mean*	*SD*	*T*	*P*
Perceptual Speed	Pretest	26	24.615	2.385	11.561	.000**
	Posttest	26	30.423	2.548		

**: Significant at 0.01 level of significance

The table no.50 presents the comparison of pretest to posttest scores for the Perceptual Speed variable within the experimental group. For pretest the mean score was 24.615 with a standard deviation of 2.385. For posttest, the mean score increased to 30.423. A paired-samples *t*-test was conducted to assess the significance of this change. The analysis revealed a statistically significant difference between the pretest and posttest scores, t (26) = 11.561, p <. 001, indicating a notable improvement in Perceptual Speed. Hence Brain-compatible learning strategy is effective in enhancing the perceptual speed of boys in the coastal area secondary school.

The mean pretest and posttest scores of perceptual speed in the experimental group - Boys are presented graphically in figure 34.

Figure 34

Mean Pretest and Posttest Scores of Perceptual Speed of Experimental Group-Subsample Boys

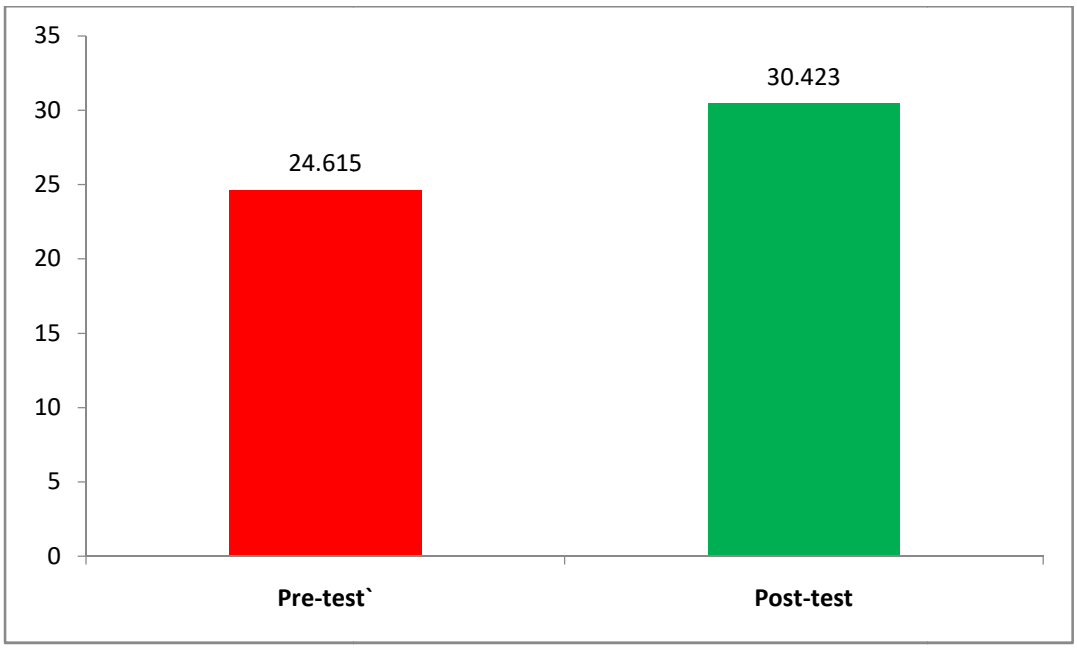


Figure 34, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable perceptual speed for Boys. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the two tests; of the variable perceptual speed of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of experimental group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Experimental group for Boys.

Comparison of the Mean Pretest and Posttest Scores of Perceptual Speed in the Experimental Group among Girls

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of mathematics anxiety in Experimental group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 51.

Table 51

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Perceptual Speed in Experimental Group - Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Pretest	28	27.643	2.231	9.357	.000**
	Posttest	28	31.464	1.856		

**: Significant at 0.01 level of significance

The table no.51 presents data concerning the Perceptual Speed scores of 28 participants before and after the method. Initially, the mean pretest score was 27.643, with a standard deviation of 2.231. Following the method, the mean posttest score increased to 31.464. The standard deviation of the posttest scores was 1.856. A paired-samples *t*-test was conducted to compare pretest and posttest scores revealing a statistically significant difference $t\ (28) = 9.357$, $p <. 001$. This outcome suggests a substantial improvement in perceptual speed. Hence Brain compatible learning strategy is effective in enhancing the perceptual speed of girls in the coastal area secondary school.

The mean pretest and posttest scores of perceptual speed in the experimental group for girls are presented graphically in Figure 35.

Figure 35

Mean Pretest and Posttest Scores of Perceptual Speed of Experimental Group - Girls

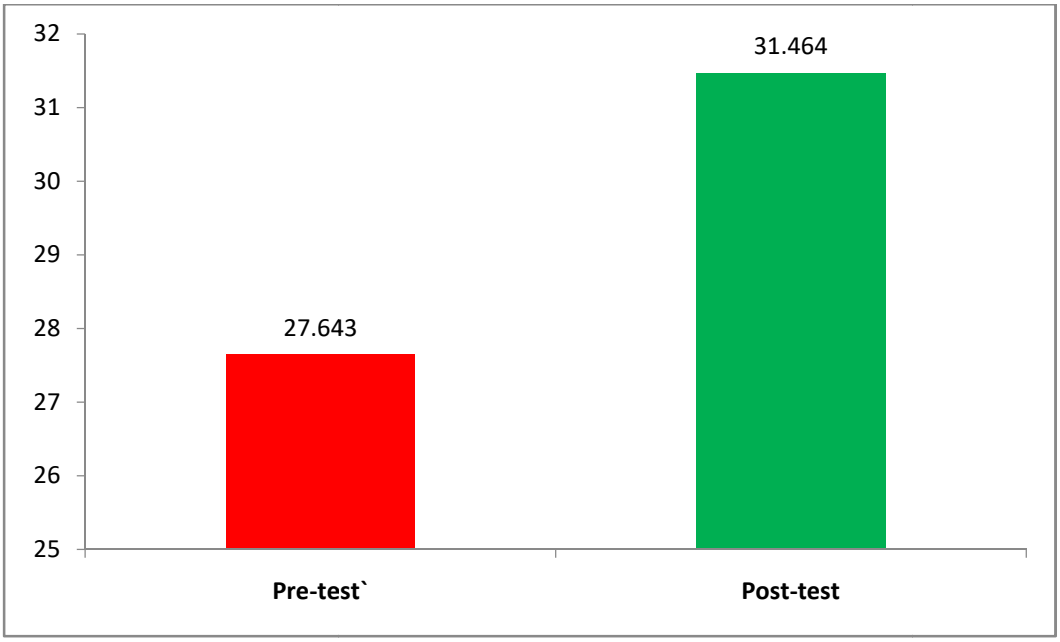


Figure 35, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable perceptual speed for Girls. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the two tests; of the variable perceptual speed of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of experimental group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Experimental group for girls.

Comparison of the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety in Experimental Group for Total Sample

To find whether there exists any significant difference in the mean scores of Pretest scores to posttest scores of Mathematics anxiety in Experimental group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 52.

Table 52

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety in Experimental Group

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	54	91.519	6.720	-7.692	.000**
	Posttest	54	81.407	9.757		

**Significant at 0.01 level of significance

The table no.52 presents data on Mathematics anxiety scores for a group of 54 participants. In the pretest phase, participants had a mean mathematics anxiety score of 91.519, with a standard deviation of 6.720. Following the method, during the posttest phase, the mean score decreased to 81.407, with a standard deviation of 9.757. The negative *t*-value of -7.692 indicates a significant difference between the pretest and posttest scores. The p-value of 0.000** signifies that this difference is highly statistically significant. This implies that the Brain compatible learning strategy administered to the Experimental group is effectively reduced mathematics anxiety among the coastal area secondary school students.

The mean pretest and posttest scores of mathematics anxiety for total sample in the experimental group are presented graphically in Figure 36.

Figure 36

Mean Pretest and Posttest Scores of Mathematics Anxiety of Experimental Group - Total Sample

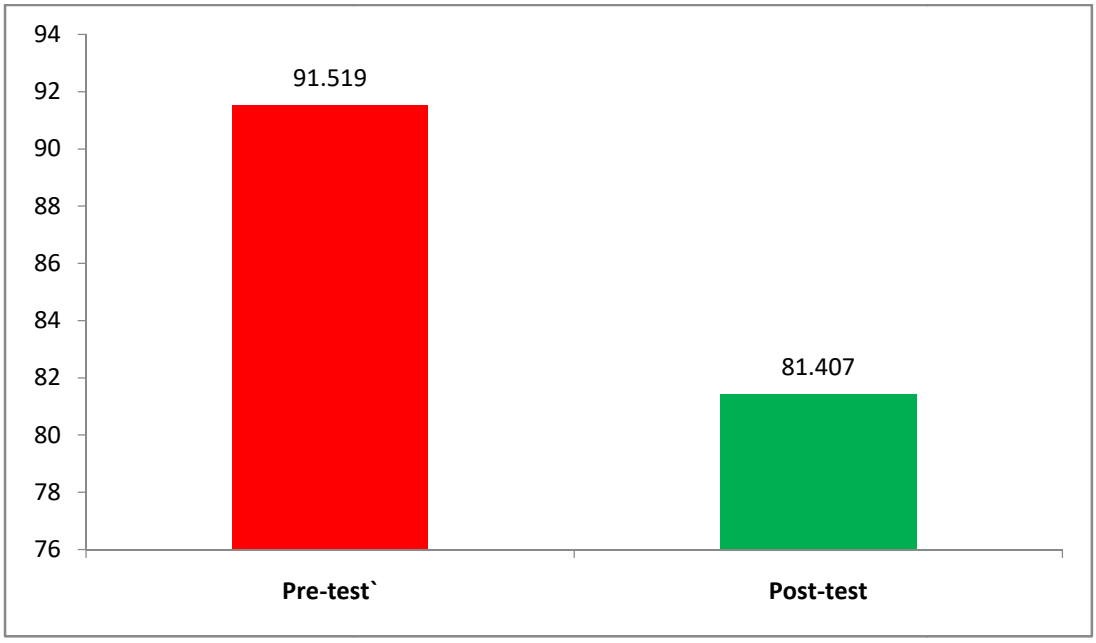


Figure 36 indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable mathematics anxiety for total sample. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the two tests; of the variable mathematics anxiety of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of experimental group shows that there is significant difference in the mean pretest and posttest scores of mathematics anxiety in the experimental group. The mean posttest scores of the experimental group is lower than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable Mathematics anxiety of the Experimental group for the total sample.

Comparison of the Mean Pretest and Posttest Scores of Mathematics Anxiety in Experimental Group among Boys

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of mathematics anxiety in Experimental group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 53.

Table 53

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety in Experimental Group - Boys

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	26	93.423	5.132	7.338	.000**
	Posttest	26	82.231	7.617		

**: Significant at 0.01 level of significance

The table no.53 compares pretest to posttest scores for mathematics anxiety within the experimental group. participants had a mean pretest score of 93.423 with a standard deviation of 5.132. After the posttest, the mean score decreased to 82.231, with a standard deviation of 7.617. A paired-samples *t*-test indicated a significant difference between pretest and posttest scores, t (26) = 7.338, $p < 0.001$. This suggests a substantial reduction in mathematics anxiety. Hence Brain compatible learning strategy is effective in reducing the mathematics anxiety of boys in the coastal area secondary school.

The mean pretest and posttest scores of mathematics anxiety in the experimental group for boys are presented graphically in Figure 37.

Figure 37

Mean Pretest and Posttest Scores of Mathematics Anxiety of Experimental Group - Boys

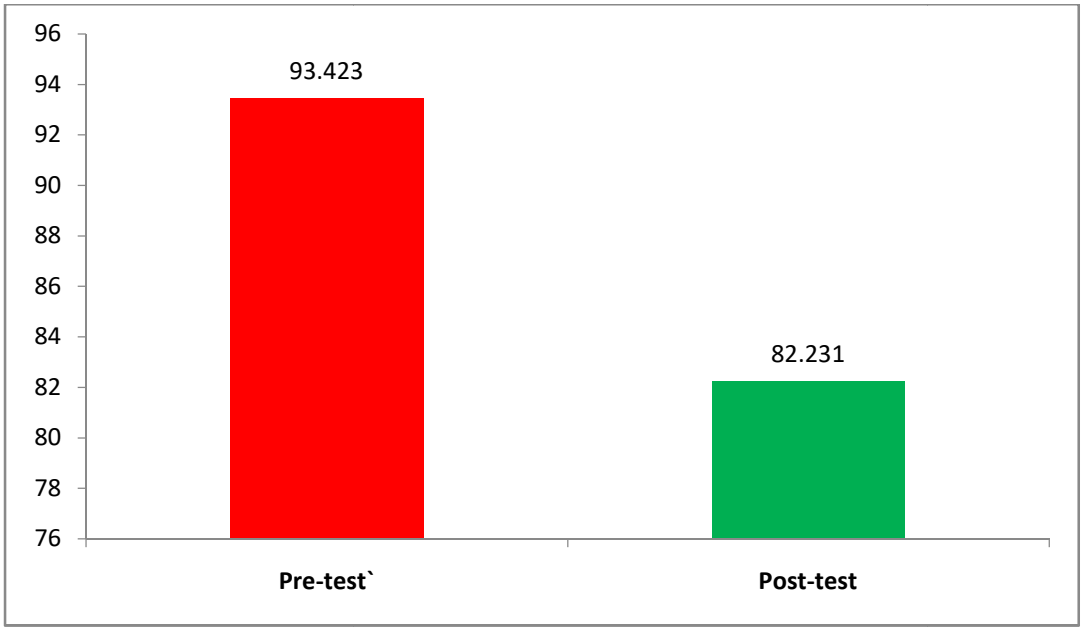


Figure 37 indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable mathematics anxiety for Boys. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the the two tests; of the variable mathematics anxiety of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of experimental group shows that there is significant difference in the mean pretest and posttest scores of mathematics anxiety in the experimental group. The mean posttest scores of the experimental group is lower than the mean pretest scores. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Experimental group for Boys.

Comparison of the Mean Pretest and Posttest Scores of Mathematics Anxiety in the Experimental Group among Girls

To find whether there exists any significant difference in the mean Pretest to posttest scores of mathematics anxiety in Experimental group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 54.

Table 54

Result of the Test of Significance of Difference in the Mean Scores of Pretest Scores and Posttest Scores of Mathematics Anxiety in Experimental Group - Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	28	89.750	7.585	4.31	.000**
	Posttest	28	80.643	11.483		

**: Significant at 0.01 level of significance

The table no.54 displays data regarding the Mathematics anxiety scores of 28 participants before and after the method. Initially, the mean pretest score was 89.750, with a standard deviation of 7.585. After the method, the mean posttest score decreased to 80.643. The standard deviation of the posttest scores was 11.483. A paired-samples *t*-test was conducted to compare pretest and posttest scores, revealing a statistically significant difference, $t\ (28) = 4.31$, $p < 0.001$. This result indicates a significant reduction in mathematics anxiety. Hence Brain compatible learning strategy is effective in reducing the mathematics anxiety of girls in the coastal area secondary school.

The mean pretest and posttest scores of mathematics anxiety in the experimental group for girls are presented graphically in Figure 38.

Figure 38

Mean Pretest and Posttest Scores of Mathematics Anxiety of Experimental Group-Girls

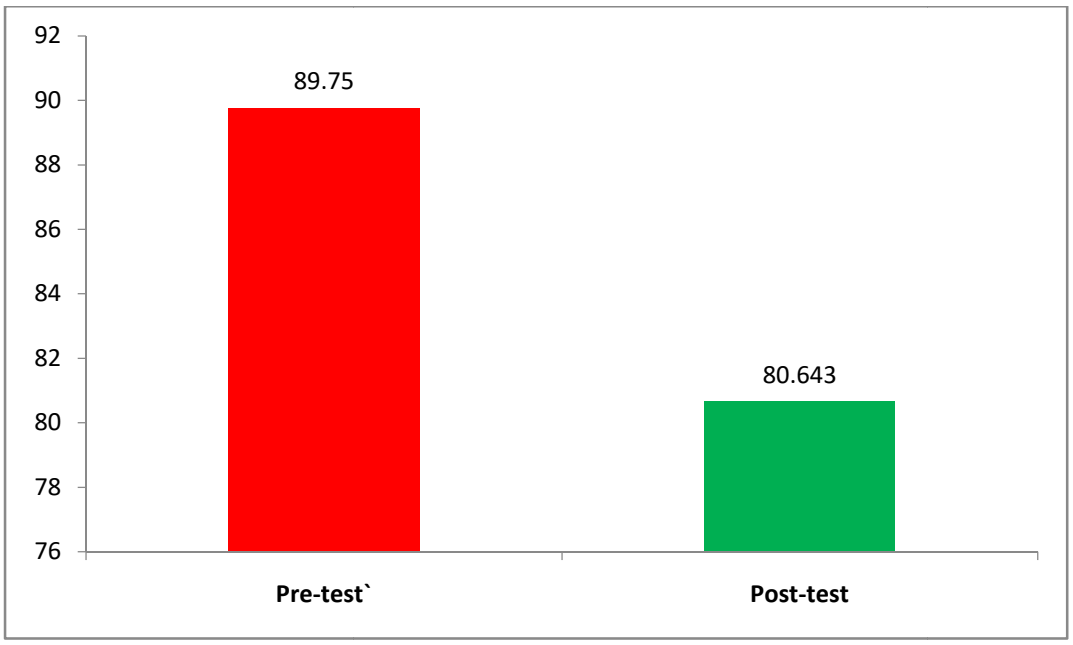


Figure 38, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable mathematics anxiety for Girls. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the two tests; of the variable mathematics anxiety of the Experimental group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of experimental group shows that there is significant difference in the mean pretest and posttest scores of mathematics anxiety in the experimental group. The mean posttest scores of the experimental group is lower than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Experimental group for girls.

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Control Group

The mean scores before and after the intervention of the students belonging to the control group were compared for the total sample, boys and girls.

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability in the Control Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Problem solving ability in Control group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 55.

Table 55

Result of the Test of Significance of Difference in the Mean Pretest and Posttest Scores of Problem Solving Ability of Control Group for Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Pretest	54	16.296	2.765	2.842	.006**
	Posttest	54	17.426	3.601		

**Significant at 0.01 level of significance

The table no.55 displays data concerning the Problem Solving Ability scores for a group of 54 individuals. In the pretest phase, participants had a mean problem solving ability score of 16.296, with a standard deviation of 2.765. Following the method, during the posttest phase, the mean score increased to 17.426. The *t*-value of 2.842 suggests a significant difference between the pretest and posttest scores. The p-value of .006** indicates that this difference is statistically significant. This suggests that the existing method has an impact on improving problem solving ability among the coastal area secondary school students for total sample.

The mean pretest and posttest scores of problem solving ability in the control group for total sample are presented graphically in Figure 39.

Figure 39

Mean Pretest and Posttest Scores of Problem Solving Ability of Control Group -Total Sample

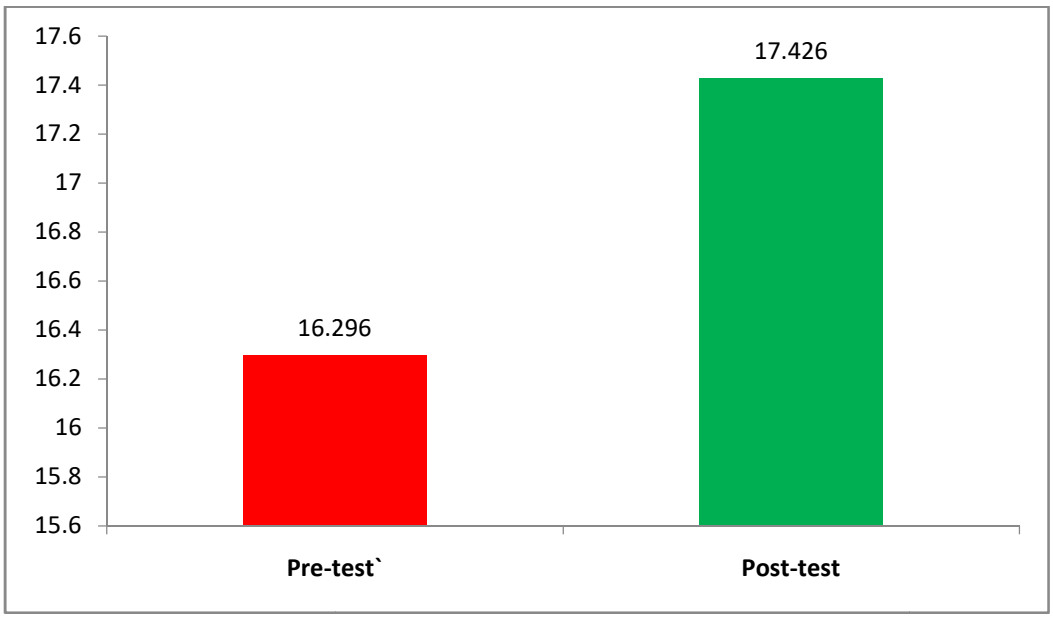


Figure 39, indicates that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable problem solving ability for Total sample. The X axis of the graph represents the two tests of the variable problem solving ability..The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of Control group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the control group. The mean post-est scores of the control group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Control group for the total sample.

Comparison of the Mean Pretest and Posttest Scores of Problem Solving Ability in Control Group among Boys

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Problem solving ability in Control group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 56.

Table 56

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Problem Solving Ability in Control Group among Boys

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Pretest	24	16.083	3.635	1.326	$.198^{NS}$
	Posttest	24	17.000	4.404		

Ns: Not significant at 0.05 level of significance.

The table no. 56 presents the comparison of pretest to posttest scores for Problem solving ability within a group of 24 participants. For Pretest, the mean score was 16.083, with a standard deviation of 3.635. For posttest the mean score increased slightly to 17.000, with a standard deviation of 4.404. A paired-samples *t*-test showed no significant difference between pretest and posttest scores, $t\ (24) = 1.326$, $p = .198$, indicating that the method did not significantly impact problem solving ability within this group. Hence existing method is not effective in enhancing problem solving ability of Boys in the coastal area secondary school.

The mean pretest and posttest scores of problem solving ability in the control group for total sample are presented graphically in Figure 40.

Figure 40

Mean Pretest and Posttest Scores of Problem Solving Ability of Control Group – Boys

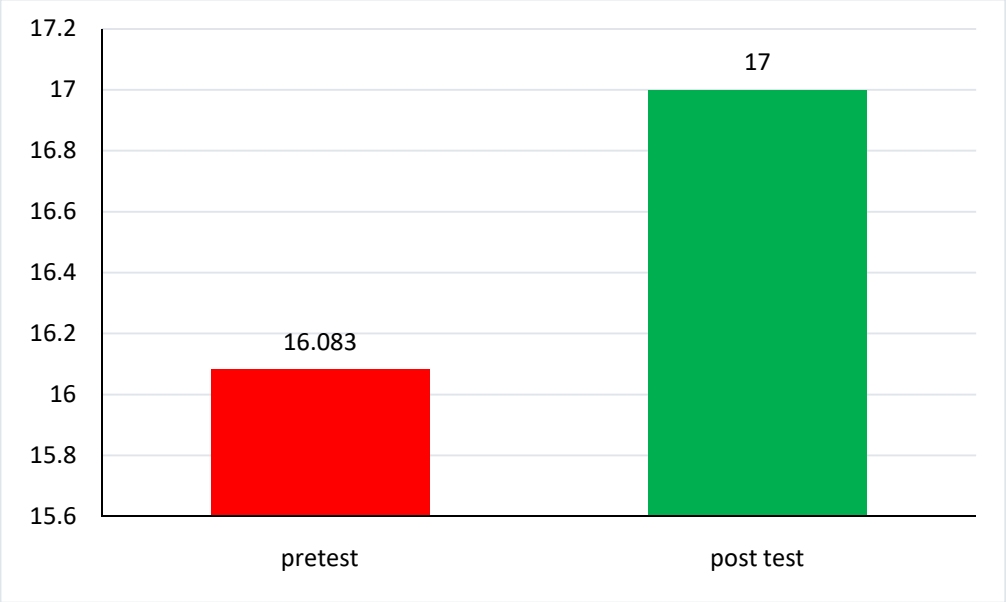


Figure 40, evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable problem solving ability for Boys. The X axis of the graph represents the two tests of the variable problem solving ability. The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of Control group shows that there is no significant difference in the mean pretest and posttest scores for the Boys.

Comparison of the Mean Pretest and Posttest Score of Problem Solving Ability in Control Group among Girls

To find whether there exists any significant difference in the mean scores of Pretest scores to posttest scores of Problem solving ability in Control group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 57.

Table 57

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Problem Solving Ability in Control Group among Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Problem Solving Ability	Pretest	30	16.467	1.852	2.809	.009**
	Posttest	30	17.767	2.837		

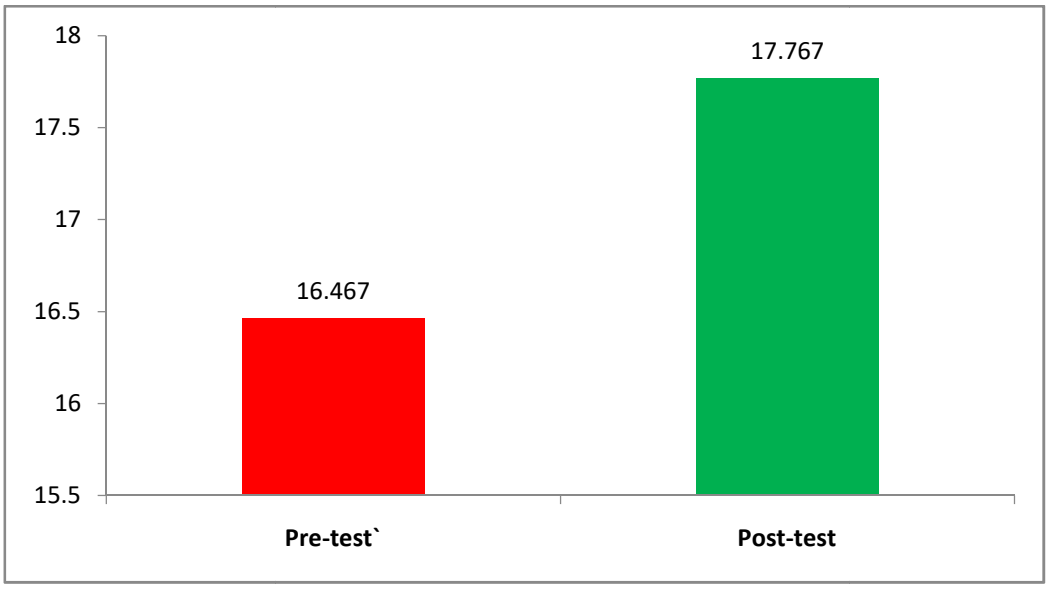
**: Significant at 0.01 level of significance

The table no.57 presents data on the Problem solving ability scores of 30 participants before and after the test period. Initially, the mean pretest score was 16.467, with a standard deviation of 1.852. After the method mean posttest score increased to 17.767. The standard deviation of the posttest scores was 2.837. A paired-samples *t*-test was conducted to compare pretest and posttest scores, revealing a statistically significant difference, t (30) = 2.809, p = .009. This result suggests that the existing method had a positive impact on problem solving ability of girls in the coastal area secondary school.

The mean pretest and posttest scores of problem solving ability in the control group for girls are presented graphically in Figure 41.

Figure 41

Mean Pretest and Posttest Scores of Problem Solving Ability in the Control Group-Girls



From the Figure 41, it is evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable problem solving ability for Girls. The X axis of the graph represents the two tests of the variable problem solving ability. The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of Control group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the control group. The mean posttest scores of the control group is greater than the mean pretest scores. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Control group for Girls.

Comparison of the Mean Pretest and Posttest Scores of Perceptual Speed in the Control Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Perceptual Speed in Control group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 58.

Table 58

Result of the Test of Significance of Difference in the Mean Pretest and Posttest Scores of Perceptual Speed of Control Group - Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Pretest	54	25.926	2.205	2.959	.005**
	Posttest	54	27.185	3.624		

**Significant at 0.01 level of significance

The table no. 58 illustrates the comparison of Perceptual Speed scores for a group of 54 individuals. In the pretest phase, participants had a mean perceptual speed score

of 25.926, with a standard deviation of 2.205. Following the method, during the posttest phase, the mean score increased to 27.185, with a standard deviation of 3.624. The *t*-value of 2.959 suggests a significant difference between the pretest and posttest scores (p = .005**), indicating that the existing method likely influenced perceptual speed among coastal area secondary school students.

The mean pretest and posttest scores of perceptual speed in the control group for total sample are presented graphically in Figure 42.

Figure 42

Mean Pretest and Posttest Scores of Perceptual Speed of Control Group -Total Sample

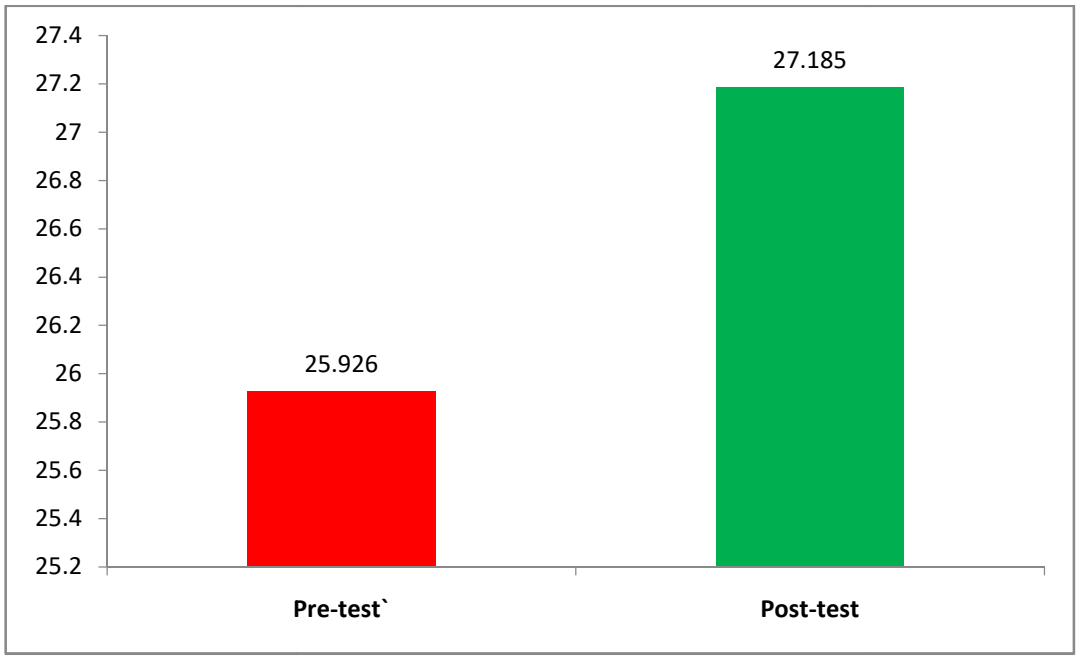


Figure 42, evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable perceptual speed for Total sample. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the two tests; of the variable perceptual speed of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual

speed of Control group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the control group. The mean posttest scores of the control group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Control group for the total sample.

Comparison of the Mean Pretest and Posttest Scores of Perceptual Speed in Control Group among Boys

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Perceptual Speed in Control group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 59.

Table 59

Result of the Test of Significance of Difference in the Mean Scores of Pretest Scores and Posttest Scores of Perceptual Speed in Control Group among Boys

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Pretest	24	25.042	2.312	2.889	.008**
	Posttest	24	26.792	3.878		

**: Significant at 0.01 level of significance

The table no.59 displays the comparison of pretest to posttest scores for Perceptual Speed among 24 participants. Initially, the mean pretest score was 25.042, with a standard deviation of 2.312. Following the method, the mean posttest score rose to 26.792 with a standard deviation of 3.878. The paired-samples *t*-test revealed a statistically significant difference between pretest and posttest scores, $t\ (24) = 2.889$, $p = .008$, indicating that the existing method had a significant positive effect on perceptual speed among boys in coastal area secondary school.

The mean pretest and posttest scores of perceptual speed in the control group for boys are presented graphically in Figure 43.

Figure 43

Mean Pretest and Posttest Scores of Perceptual Speed of Control Group - Boys

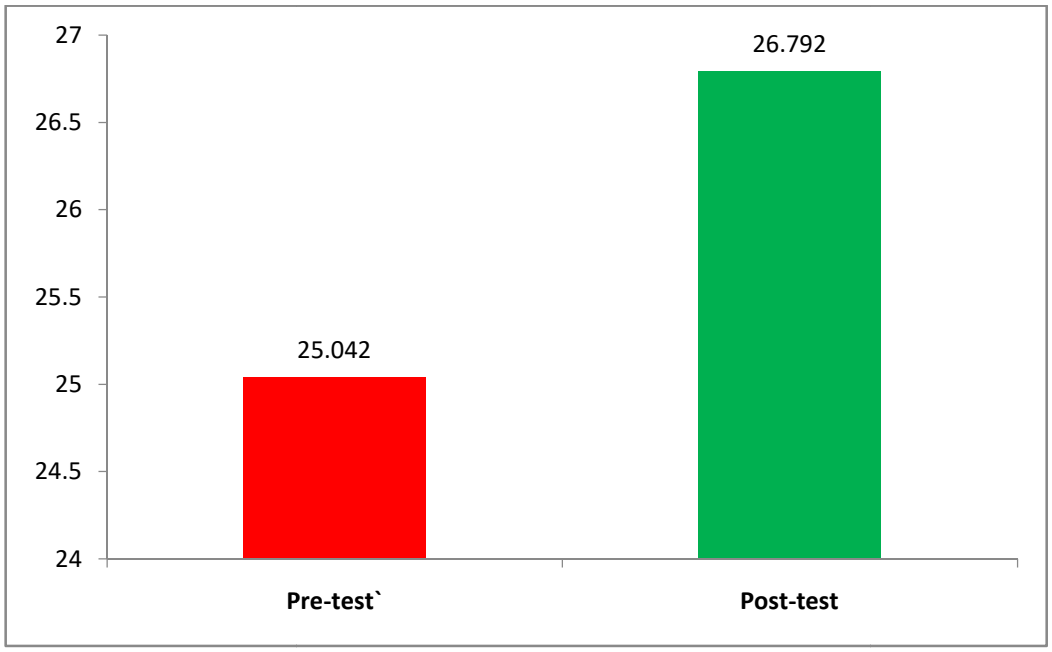


Figure 43, evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable perceptual speed for Boys. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the the two tests; of the variable perceptual speed of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of Control group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the control group. The mean posttest scores of the control group is greater than the mean pretest score. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Control group for Boys.

Comparison of the Mean Pretest and Posttest Score of Perceptual Speed in Control Group among Girls

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Perceptual Speed in Control group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 60.

Table 60

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Perceptual Speed in Control Group among Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Perceptual Speed	Pretest	30	26.633	1.866	1.463	.154[NS]
	Posttest	30	27.500	3.442		

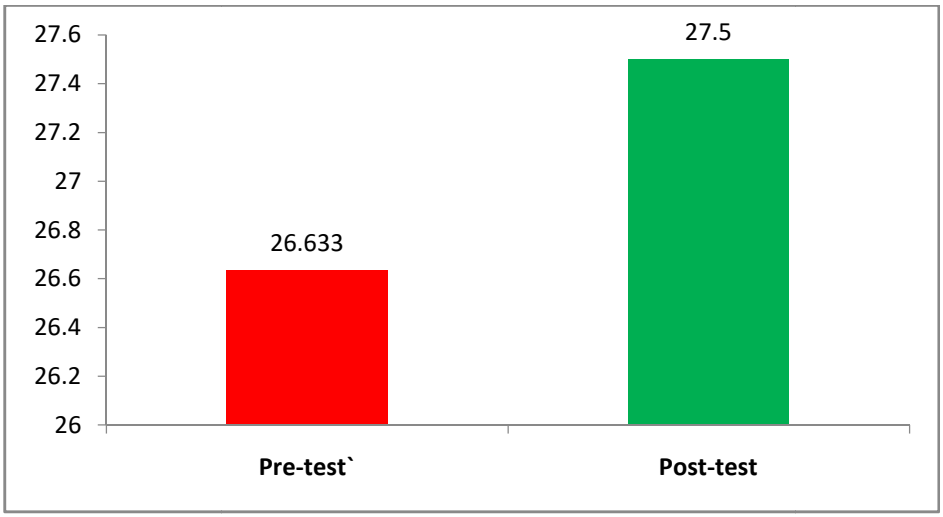
NS: Not significant at 0.05 level of significance

The table no.60 displays data concerning the Perceptual Speed scores of 30 participants. Initially, the mean pretest score was 26.633, with a standard deviation of 1.866. Following the method, the mean posttest score increased to 27.500, accompanied by a standard deviation of 3.442. A paired-samples *t*-test was conducted to assess the difference between pretest and posttest scores, yielding a non-significant result, t (30) = 1.463, p = .154. This suggests that there was no statistically significant change in perceptual speed following the method. Hence existing method is not effective for enhancing perceptual speed of girls among coastal area secondary school.

The mean pretest and posttest scores of perceptual speed in the control group for girls are presented graphically in Figure 44.

Figure 44

Mean Pretest and Posttest Scores of Perceptual Speed in the Control Group - Girls



From the Figure 44, it is evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable perceptual speed for Girls. The X axis of the graph represents the two tests of the variable perceptual speed. The Y axis represents the mean scores of the the two tests; of the variable perceptual speed of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of Control group shows that there is no significant difference between pretest and posttest scores. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Control group for Girls.

Comparison of the Mean Pretest and Posttest Scores of Mathematics Anxiety in the Control Group for Total Sample

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Mathematics anxiety in Control group, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 61

Table 61

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety of Control Group for total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	54	88.833	7.652	1.413	.163[NS]
	Posttest	54	87.426	9.961		

NS; Not significant at 0.05 level of significance

The table no. 61 presents the comparison of pretest to posttest scores for Mathematics anxiety within the experimental group. The mean pretest score for Mathematics Anxiety was 88.833 with a standard deviation of 7.652. The mean posttest score decreased slightly to 87.426, with a standard deviation of 9.961. The *t*-test was conducted to assess the significance of this change, resulting in a *t*-value of 1.413. However, the p-value is. 163, indicating that the difference between pretest and posttest scores was not statistically significant. Hence existing method is not effective for reducing mathematics anxiety of coastal area secondary school students

The mean pretest and posttest scores of mathematics anxiety in the control group for total sample are presented graphically in Figure 45

Figure 45

Mean Pretest and Posttest Scores of Mathematics Anxiety of Control Group -Total Sample

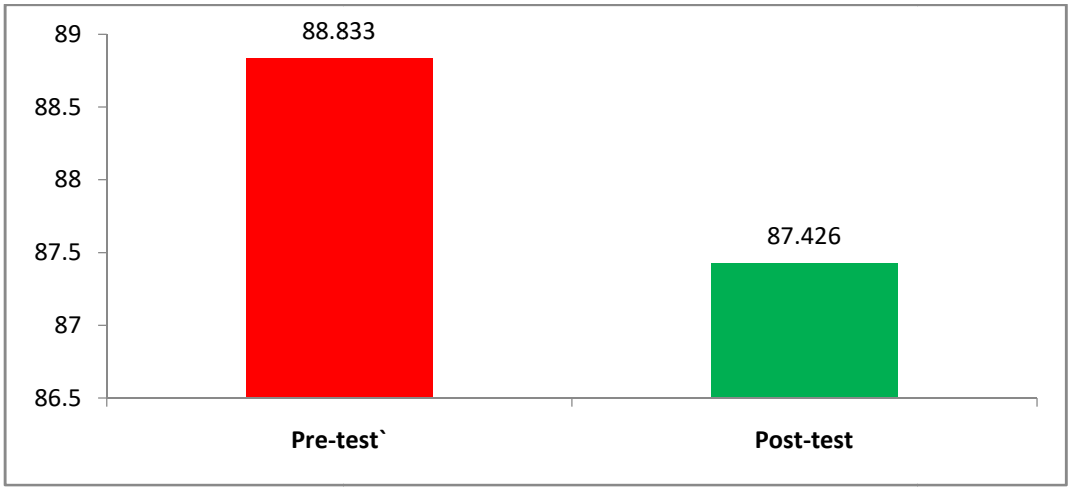


Figure 45, evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable mathematics anxiety for Total sample. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the the two tests; of the variable mathematics anxiety of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of Control group shows that there is no significant difference in the mean pretest and posttest scores of mathematics anxiety in the control group. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Control group for the total sample.

Comparison of the mean Pretest and Posttest Score of Mathematics Anxiety in Control Group among Boys

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Mathematics anxiety in Control group among boys, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 62.

Table 62

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety in Control Group among Boys

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	24	91.375	6.819	3.045	.006**
	Posttest	24	87.917	8.612		

**: Significant at 0.01 level of significance

The table no. 62 presents data on Mathematics anxiety scores for 24 participants. Initially, the mean pretest score was 91.375, with a standard deviation of 6.819.

After the method, the mean posttest score decreased to 87.917, with a standard deviation of 8.612. A paired-samples *t*-test was conducted to compare pretest and posttest scores, revealing a statistically significant difference, t (24) = 3.045, p = .006. This result suggests that the existing method had a significant effect in reducing mathematics anxiety among the boys in coastal area secondary school.

The mean pretest and posttest scores of mathematics anxiety in the control group for boys are presented graphically in Figure 46.

Figure 46

Mean Pretest and Posttest Scores of Mathematics Anxiety in the Control Group- Sub sample Boys

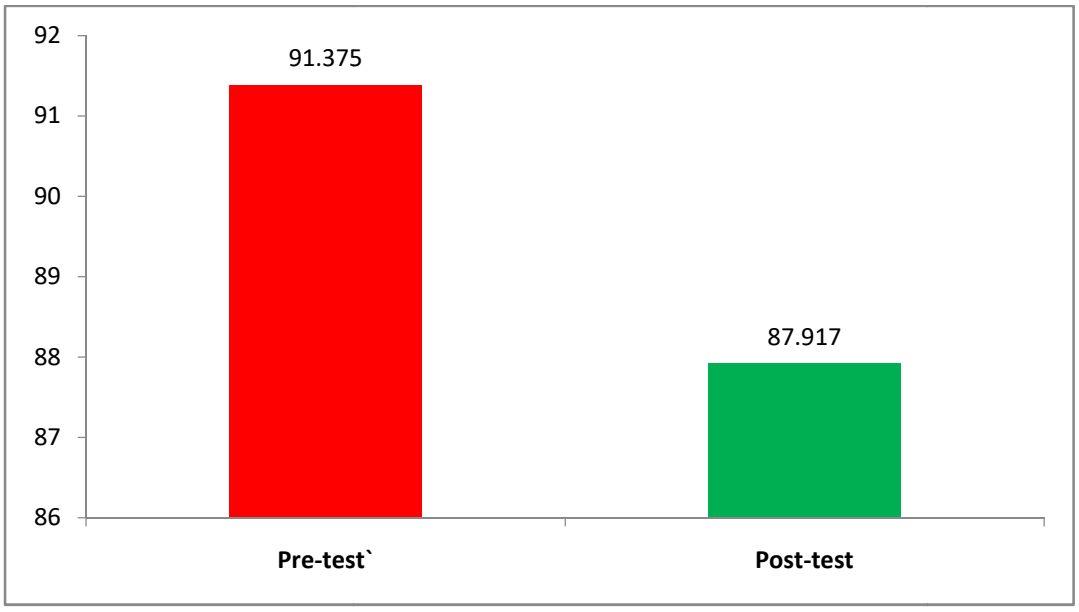


Figure 46, evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable mathematics anxiety for Boys. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the two tests; of the variable mathematics anxiety of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of Control group shows that there is significant difference in

the mean pretest and posttest scores of mathematics anxiety in the control group. The mean posttest scores of the control group is lower than the mean pretest score.. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Control group for the Boys.

Comparison of the Mean Pretest and posttest score of Mathematics Anxiety in Control Group among Girls

To find whether there exists any significant difference in the mean Pretest scores to posttest scores of Mathematics Anxiety in Control group among girls, the investigator used paired sample *t*-test. The result of the statistical analysis is presented in the Table 63.

Table 63

Result of the Test of Significance of Difference in the Mean Pretest Scores and Posttest Scores of Mathematics Anxiety in Control Group among Girls

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*
Mathematics Anxiety	Pretest	30	86.800	7.779	0.156	.877[NS]
	Posttest	30	87.033	11.053		

NS: Not significant at 0.05 level of significance

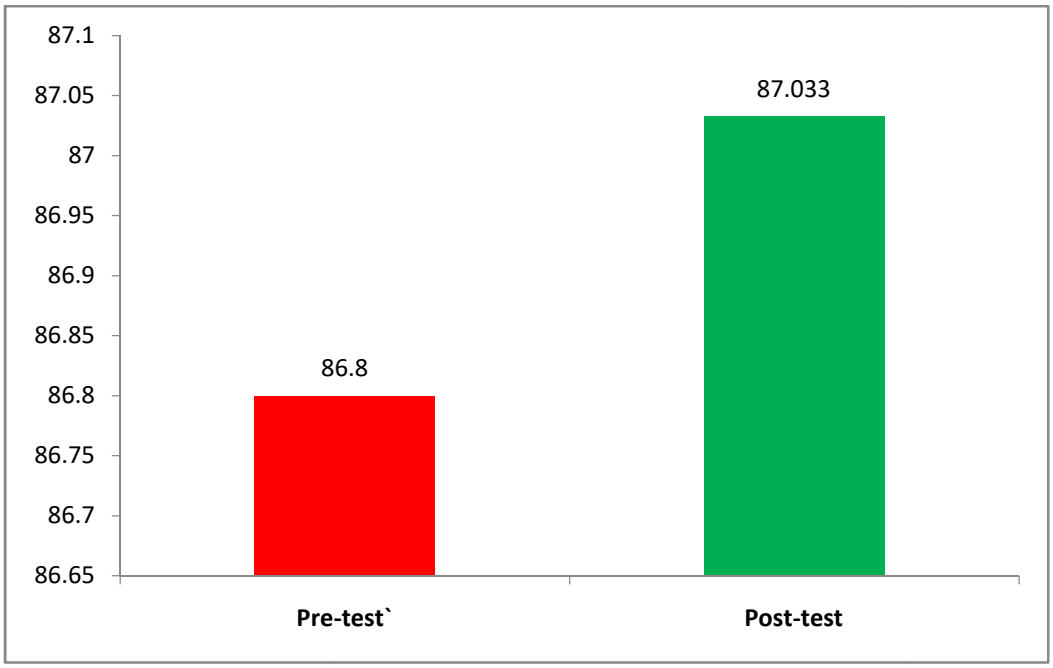
The table no.63 presents data regarding Mathematics Anxiety scores for a sample of 30 participants before and after the method. Initially, the mean pretest score was 86.800, with a standard deviation of 7.779. Following the method, the mean posttest score slightly increased to 87.033, accompanied by a standard deviation of 11.053. A paired-samples *t*-test was conducted to assess the difference between pretest and posttest scores, yielding a non-significant result t (30) = 0.156, p = .877. This indicates that there was no statistically significant change in mathematics anxiety

following the method. Hence existing method is not effective for reducing mathematics anxiety of girls of coastal area secondary school.

The mean pretest and posttest scores of mathematics anxiety in the control group for girls are presented graphically in Figure 47.

Figure 47

Mean Pretest and Posttest Scores of Mathematics Anxiety in the Control Group - Girls



From the Figure 47, it is evident that the bar chart used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable mathematics anxiety of Girls. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the two tests; of the variable mathematics anxiety of the Control group. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of Control group girls shows that there is no significant difference in the mean pretest and posttest scores of mathematics anxiety in the control group. Hence the graphical representation also supports the result of mean

difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Control group of Girls.

Discussion

The mean difference analysis of pretest and posttest scores of problem solving ability, perceptual speed and mathematics anxiety of coastal area secondary school students in the control group. There is significant Impact on improving problem solving ability for total Sample and girls. But not significantly impact on boys. For the variable perceptual speed influence the total sample and significantly positive impact on boys but not Statistically significant change on girls. For the variable mathematics anxiety, There is no significant difference in total sample and girls but significant effect in reducing mathematics anxiety on boys.

The mean difference analysis of pretest and posttest scores of problem solving ability, perceptual speed and mathematics anxiety of coastal area secondary school students in the experimental group.; There is significant Positive improvements on problem solving ability for total sample and girls and notable improvement in problem solving ability for boys. Hence, The brain compatible learning strategies is effective in enhancing problems solving ability for total sample and boys and girls.

The mean pretest and posttest scores of perceptual Speed Shows substantial improvement For the total sample and girls, and shows notable improvement in boys. Hence the brain compatible learning strategy is effective in enhancing perceptual speed for total sample, boys and girls. The difference between pretest and posttest scores of mathematics anxiety Shows significant reduction in mathematics anxiety for total sample and girls and Substantial reduction in mathematics anxiety for boys Hence Brain compatible learning

strategy is effective in reducing the mathematics anxiety for total sample and boys and girls.

Comparison of the Mean Posttest Scores of Variables of Experimental and Control Groups

The comparisons of mean scores were carried out to test Whether significant differences exist between mean scores of experimental and control group in the dependent variables, Problem solving ability, perceptual speed and mathematics anxiety. After the intervention means and standard deviation of posttest scores of both experimental and control group were calculated and these values were subjected to the test of significance of difference between means for the total sample, boys and girls are given in the following section.

Comparison of the Mean Posttest Scores of Problem Solving Ability between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean Posttest scores of Problem solving ability between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 64

Table 64

Result of the Test of significance of Difference in Mean Posttest Scores of Problem Solving Ability between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Problem Solving Ability	Experimental group	54	20.333	3.420	4.302	.000**	0.01
	Control group	54	17.426	3.601			

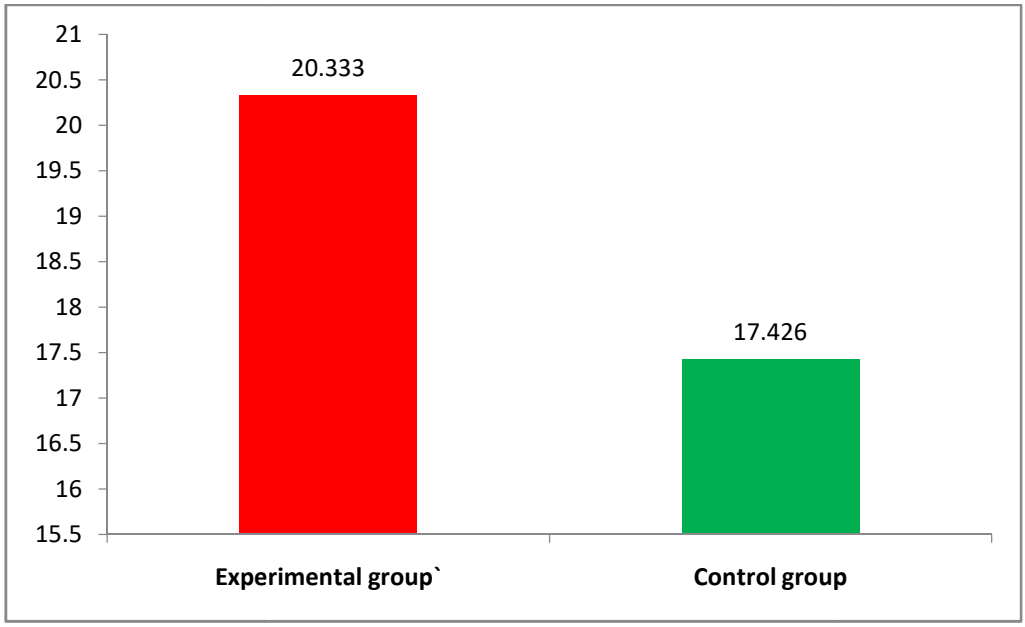
**: significant at 0.01 level of significance

The table no.64 compares the posttest scores of problem solving ability between participants in experimental group and control group. In the experimental group, consisting of 54 participants, the mean posttest scores of problem solving ability is 20.333 with a standard deviation of 3.420. Conversely, the control group also comprising 54 participants, has a lower mean posttest score of 17.426 with a standard deviation of 3.601. Statistical analysis using the two independent sample *t*-test method reveals a significant difference between the two groups, with a *t*-value of 4.302 and a p-value of .000 (**), indicating a statistically significant result. These findings suggest that the Braincompatible learning strategy applied in the experimental group had a notable impact on improving problem solving ability compared to the control group, highlighting the effectiveness of Brain compatible learning strategy on problem solving ability of coastal area secondary school students.

The mean posttest scores of problem solving ability in the experimental and control groups for total sample are presented graphically in Figure 48.

Figure 48

Mean Posttest Scores of Problem Solving Ability of Experimental and Control Group -Total Sample



From the Figure 48, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest scores of the variable problem solving ability for total sample. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean posttest scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of mean posttest scores of problem solving ability of the experimental and Control group shows that there is significant difference in the mean posttest scores of problem solving ability between the two groups. The mean posttest scores of the problem solving ability of the Experimental group is greater than the mean posttest score of Control group. Hence the graphical representation also supports the result of mean difference analysis of posttest scores of the variable problem solving ability of the Experimental and control group for total sample.

Comparison of the Mean Posttest Scores of Problem Solving Ability between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of posttest scores of Problem solving ability between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 65.

Table 65

Result of the Test of significance of Difference in Mean Posttest Scores of Problem Solving Ability between Experimental and Control Groups - boys.

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Problem Solving Ability	Experimental group	26	19.885	3.421	2.598	.012*	0.05
	Control group	24	17.000	4.404			

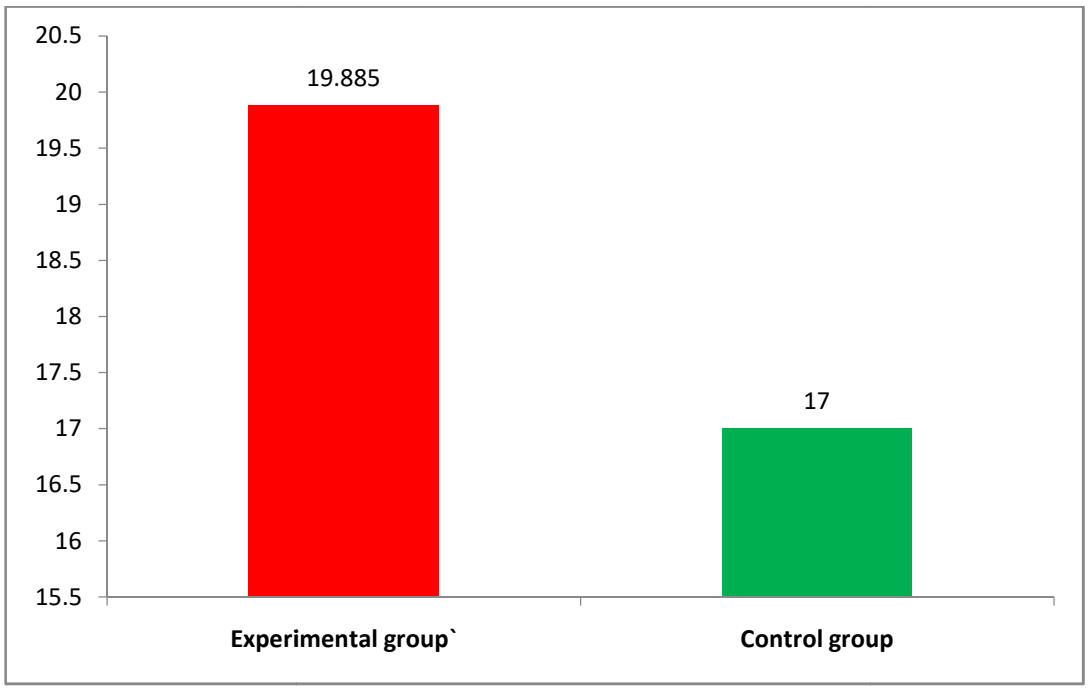
*: Significant at 0.05 level of significance

The table no. 65 compares the posttest scores of problem solving ability for boys in experimental group and control group. In the experimental group consisting of 26 boys, the mean posttest score of problem solving ability is 19.885 with a standard deviation (SD) of 3.421. Conversely, the control group comprising 24 boys, shows a mean posttest score of 17.000 with an SD 4.404. Utilizing the two independent sample *t*-test method a significant difference is found between the two groups with a *t*-value of 2.598 and a p-value of 0.012 (*), indicating statistical significance.. These results suggest that the Brain compatible learning strategy in the experimental group had a significant impact on improving problem solving ability compared to the control group. Hence Brain compatible learning strategy is effective in enhancing problem solving ability of Boys of coastal area secondary school students.

The mean posttest scores of problem solving ability in the experimental and control groups for boys are presented graphically in Figure 49.

Figure 49

Mean Posttest Scores of Problem Solving Ability of Experimental and Control Group - Boys.



From the Figure 49, it is evident that the bar chart used to compare the difference in the mean scores among two groups. Experimental and Control group for the posttest scores of the variable problem solving ability for boys. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean posttest scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of problem solving ability of the experimental and Control group for boys shows that there is significant difference in the mean posttest scores of problem solving ability between the two groups. The mean posttest scores of the problem solving ability of the Experimental group is higher than the mean posttest score of Control group. Hence the graphical representation also supports the result of mean difference analysis of posttest scores of the variable problem solving ability of the Experimental and control group for boys.

Comparison of the Mean Posttest Scores of Problem Solving Ability between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of posttest scores of Problem solving ability between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 66.

Table 66

Result of the Test of Significance of Difference in Mean Posttest Scores of Problem Solving Ability between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Level of significance*
Problem Solving Ability	Experimental group	28	20.750	3.428	3.621	.001**	0.01
	Control group	30	17.767	2.837			

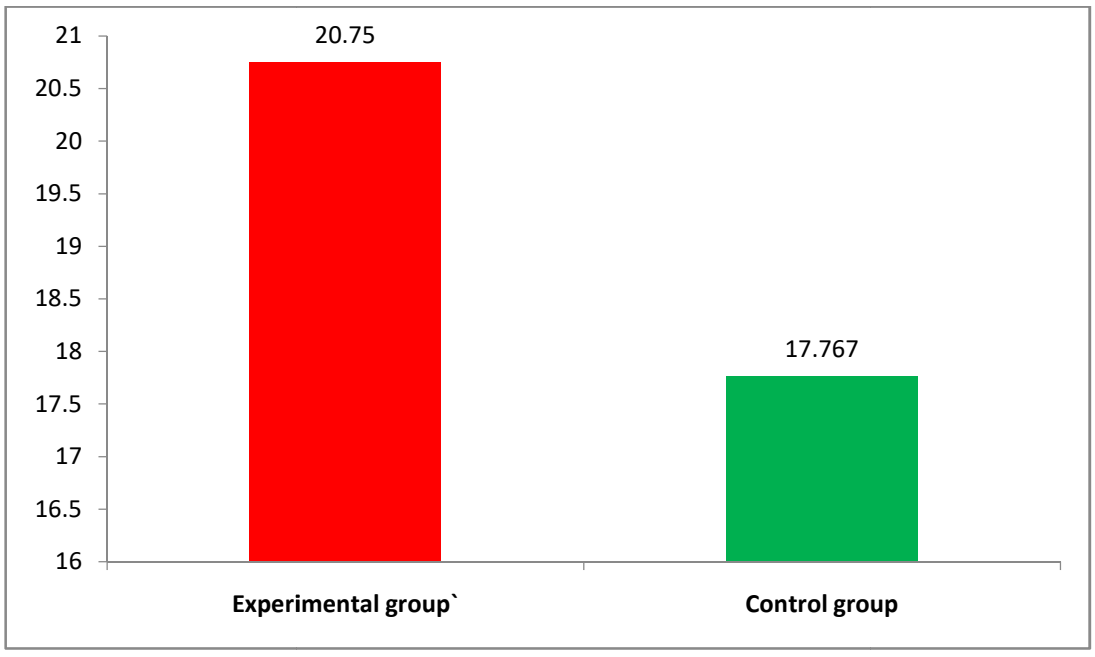
**: Significant at 0.01 level of significance

The table no.66 presents the posttest scores of problem solving ability for girls in experimental group and control group. The experimental group, comprising 28 girls, the mean posttest score of problem solving ability is 20.750 (SD = 3.428). Conversely, the control group consisting of 30 girls shows a mean posttest score of 17.767 (SD = 2.837). Utilizing the independent sample *t*-test method a significant difference is found between the two groups, with a *t*-value of 3.621 and a p-value of .001 (**) indicating statistical significance.. The significant improvement in problem solving ability among girls in the experimental group suggests that the method they received was effective. This finding indicating a meaningful impact of the Brain compatible learning strategy on enhancing problem solving ability of girls of coastal area secondary school students.

The mean posttest scores of problem solving ability in the experimental and control groups for girls are presented graphically in Figure 50.

Figure 50

Mean Posttest Scores of Problem Solving Ability of Experimental and Control Group - Girls



From the Figure 50, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest scores of the variable problem solving ability for girls. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean posttest scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of problem solving ability of the experimental and Control group for girls shows that there is significant difference in the mean posttest scores of problem solving ability between the two groups. The mean posttest scores of the problem solving ability of the Experimental group is higher than the mean posttest score of Control group. The graphical representation also supports the result of mean difference analysis of posttest scores of the variable problem solving ability of the Experimental and control group for girls.

Comparison of the Mean Posttest Scores of Perceptual Speed between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean Posttest scores of Perceptual Speed between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 67.

Table 67

Result of the Test of Significance of Difference in Mean Posttest Scores of Perceptual Speed between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Perceptual Speed	Experimental group	54	30.963	2.257	6.502	.000**	0.01
	Control group	54	27.185	3.624			

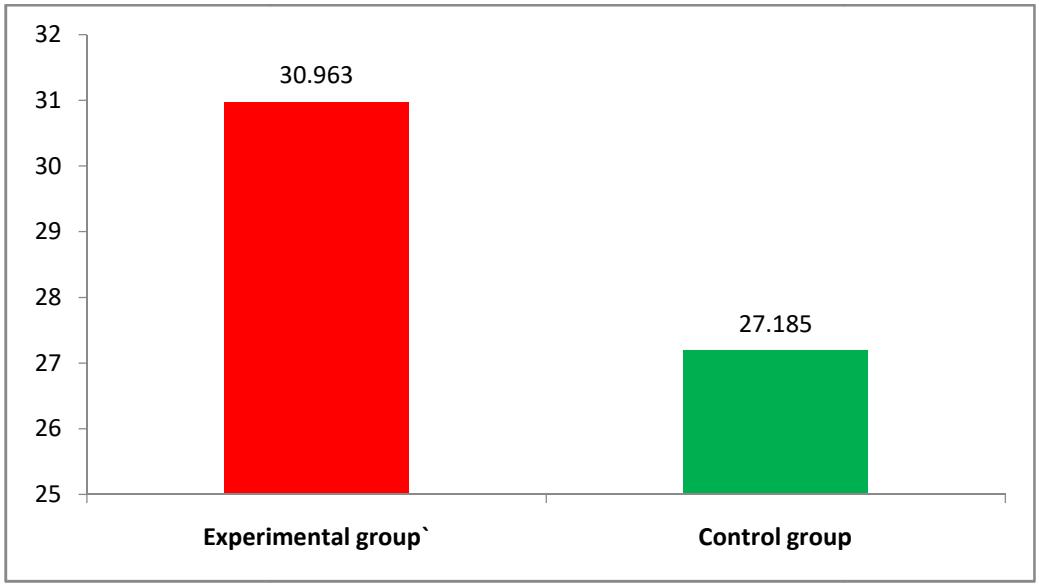
**: significant at 0.01 level of significance

The table no.67 presents the posttest scores of perceptual speed for students in experimental group and control group. In the experimental group comprised of 54 participants, the mean posttest score of perceptual speed is 30.963 with a standard deviation of 2.257. Conversely the control group also consisting of 54 participants has a lower mean posttest score of 27.185 with a standard deviation 3.624. Utilizing the two independent sample *t*-test method a significant difference between the two groups is revealed with a *t*-value of 6.502 and a p-value of .000 (**) indicating statistical significance underscores the substantial difference in post- test scores of perceptual speed between the experimental and control groups. These findings suggest that the Brain compatible learning strategy implemented in the experimental group had a significant impact on improving perceptual speed compared to the control group. Hence Brain compatible learning strategy is effective in enhancing perceptual speed of coastal area secondary school students.

The mean posttest scores of perceptual speed in the experimental and control groups for total sample are presented graphically in Figure 51.

Figure 51

Mean Posttest Scores of Perceptual Speed of Experimental and Control Group -Total Sample



From the Figure 51, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest scores of the variable perceptual speed for total sample. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean posttest scores of the variable perceptual speed of two groups experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of perceptual speed of the experimental and Control group shows that there is significant difference in the mean posttest scores of perceptual speed between the two groups. The mean posttest scores of the perceptual speed of the Experimental group is greater than the mean posttest score of Control group. Hence the graphical representation also supports the result of mean difference analysis of posttest scores of the variable perceptual speed of the Experimental and control group for total sample.

Comparison of the Mean Posttest Scores of Perceptual Speed between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean posttest scores of Perceptual Speed between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 68.

Table 68

Result of the Test of significance of Difference in Mean Posttest Scores of Problem Solving Ability between Experimental and Control Groups - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Perceptual Speed	Experimental group	26	30.423	2.548	3.942	.000**	0.01
	Control group	24	26.792	3.878			

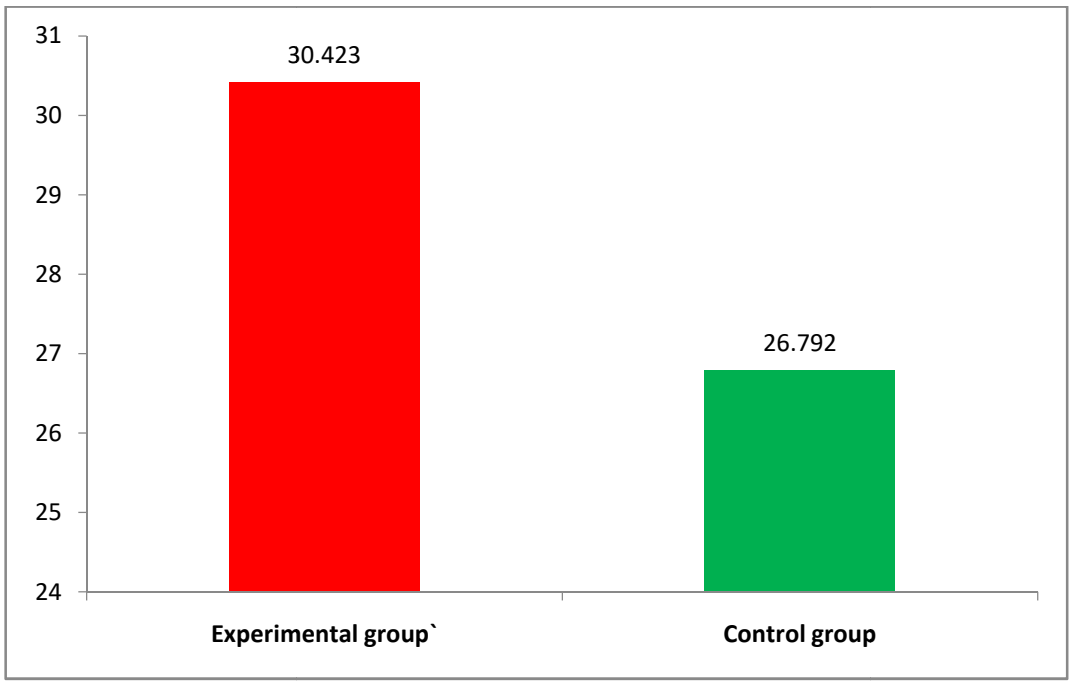
**: Significant at 0.01 level of significance

The table no.68 compares the posttest scores of perceptual speed for boys in experimental group and control group. In the experimental group comprising 26 boys the mean posttest score of perceptual speed is 30.423 with a standard deviation (SD) of 2.548. Conversely the control group consisting of 24 boys shows a mean posttest score of 26.792 with a standard deviation (SD) of 3.878. Utilizing the two independent sample *t*-test method a significant difference is found between the two groups with a *t*-value of 3.942 and a p-value of .000 (**), indicating statistical significance. These results suggest that the method in the experimental group had a significant impact on improving perceptual speed compared to the control group. Hence Braincompatible learning strategy is effective in enhancing perceptual speed of boys for coastal area secondary school.

The mean posttest scores of perceptual speed in the experimental and control groups for boys are presented graphically in Figure 52.

Figure 52

Mean Posttest Scores of Perceptual Speed of Experimental and Control Group - Boys



From the Figure 52, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest scores of the variable perceptual speed for boys. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean posttest scores of the variable perceptual speed of two groups experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of perceptual speed of the experimental and Control group for boys shows that there is significant difference in the mean posttest scores of perceptual speed between the two groups. The mean post-est scores of the perceptual speed of the Experimental group is higher than the mean posttest score of Control group. The graphical representation also supports the result of mean difference analysis of posttest scores of the variable perceptual speed of the Experimental and control group for boys.

Comparison of the Mean Posttest Scores of Perceptual Speed between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean posttest scores of Perceptual Speed between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 69.

Table 69

Result of the Test of Significance of Difference in Mean Posttest Scores of Perceptual Speed between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Perceptual Speed	Experimental group	28	31.464	1.856	5.404	.000**	0.01
	Control group	30	27.500	3.442			

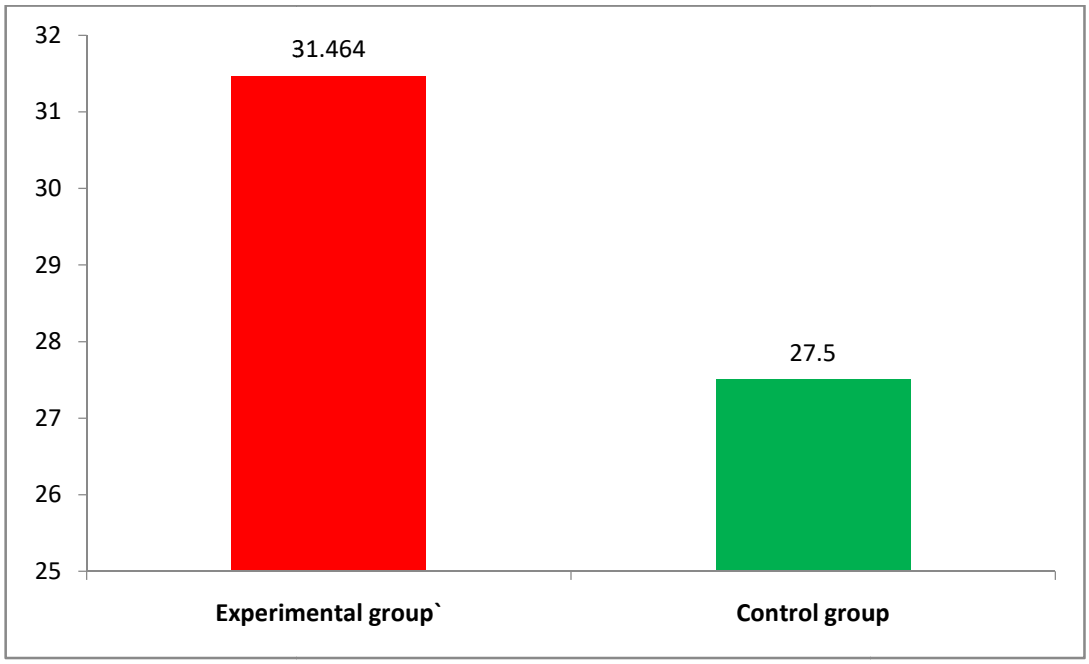
**: Significant at 0.01 level of significance

The table no.69 compares the posttest scores of perceptual speed for girls in experimental group and control group. In the experimental group comprising 28 girls the mean posttest score of perceptual speed is 31.464 with a standard deviation (SD) of 1.856. Conversely the control group consisting of 30 girls shows a mean posttest score of 27.500 with a SD of 3.442. Utilizing the independent sample *t*-test method a significant difference is found between the two groups with a *t*-value of 5.404 and a p-value of .000 (**) indicating statistical significance.. This findings indicating a meaningful impact of the Brain compatible learning strategy on enhancing perceptual speed of coastal area secondary school girls.

The mean posttest scores of perceptual speed in the experimental and control groups for girls are presented graphically in Figure 53.

Figure 53

Mean Posttest Scores of Perceptual Speed of Experimental and Control Group-Girls



From the Figure 53, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest

scores of the variable perceptual speed for girls. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean posttest scores of the variable perceptual speed of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of perceptual speed of the experimental and Control group for girls shows that there is significant difference in the mean posttest scores of perceptual speed between the two groups. The mean posttest scores of the perceptual speed of the Experimental group is higher than the mean posttest score of Control group. The graphical representation also supports the result of mean difference analysis of posttest scores of the variable perceptual speed of the Experimental and control group for girls.

Comparison of the Mean Posttest Scores of Mathematics Anxiety between Experimental Group and Control Group for Total Sample

To find whether there exists any significant difference in the mean Posttest scores of Mathematics anxiety between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 70

Table 70

Result of the Test of Significance of Difference in Mean Posttest Scores of Mathematics Anxiety between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Mathematics Anxiety	Experimental group	54	81.407	9.757	3.172	.002**	0.01
	Control group	54	87.426	9.961			

**: significant at 0.01 level of significance

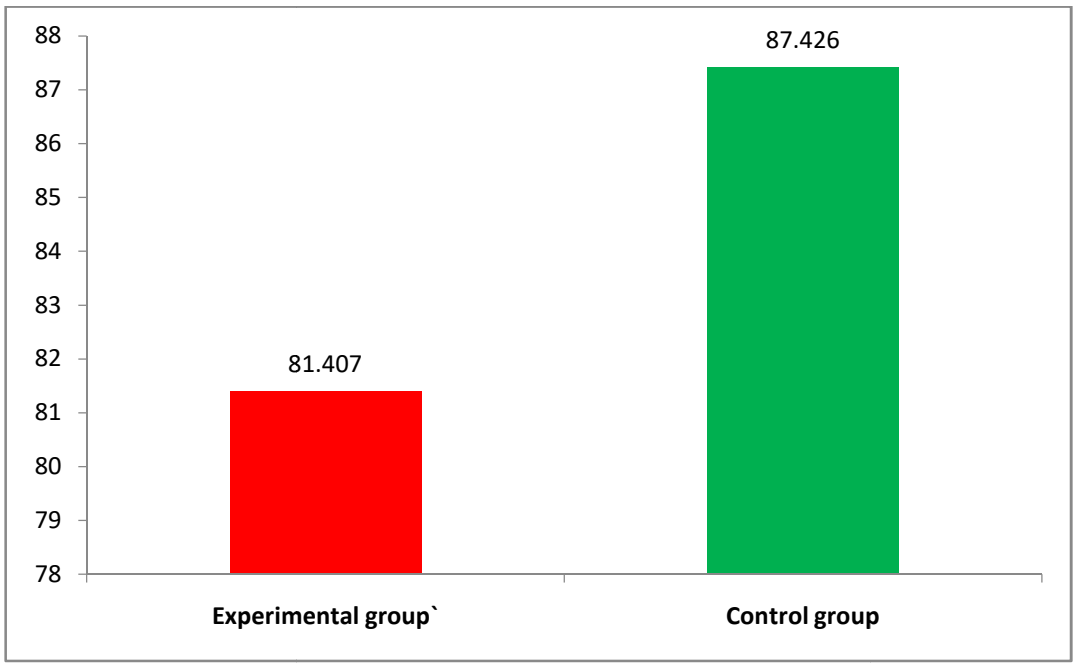
The table no.70 compares the posttest scores of mathematics anxiety between students in experimental group and control group. In the experimental group

consisting of 54 students, the mean posttest score of mathematics anxiety is 81.407 with a standard deviation of 9.757. Conversely, the control group also comprising 54 participants has a higher mean post- test score of 87.426 with a standard deviation 9.961. Utilizing the two independent sample *t*-test method a significant difference between the two groups is found with a *t*-value of 3.172 and a p-value of .002 (**) indicating statistical significance highlights the noticeable difference in post- test scores of mathematics anxiety between the experimental and control groups. These results suggest that the method implemented in the experimental group had a significant impact on reducing mathematics anxiety compared to the control group,. Hence Brain compatible learning strategy is effective in reducing mathematics anxiety of Coastal area secondary school students.

The mean posttest scores of mathematics anxiety in the experimental and control groups for total sample are presented graphically in Figure 54.

Figure 54

Mean Posttest Scores of Mathematics Anxiety of Experimental and Control Group - Total Sample



From the Figure 54, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control groups for the posttest scores of the variable mathematics anxiety for total sample. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean posttest scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of mathematics anxiety of the experimental and Control group shows that there is significant difference in the mean posttest scores of mathematics anxiety between the two groups. The mean posttest scores of the mathematics anxiety of the Experimental group is lower than the mean posttest score of Control group. Hence the graphical representation also supports the result of mean difference analysis of posttest scores of the variable mathematics anxiety of the Experimental and control group for total sample.

Comparison of the Mean Posttest Scores of Mathematics Anxiety between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of posttest scores of Mathematics anxiety between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 71.

Table 71

Result of the Test of Significance of Difference in Mean Posttest Scores of Mathematics Anxiety between Experimental and Control Groups - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Mathematics Anxiety	Experimental group	26	82.231	7.617	2.477	.017*	0.05
	Control group	24	87.917	8.612			

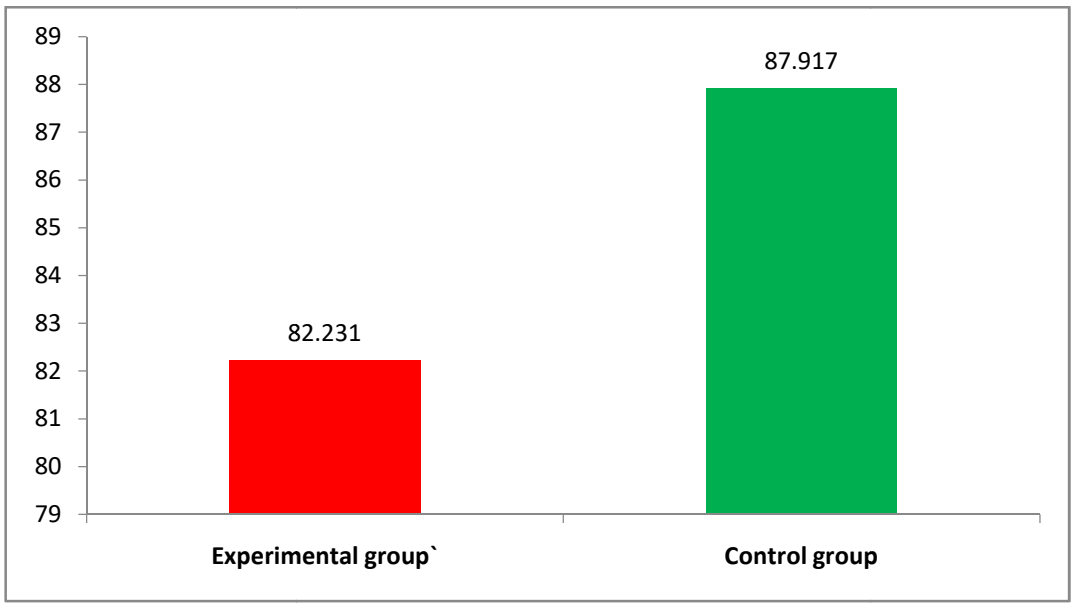
*: Significant at 0.05 level of significance

The table no. 71 compares the posttest scores of mathematics anxiety for boys in experimental group and control group. In the experimental group comprising 26 boys, the mean posttest score of mathematics anxiety is 82.231 (SD = 7.617). Conversely the control group consisting of 24 boys shows a mean posttest score of 87.917 (SD = 8.612). Utilizing the two independent sample *t*-test method, a significant difference is found between the two groups with a *t*-value of 2.477 and a p-value of .017 (*) indicating statistical significance of the difference. These results suggest that the method in the experimental group had a significant impact on reducing mathematics anxiety compared to the control group. Hence Brain compatible learning strategy is effective in reducing mathematics anxiety of boys of coastal area secondary school

The mean posttest scores of mathematics anxiety in the experimental and control groups for boys are presented graphically in Figure 55.

Figure 55

Mean Posttest Scores of Mathematics Anxiety of Experimental and Control Group - Boys



From the Figure 56, it is evident that the bar chart used to compare the difference in the mean scores among two groups; Experimental and Control group for the posttest

scores of the variable mathematics anxiety for boys. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean posttest scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of mathematics anxiety of the experimental and Control group for boys shows that there is significant difference in the mean posttest scores of mathematics anxiety between the two groups. The mean posttest scores of the mathematics anxiety of the Experimental group is lower than the mean posttest score of Control group. The graphical representation also supports the result of mean difference analysis of posttest scores of the variable mathematics anxiety of the Experimental and control group for boys.

Comparison of the Mean Posttest Scores of Mathematics Anxiety between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of posttest scores of Mathematics Anxiety between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 72.

Table 72

Result of the Test of significance of Difference in Mean Posttest Scores of Mathematics Anxiety between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Level of Significance*
Mathematics Anxiety	Experimental group	28	80.643	11.483	2.159	.035*	0.05
	Control group	30	87.033	11.053			

*: Significant at 0.05 level of significance

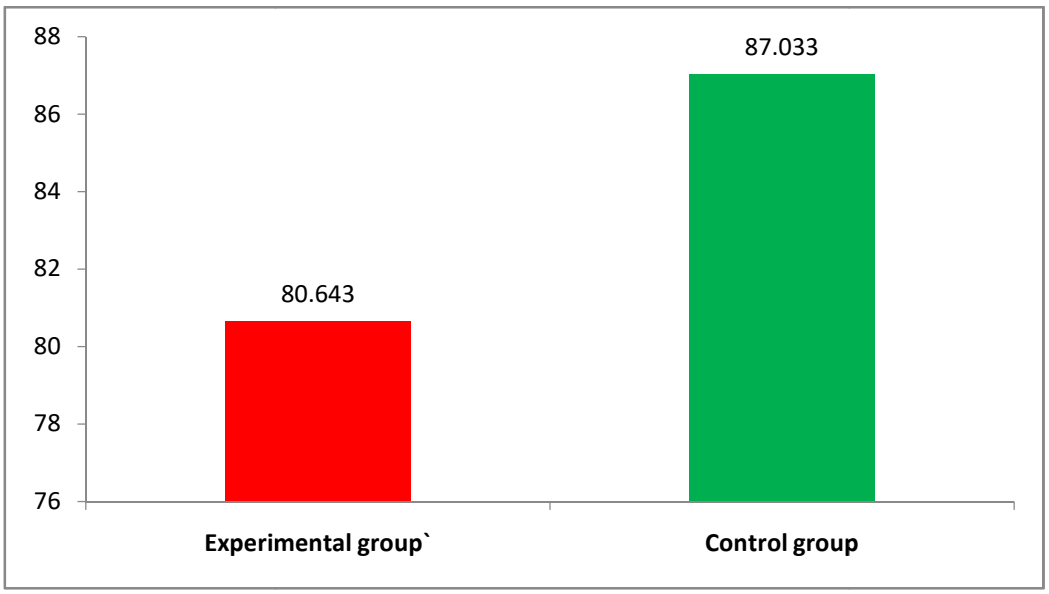
The table no.72 displays the outcomes of a comparison between post scores of mathematics anxiety among girls in both experimental group and control group. In

the experimental group consisting of 28 girls, the mean posttest scores of mathematics anxiety is 80.643 with a standard deviation (SD) of 11.483. Conversely in the control group comprised of 30 girls, the mean post score is 87.033 accompanied by a SD of 11.053. An independent sample *t*-test was conducted to examine the difference in mean posttest scores between the two groups. The analysis yielded a *t*-value of 2.159 and a corresponding p-value of .035 (*) indicating statistical significance.. This suggests that the reduction in mathematics anxiety among girls in the experimental group compared to the control group. Hence Brain compatible learning strategy is effective in reducing mathematics anxiety of coastal area secondary school girls.

The mean posttest scores of mathematics anxiety in the experimental and control groups for girls are presented graphically in Figure 56.

Figure 56

Mean Posttest Scores of Mathematics Anxiety of Experimental and Control Group - Girls



From the Figure 56, it is evident that the bar chart used to compare the difference in the mean posttest scores among two groups; Experimental and Control group for the

posttest scores of the variable mathematics anxiety for girls. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean posttest scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of posttest scores of mathematics anxiety of the experimental and Control group for girls shows that there is significant difference in the mean posttest scores of mathematics anxiety between the two groups. The mean posttest scores of the mathematics anxiety of the Experimental group is lower than the mean posttest score of Control group. The graphical representation also supports the result of mean difference analysis of posttest scores of the variable mathematics anxiety of the Experimental and control group for girls.

Discussion

The mean difference analysis of posttest scores of problem solving ability, perceptual speed and mathematics anxiety of coastal area secondary school students between experimental group and control group showed the following result.

There is significant difference in the mean posttest scores of problem solving ability for total sample, boys and girls. The differences in total sample, Boys and girls Shows significant impact on improving problem solving ability Compared to the control group. Thus, it proves that the Brain compatible learning strategy is effective in enhancing the problem solving ability for total sample, boys and girls.

The mean posttest scores differ significantly for perceptual speed for total sample, boys and girls. The differences in total sample, boys and girls shows significant impact on improving perceptual speed compared to the control group. The difference between the posttest scores of mathematics anxiety Shows significant impact on reducing mathematics anxiety of the experimental group compared to the control group for total sample and boys and girls. Hence Brain compatible learning

strategy is effective in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety for total sample, boys and girls.

Comparison of the Mean Gain/Change Scores of Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Experimental and Control Groups

Initial differences in the mean scores may be significant and it may not be the same after intervention and vice versa. Mean difference analysis was utilized to clarify this result. To test the effectiveness of brain compatible learning strategy in enhancing problem solving ability and perceptual speed among coastal area Secondary school students, mean gain scores of experimental and control groups on these variables were compared. Similarly, the mean change scores of mathematics anxiety of experimental and control groups were compared to test the effectiveness of Brain compatible learning strategy in reducing mathematics anxiety of coastal area secondary school students. Whenever the groups were found statistically significant, effect size was calculated.

Two tailed tests of significance of difference between means were administered to test whether significant difference exists between experimental group and the control group for the dependant variables problem solving ability, perceptual speed and mathematics anxiety. Mean difference analysis was carried out with the means and standard deviations of variables of the two groups and the calculated *t* values were tested for significance. For significant mean differences the magnitude of the effect also found out using effect size measure of two groups. The data and results of *t* tests for Total sample, Boys and Girls are given in the following sections.

Comparison of the Mean Gain Scores of Problem Solving Ability between Experimental Group and Control Group

To find whether there exists any significant difference in the mean gain scores of Problem solving ability between Experimental group and Control group,

the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 73.

Table 73

Results of Test of Significance of Difference in Mean Gain Scores of Problem Solving Ability between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*P*	*Effect size and Cohen's Category*
Problem Solving Ability	Experimental group	54	3.704	4.381	3.592	.000**	.990
	Control group	54	1.130	2.921			Large

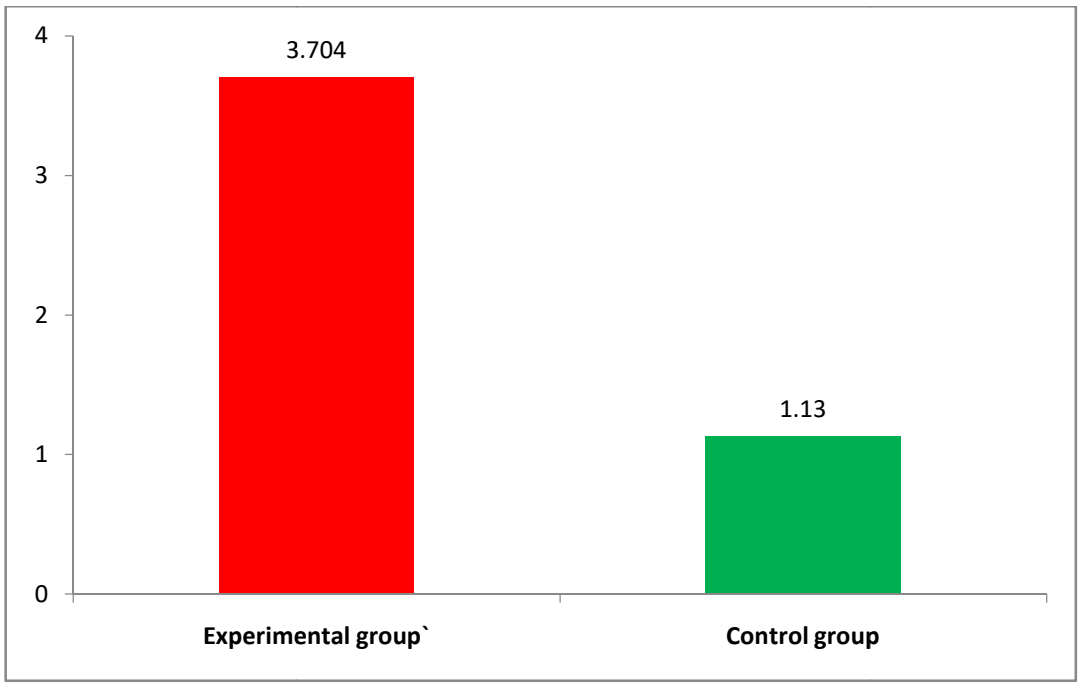
**: significant at 0.01 level of significance

The table no.73 compares the gain scores of problem solving ability between students in experimental group and control group. In the experimental group comprised of 54 participants, the mean gain score of problem solving ability is 3.704 with a standard deviation of 4.381. Conversely, the control group also consisting of 54 participants has a lower mean gain score of 1.130 with a standard deviation 2.921. Employing the two independent sample *t*-test method, a significant difference between the two groups is observed with a *t*-value of 3.592 and a p-value of .000 (**) indicating statistical significance. Moreover, an effect size of 0.990, categorized as large, emphasizes the substantial difference in gain scores of problem solving ability between the experimental and control groups. These findings suggest that the method implemented in the experimental group had a significant impact on enhancing problem solving ability compared to the control group, with a large effect size indicating a considerable practical significance. Hence Braincompatible learning strategy is effective in enhancing problem solving ability of coastal area secondary school students.

The mean gain scores of problem solving ability of the experimental and control groups for Total sample are presented graphically in Figure 57.

Figure 57

Mean Gain Scores of Problem Solving Ability of Experimental and Control Groups – Total Sample



From the Figure 57, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the variable problem solving ability for total sample. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean gain scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of problem solving ability of the experimental and Control group for total sample shows that there is significant difference in the mean gain scores of problem solving ability between the two groups. The mean posttest scores of the problem solving ability of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable problem solving ability of the Experimental and control group for total sample.

Comparison of the Mean Gain scores of Problem Solving Ability between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of gain scores of Problem solving ability between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 74.

Table 74

Results of Test of Significance of Difference in Mean Gain Scores of Problem Solving Ability between Experimental and Control Groups - Boys

Variable	Boys	*N*	*Mean*	*SD*	*T*	*P*	*Effect size and Cohen's category*
Problem Solving Ability	Experimental group	26	3.346	3.543	2.474	.017*	.701
	Control group	24	0.917	3.387			Medium

*: Significant at 0.05 level of significance

The table no.74 presents the results of a comparison between gain scores of problem solving ability in boys between experimental group and control group. The experimental group, comprising 26 boys had a mean gain score of 3.346 with a standard deviation of 3.543, while the control group consisting of 24 boys had a mean gain score of 0.917 with a standard deviation of 3.387.

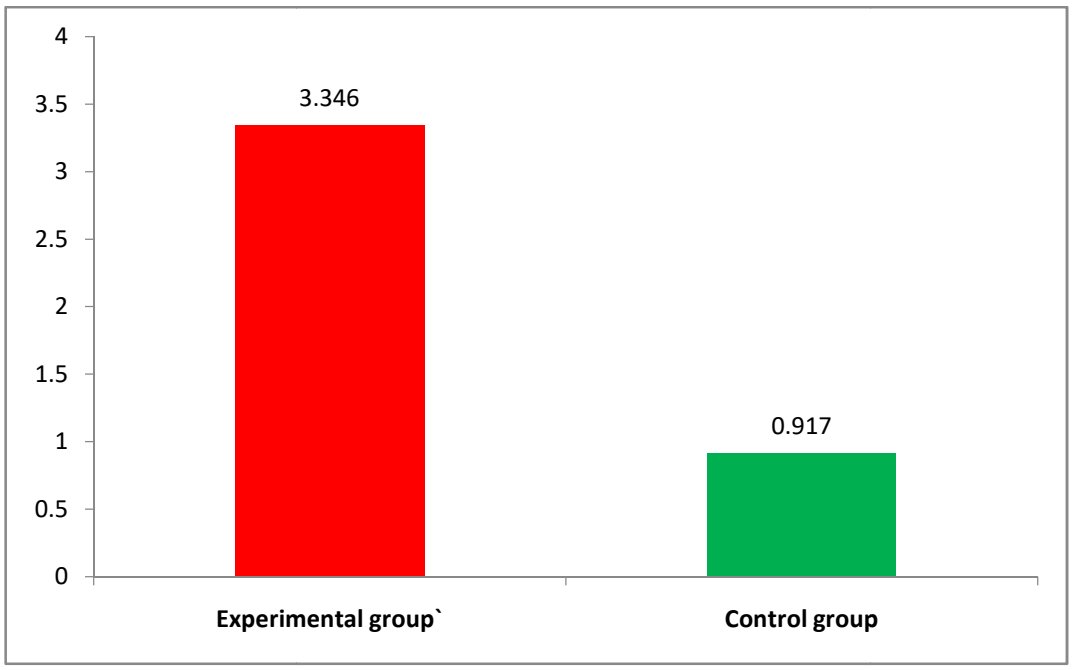
A *t*-test was conducted to compare the mean gain scores between the two groups. The *t*-value was found to be 2.474 with a corresponding p-value of 0.017 indicating statistical significance. This suggests that there is a significant difference in gain scores of problem solving ability between the experimental and control groups. Furthermore Cohen's d was calculated as a measure of effect size, yielding a value of 0.701. According to Cohen's criteria, this falls within the medium range, indicating that the difference in gain scores between the experimental and control

groups is of medium magnitude. Hence Brain compatible learning strategy is effective in enhancing problem solving ability of boys of coastal area secondary school.

The mean gain scores of problem solving ability of the experimental and control groups for boys are presented graphically in Figure 58.

Figure 58

Mean Gain Scores of Problem Solving Ability of Experimental and Control Groups – Boys



From the Figure 58, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the variable problem solving ability for boys. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean gain scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of problem solving ability of the experimental and Control group for boys shows that there is significant difference in the mean gain

scores of problem solving ability between the two groups. The mean gain scores of the problem solving ability of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable problem solving ability of the Experimental and control group for boys.

Comparison of the Mean Gain Scores of Problem Solving Ability between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean gain scores of Problem solving ability between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 75.

Table 75

Results of Test of Significance of Difference in Mean gain Scores of Problem Solving Ability between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Problem Solving Ability	Experimental group	28	4.036	5.081	2.621	.011*	.681
	Control group	30	1.300	2.535			Medium

*: Significant at 0.05 level of significance

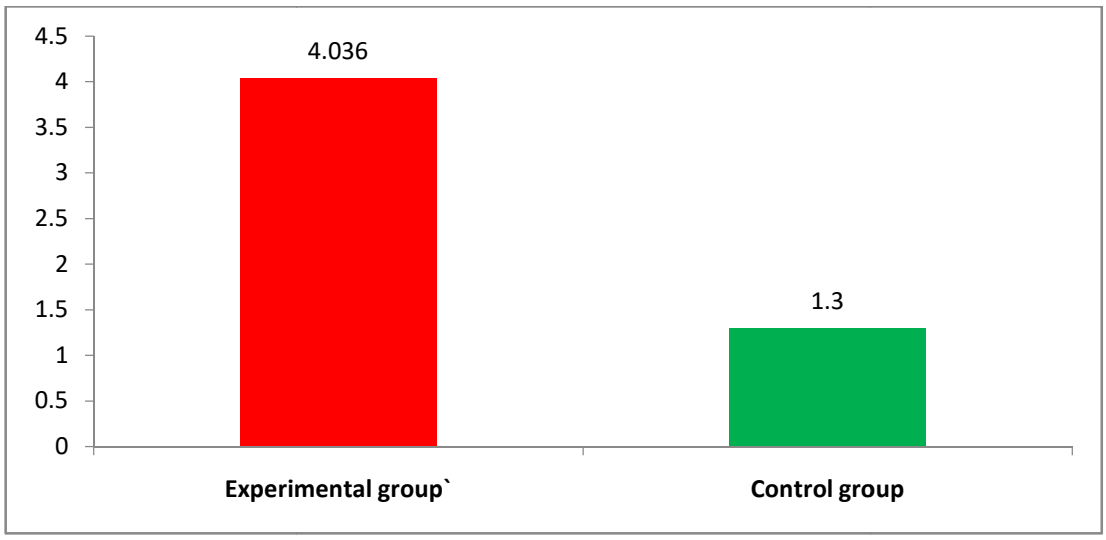
The table no.75 presents a comparison of gain scores of problem solving ability in girls between experimental group and control group. In the experimental group, consisting of 28 girls, the mean gain score of problem solving ability is 4.036 with a standard deviation (SD) of 5.081. Conversely, in the control group comprising 30 girls, the mean gain score is 1.300 with SD of 2.535. Utilizing an independent sample *t*-test, a significant difference is observed between the groups with a *t*-value of 2.621 and a p-value of .011 (*) indicating statistical significance. Additionally, Cohen's d was calculated as 0.681, categorizing the effect size as medium according

to Cohen's criteria. These findings suggest that the method administered to the experimental group has led to a medium-sized improvement in problem solving ability compared to the control group. The significant difference in gain scores between the experimental and control groups underscores the efficacy of the method in enhancing problem solving abilities among girls. This indicates that the Brain compatible learning strategy is effective in meaningful improvements in problem solving ability of girls of coastal area secondary school.

The mean gain scores of problem solving ability of the experimental and control groups for girls are presented graphically in Figure 59.

Figure 59

Mean Gain Scores of Problem Solving Ability of Experimental and Control Groups – Girls



From the Figure 59, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the variable problem solving ability for girls. The X axis of the graph represents the two groups for the variable problem solving ability. The Y axis represents the mean gain scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of problem solving ability of the experimental and

Control group for girls shows that there is significant difference in the mean gain scores of problem solving ability between the two groups. The mean gain scores of the problem solving ability of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable problem solving ability of the Experimental and control group for girls.

Comparison of the Mean Gain Scores of Perceptual Speed between Experimental Group and Control Group

To find whether there exists any significant difference in the mean gain scores of Perceptual Speed between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table76.

Table 76

Results of Test of Significance of Difference in Mean Gain Scores of Perceptual Speed between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Perceptual Speed	Experimental group	54	4.778	2.545	6.412	.000**	1.153
	Control group	54	1.259	3.127			Large

**: significant at 0.01 level of significance

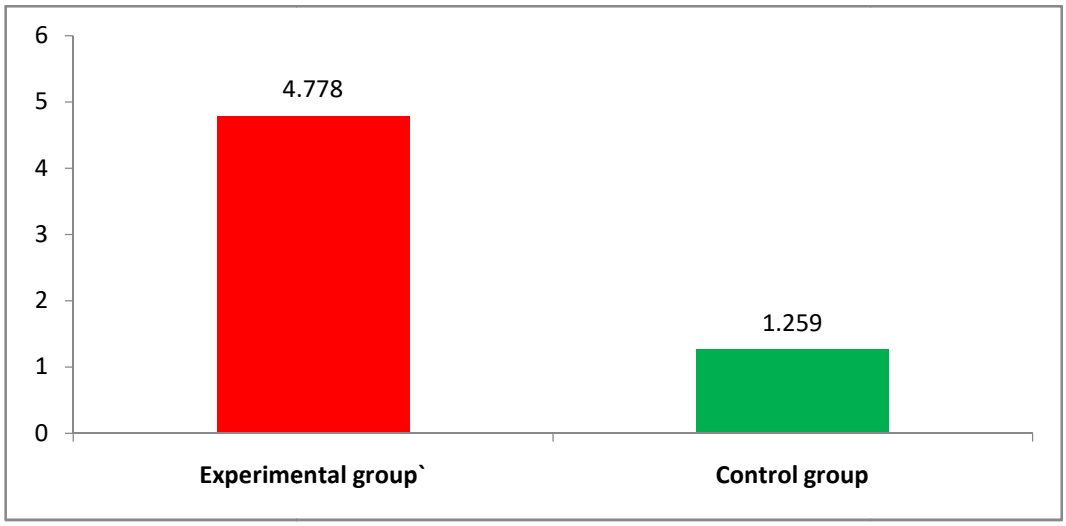
The table no.76 compares the gain scores of perceptual speed between students in experimental group and control group. In the experimental group comprising 54students, the mean gain score of perceptual speed is 4.778, with a standard deviation of 2.545. Conversely, the control group also consisting of 54students shows a lower mean gain score of 1.259 with standard deviation 3.127. Utilizing the two independent sample *t*-test method a significant difference between the two groups is observed with a *t*-value of 6.412 and a p-value of .000 (**) indicating

statistical significance. Moreover, an effect size of 1.153 categorized as large, underscores the substantial difference in gain scores of perceptual speed between the experimental and control groups. These results suggest that the method implemented in the experimental group had a significant impact on improving perceptual speed compared to the control group with a large effect size indicating a considerable practical significance. Hence Brain compatible learning strategy is effective in enhancing perceptual speed of coastal area secondary school students.

The mean gain scores of perceptual speed of the experimental and control groups for Total sample are presented graphically in Figure 60.

Figure 60

Mean gain Scores of Perceptual Speed of Experimental and Control Groups – Total Sample



From the Figure 60, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control groups for the variable perceptual speed for total sample. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean gain scores of the variable perceptual speed of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of perceptual speed of the experimental and Control

group for total sample shows that there is significant difference in the mean gain scores of perceptual speed between the two groups. The mean gain scores of the perceptual speed of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable perceptual speed of the Experimental and control group for total sample.

Comparison of the Mean Gain Scores of Perceptual Speed between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean scores of gain scores of Perceptual Speed between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 77.

Table 77

Results of Test of Significance of Difference in Mean Gain Scores of Perceptual Speed between Experimental and Control Groups - Boys

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Perceptual Speed	Experimental group	26	5.808	2.562	5.187	.000**	1.464
	Control group	24	1.750	2.967			Large

**: Significant at 0.01 level of significance

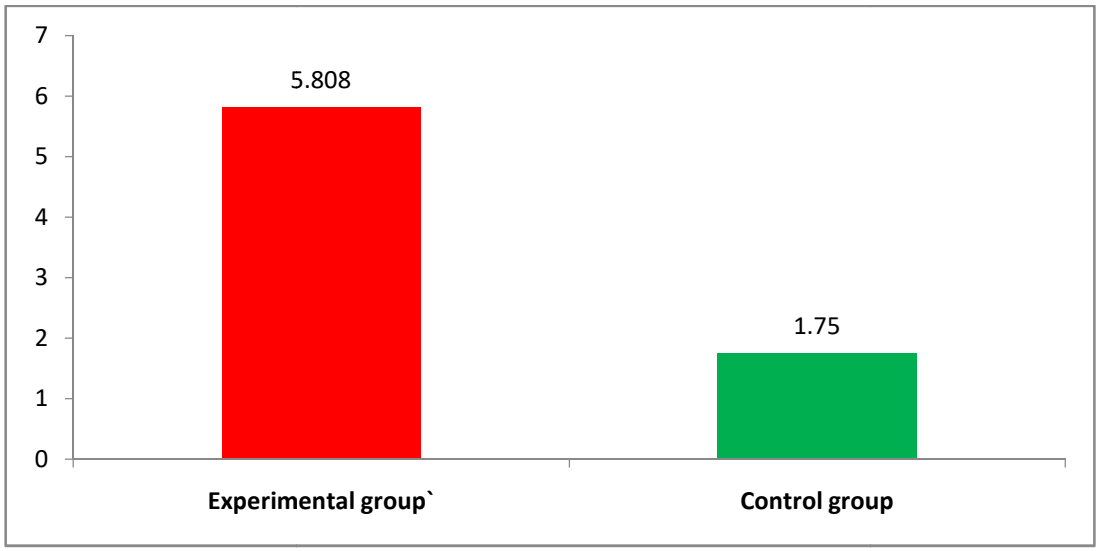
The table no.77 illustrates the comparison of gain scores of perceptual speed between boys in experimental group and control group. In the experimental group consisting of 26 boys, the mean gain score for perceptual speed was notably higher at 5.808 (SD=2.562) compared to the control group which had a mean gain score of 1.750 (SD=2.967) among 24 boys. Statistical analysis revealed a significant difference between the two groups, with a *t*-value of 5.187 and a p-value of .000,

indicating statistical significance. Furthermore, Cohen's d was calculated as 1.464 reflecting a large effect size. These findings suggest that the method implemented in the experimental group had a substantial impact on improving perceptual speed among boys compared to the control group. This significant and practically meaningful difference underscores the effectiveness of the Brain compatible learning strategy in enhancing perceptual speed of coastal area secondary school boys.

The mean gain scores of perceptual speed of the experimental and control groups for boys are presented graphically in Figure 61.

Figure 61

Mean Gain Scores of Perceptual Speed of Experimental and Control Groups – Boys



From the Figure 61, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the variable perceptual speed for boys. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean gain scores of the variable perceptual speed of two groups experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of

perceptual speed of the experimental and Control group for boys shows that there is significant difference in the mean gain scores of perceptual speed between the two groups. The mean gain scores of the perceptual speed of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable perceptual speed of the Experimental and control group for boys.

Comparison of the Mean Gain Scores of Perceptual Speed between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of gain scores of Perceptual Speed between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 78.

Table 78

Results of Test of Significance of Difference in Mean Gain Scores of Perceptual Speed between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Perceptual Speed	Experimental group	28	3.821	2.161	4.051	.000**	1.072
	Control group	30	0.867	3.246			Large

**: Significant at 0.01 level of significance

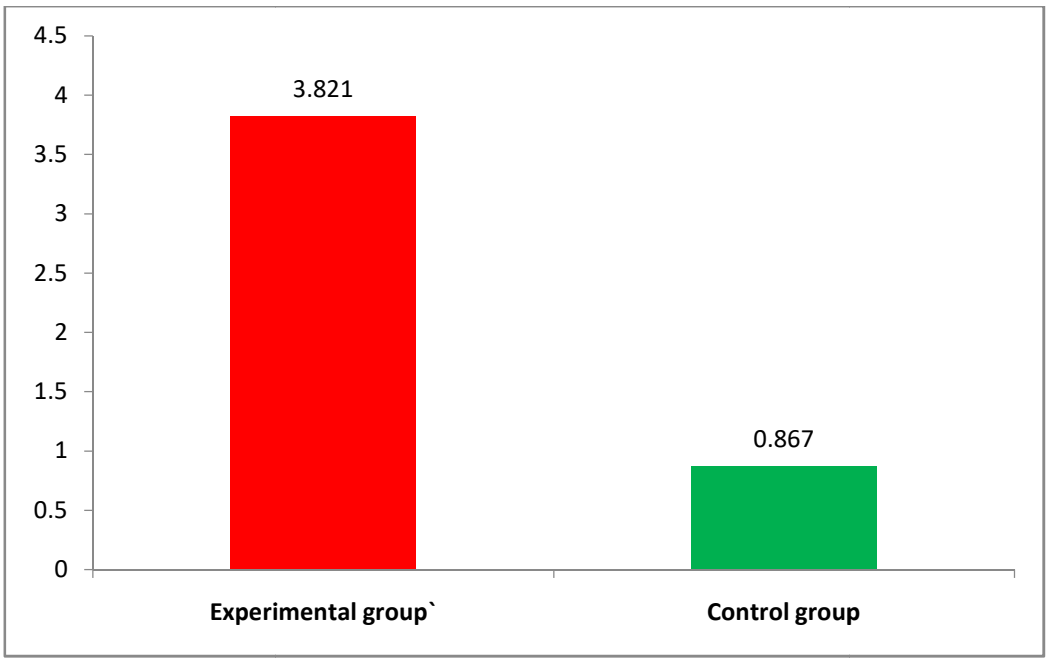
The table no.78 compares the gain scores of perceptual speed in girls between experimental group and control group. In the experimental group comprising 28 girls, the mean gain score of perceptual speed is 3.821, with a standard deviation (SD) of 2.161. Conversely, in the control group consisting of 30 girls, the mean gain score is 0.867, with a SD of 3.246. Through an independent sample *t*-test, a significant difference emerges between the groups with a *t*-value of 4.051 and a p-

value of .000 (**) indicating statistical significance. Additionally, the effect size measured by Cohen's d is computed as 1.072, categorizing the difference as large according to Cohen's criteria. These results suggest that the method administered to the experimental group has led to a significant and substantial improvement in perceptual speed compared to the control group. The considerable difference in gain scores between the experimental and control groups highlights the effectiveness of the method in enhancing perceptual speed among girls. This indicates that the Braincompatible learning strategy implemented in the experimental group of girls has resulted meaningful improvements in perceptual speed of coastal area secondary school.

The mean gain scores of perceptual speed of the experimental and control groups for girls are presented graphically in Figure 62.

Figure 62

Mean gain Scores of Perceptual Speed of Experimental and Control Groups - Girls



From the Figure 62, it is evident that the bar chart used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the

variable perceptual speed for girls. The X axis of the graph represents the two groups for the variable perceptual speed. The Y axis represents the mean gain scores of the variable perceptual speed of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of perceptual speed of the experimental and Control group for girls shows that there is significant difference in the mean gain scores of perceptual speed between the two groups. The mean gain scores of the perceptual speed of the Experimental group is higher than the mean gain scores of Control group. The graphical representation also supports the result of mean difference analysis of gain scores of the variable perceptual speed of the Experimental and control group for girls.

Comparison of the Mean Change Scores of Mathematics Anxiety between Experimental Group and Control Group

To find whether there exists any significant difference in the mean change scores of Mathematics Anxiety between Experimental group and Control group, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 79

Table 79

Results of Test of Significance of Difference in Mean Change Scores of Mathematics Anxiety between Experimental and Control Groups -Total Sample

Variable	Group	*N*	*Mean*	*SD*	*T*	*P*	*Effect size and Cohen's category*
Mathematics Anxiety	Experimental group	54	10.111	9.660	5.277	.000**	1.304
	Control group	54	1.407	7.319			Large

**: significant at 0.01 level of significance

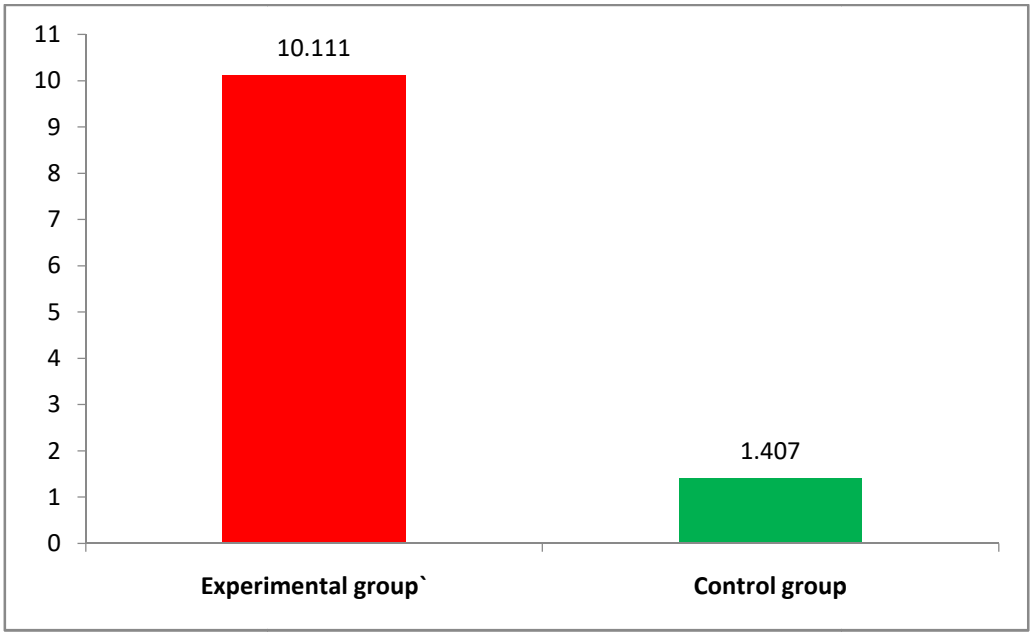
The table no.79 compares the change scores of mathematics anxiety between participants in experimental group and control group. In the experimental group,

consisting of 54 participants, the mean change score of mathematics anxiety is 10.111 with a standard deviation of 9.660. Conversely, the control group also comprising 54 participants exhibits a lower mean change score of 1.407 with a standard deviation 7.319. Utilizing the two independent sample *t*-test method, a significant difference between the two groups is observed with a *t*-value of 5.277 and a p-value of .000 (**) indicating statistical significance. Moreover, an effect size of 1.304 categorized as large highlights the substantial difference in gain scores of mathematics anxiety between the experimental and control groups. These results suggest that the method implemented in the experimental group had a significant impact on reducing mathematics anxiety compared to the control group with a large effect size indicating a considerable practical significance. Hence Brain compatible learning strategy is effective in reducing mathematics anxiety among coastal area secondary school students.

The mean change scores of mathematics anxiety of the experimental and control groups for Total sample are presented graphically in Figure 63.

Figure 63

Mean change Scores of Mathematics Anxiety of Experimental and Control Groups – Total Sample



From the Figure 63, it is evident that the bar chart used to compare the difference in the mean change scores among two groups; Experimental and Control group for the variable mathematics anxiety for total sample. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean change scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of change scores of mathematics anxiety of the experimental and Control group for total sample shows that there is significant difference in the mean change scores of mathematics anxiety between the two groups. The mean change scores of the mathematics anxiety of the Experimental group is higher than the mean change scores of Control group. The graphical representation also supports the result of mean difference analysis of change scores of the variable mathematics anxiety of the Experimental and control group for total sample.

Comparison of the Mean Change Scores of Mathematics Anxiety between Experimental Group and Control Group among Boys

To find whether there exists any significant difference in the mean change scores of Mathematics Anxiety between Experimental group and Control group among boys, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 80.

Table 80

Results of Test of Significance of Difference in Mean change Scores of Mathematics Anxiety between Experimental and Control Groups - boys.

Variable	Boys	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Mathematics Anxiety	Experimental group	26	11.192	7.777	4.014	.000**	1.144
	Control group	24	3.458	5.564			Large

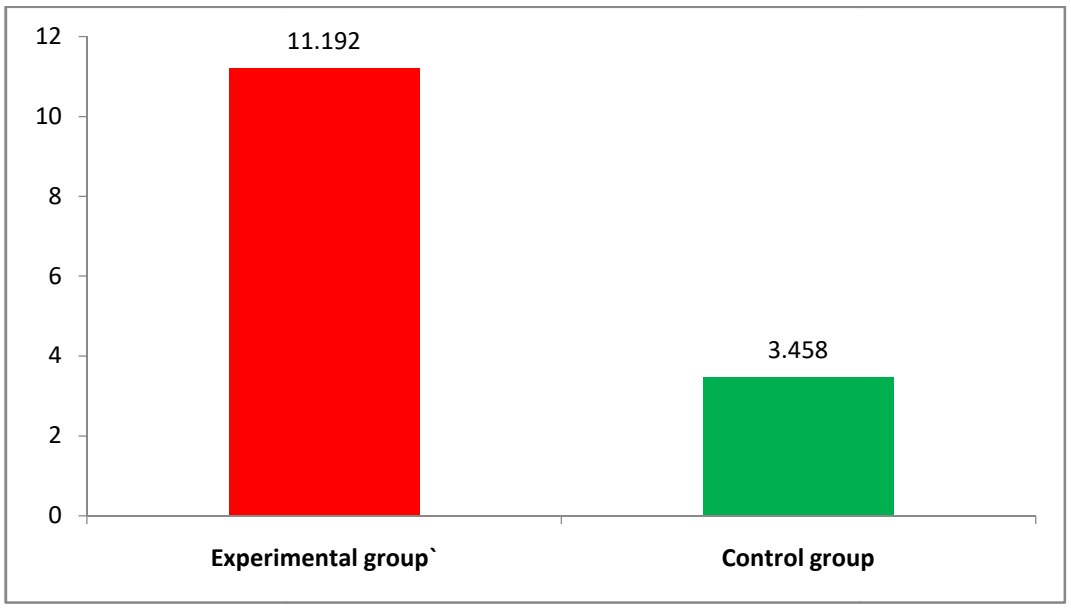
**: Significant at 0.01 level of significance

The table no.80 compares the change scores of mathematics anxiety between boys in experimental group and control group. In the experimental group comprised of 26 boys, the mean change score for mathematics anxiety was notably higher with an average increase of 11.192 points and a standard deviation of 7.777. Conversely, the control group consisting of 24 boys exhibited a lower mean change score of 3.458 points with a standard deviation of 5.564. Statistical analysis revealed a significant difference between the two groups with a *t*-value of 4.014 and a p-value of .000 indicating statistical significance. Moreover, Cohen's d was calculated as 1.144, reflecting a large effect size. These findings suggest that the method implemented in the experimental group had a substantial impact on reducing mathematics anxiety among boys compared to the control group. This significant and practically meaningful difference underscores the effectiveness of the Brain compatible learning strategy in alleviating mathematics anxiety in the experimental group.

The mean change scores of mathematics anxiety of the experimental and control groups for boys are presented graphically in Figure 64.

Figure 64

Mean Change Scores of Mathematics Anxiety of Experimental and Control Groups-Boys



From the Figure 64, it is evident that the bar chart used to compare the difference in the mean change scores among two groups; Experimental and Control group for the variable mathematics anxiety for boys. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean change scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of mean change scores of mathematics anxiety of the experimental and Control group for boys shows that there is significant difference in the mean change scores of mathematics anxiety between the two groups. The mean change scores of the mathematics anxiety of the Experimental group is higher than the mean change scores of Control group. The graphical representation also supports the result of mean difference analysis of change scores of the variable mathematics anxiety of the Experimental and control group for boys.

Comparison of the Mean Change Scores of Mathematics Anxiety between Experimental Group and Control Group among Girls

To find whether there exists any significant difference in the mean scores of change scores of Mathematics Anxiety between Experimental group and Control group among girls, the investigator used independent sample *t*-test. The result of the statistical analysis is presented in the Table 81.

Table 81

Results of Test of Significance of Difference in Mean Change Scores of Mathematics Anxiety between Experimental and Control Groups - Girls

Variable	Girls	*N*	*Mean*	*SD*	*t*	*p*	*Effect size and Cohen's category*
Mathematics Anxiety	Experimental group	28	9.107	11.180	3.647	.001**	.953
	Control group	30	-0.233	8.190			Large

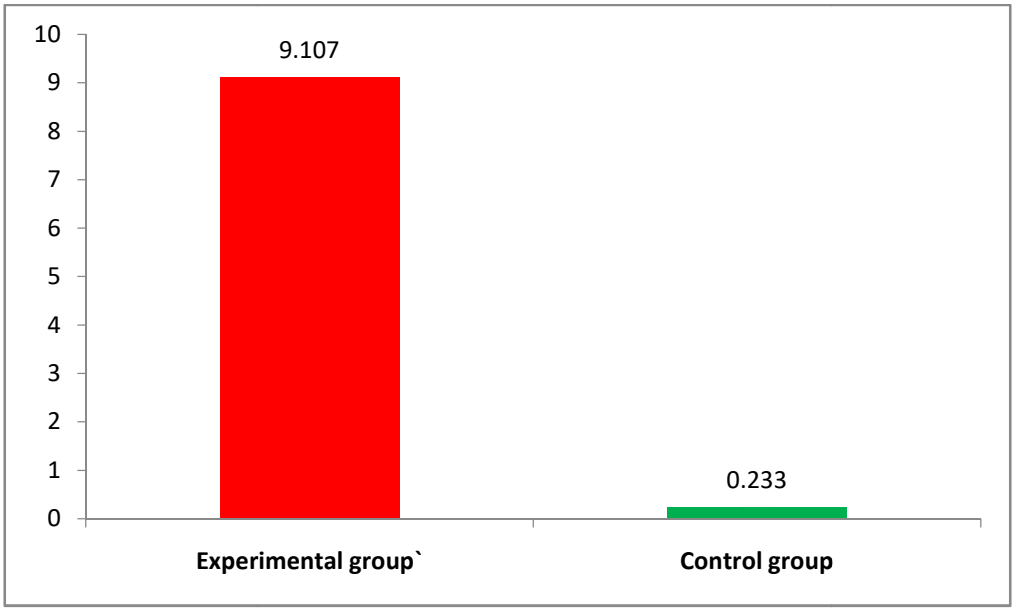
**: Significant at 0.01 level of significance

The table no.81 compares the change scores of mathematics anxiety in girls between experimental group and control group. In the experimental group, comprising 28 girls, the mean change score of mathematics anxiety is 9.107 with a standard deviation (SD) of 11.180. Conversely, in the control group consisting of 30 girls the mean change score is -0.233, with a SD of 8.190. Through an independent sample *t*-test, a significant difference emerges between the groups with a *t*-value of 3.647 and a p-value of .001 (**) indicating statistical significance. Additionally, the effect size measured by Cohen's d is computed as 0.953, categorizing the difference as large according to Cohen's criteria. These results suggest that the method administered to the experimental group has led to a significant and substantial reduction in mathematics anxiety compared to the control group. This indicates that the method implemented in the experimental group has resulted in meaningful reductions in mathematics anxiety.

The mean change scores of mathematics anxiety of the experimental and control groups for girls are presented graphically in Figure 65.

Figure 65

Mean Change Scores of Mathematics Anxiety of Experimental and Control Groups-Girls



From the Figure 65, it is evident that the bar chart used to compare the difference in the mean change scores among two groups; Experimental and Control group for the variable mathematics anxiety for girls. The X axis of the graph represents the two groups for the variable mathematics anxiety. The Y axis represents the mean change scores of the variable mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of mean change scores of mathematics anxiety of the experimental and Control group for girls shows that there is significant difference in the mean change scores of mathematics anxiety between the two groups. The mean change scores of the mathematics anxiety of the Experimental group is higher than the mean change scores of Control group. The graphical representation also supports the result of mean difference analysis of change scores of the variable mathematics anxiety of the Experimental and control group for girls.

Discussion

The mean difference analysis of the gain scores of problem solving ability, perceptual speed and change scores of mathematics anxiety of coastal area secondary school students in the experimental group shows the following result.

There is significant difference between experimental group and control group on problem solving ability for total sample, boys and girls. For the total sample, substantial difference in gain scores of problem solving ability between experimental group and control group. For boys and girls the difference in gains scores between the experimental group and control group is of medium magnitude.

There is significant difference between the experimental and control group on perceptual speed for total sample, boys and girls. For total sample, substantial difference in gain scores of the experimental and control groups, for boys and girls considerable difference for the gain scores of perceptual speed between

experimental group and control group. There is significant difference between the experimental and control groups on mathematics anxiety for total sample, boys and girls. For total sample, Substantial difference in the change scores of experimental group and control group, For boys and girls significantly meaningful difference in change scores between experimental group and control group.

Hence, Braincompatible learning strategy is effective in enhancing the problem solving ability and perceptual speed for total sample and boys and girls. The variable mathematics anxiety, meaningful reduction in mathematics anxiety for total sample, boys and girls were found by implementing Brain compatible learning strategy in experimental group compared to the control group. Thus, Braincompatible learning strategy is effective for enhancing problem solving ability, perceptual speed and reduction in mathematics anxiety of coastal area Secondary school students.

Analysis of Covariance (ANCOVA) of the Dependant Variables

In this study, single-factor ANCOVA employing six covariates was used to confirm the effect of the braincompatible learning strategy on problem solving ability, perceptual speed and mathematics anxiety. It is applied when one or more correlated variables existed with the dependent variable and can control the effect of any of the covariates on the dependent variables using ANCOVA.

By employing one way ANCOVA, the investigator could study the relative effectiveness of the braincompatible learning strategy over the existing method of teaching concerning the dependent variables of the study problem solving ability, perceptual speed and mathematics anxiety for the total sample and Boys and Girls. To study whether the experimental and control group differ significantly in mean scores of problem solving ability, perceptual speed and mathematics anxiety after controlling the covariates pretest scores on problem solving ability, pretest scores on

perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory score, Socio-Economic status score and combined effects of all these covariates for total sample and subsamples based on gender. The results and discussions are presented in the following sections.

Check for Basic Assumptions

To ensure that the collected data can be subjected to ANCOVA, it was decided to check whether the data follow the basic assumptions or not. The dependent variables of the study problem solving ability, perceptual speed and mathematics anxiety for the total sample and the subsample boys and girls are on the interval scale. The distributions of these scale variables follow normal distribution properties as evident from the preliminary analysis. The other two assumptions such as the linear relationship between dependent variables and the different covariates and homogeneity of variances were checked and are presented in the following sections.

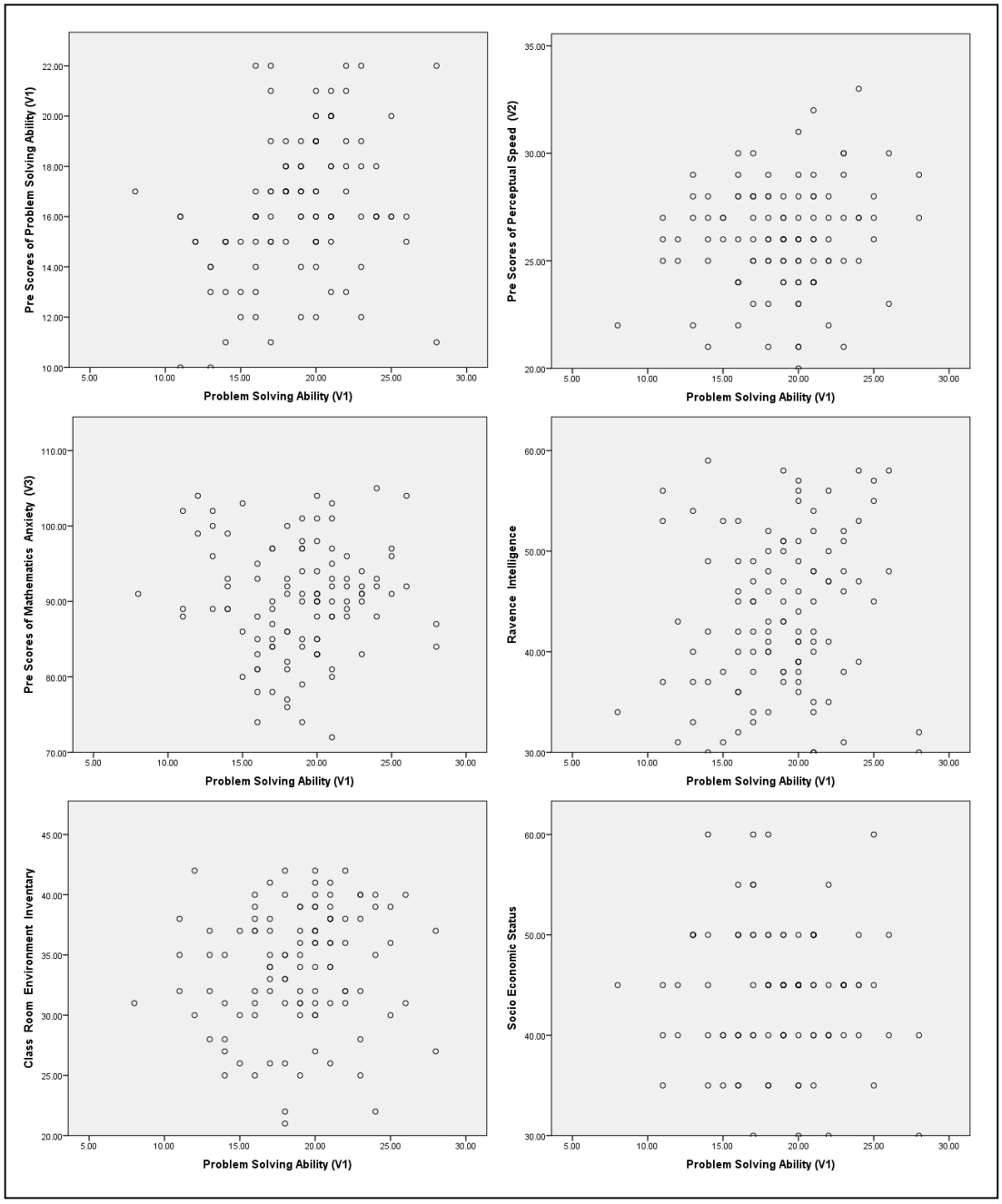
The Linear Relationship between the Dependent Variables and Covariates

A Scatter plot was used to study the nature of the relationship between the dependent variable and covariates. Scatter plots of the dependent variables problem solving ability, perceptual speed and mathematics anxiety for the total sample against the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates were generated.

Scatter plot of covariates and their combined effect against the dependent variables are given in figures 66, 67 and 68 below.

Figure 66

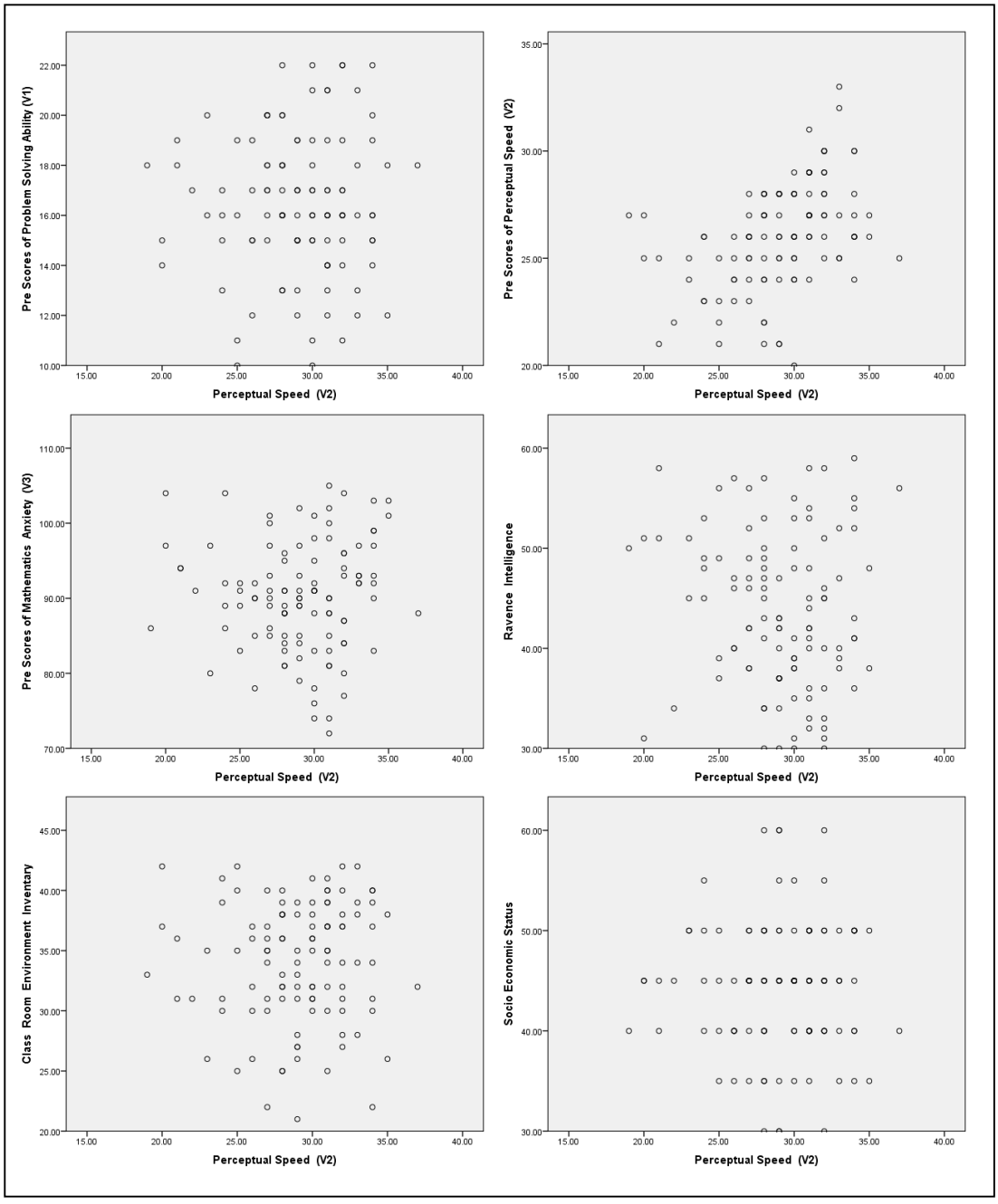
Scatterplot of Problem Solving Ability Against the Covariates for Total Sample



The scatter plots revealed that there are linear relationship between dependent variables and covariates for total sample.

Figure 67

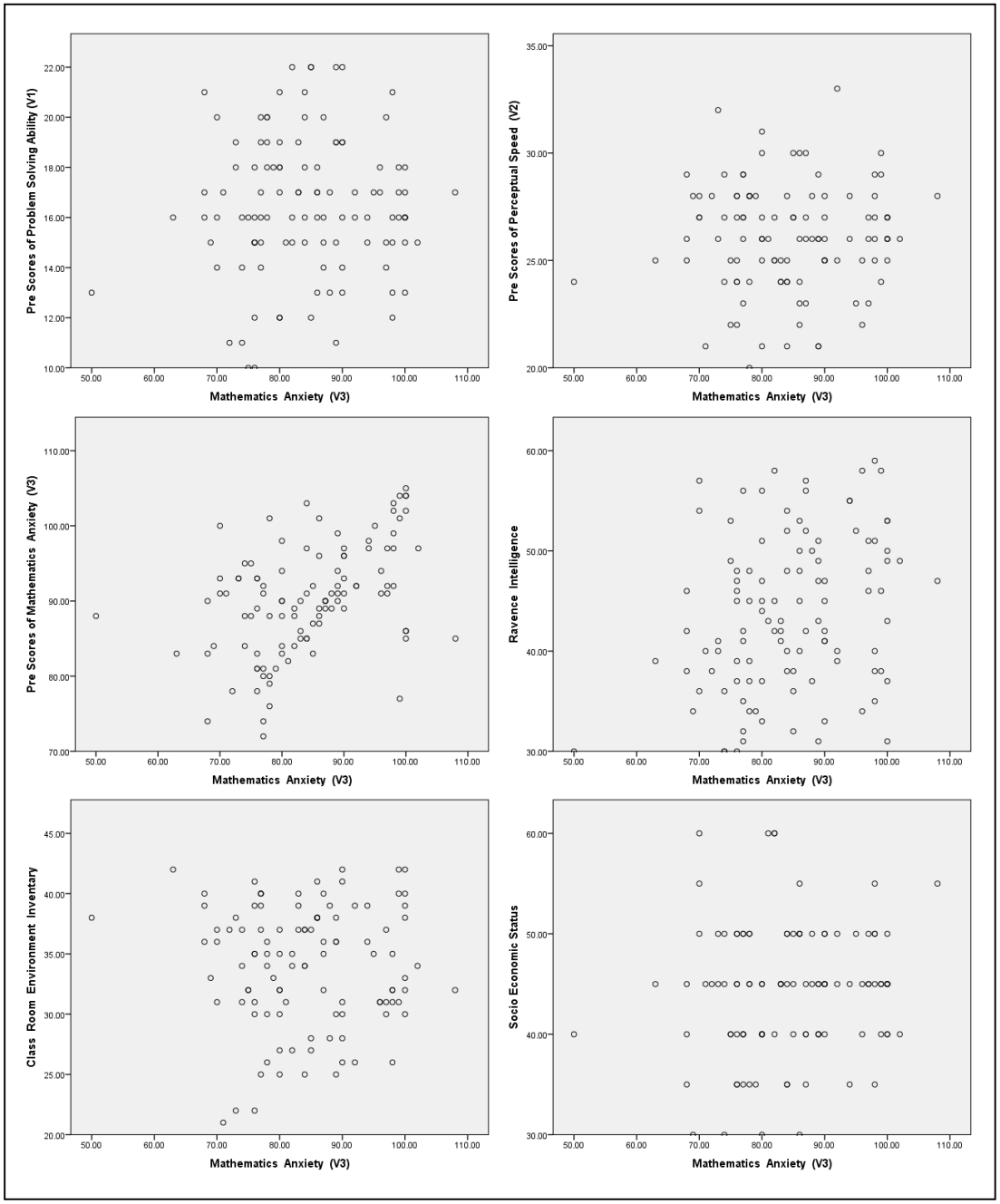
Scatter Plot of Perceptual Speed Against the Covariates for Total Sample



The scatter plots revealed that there are linear relationship between dependent variables and covariates for total sample.

Figure 68

Scatter Plot of Mathematics Anxiety Against the Covariates for Total Sample



The visual observation of the scatter plots given in figure above revealed that there are linear relationship between dependent variables and covariates for total sample.

The scatter plot of covariates and their combined effect against the dependent variables for Boys are given in figures 69, 70, and 71 below

Figure 69

Scatter Plot of Problem Solving Ability Against the Covariates for Boys

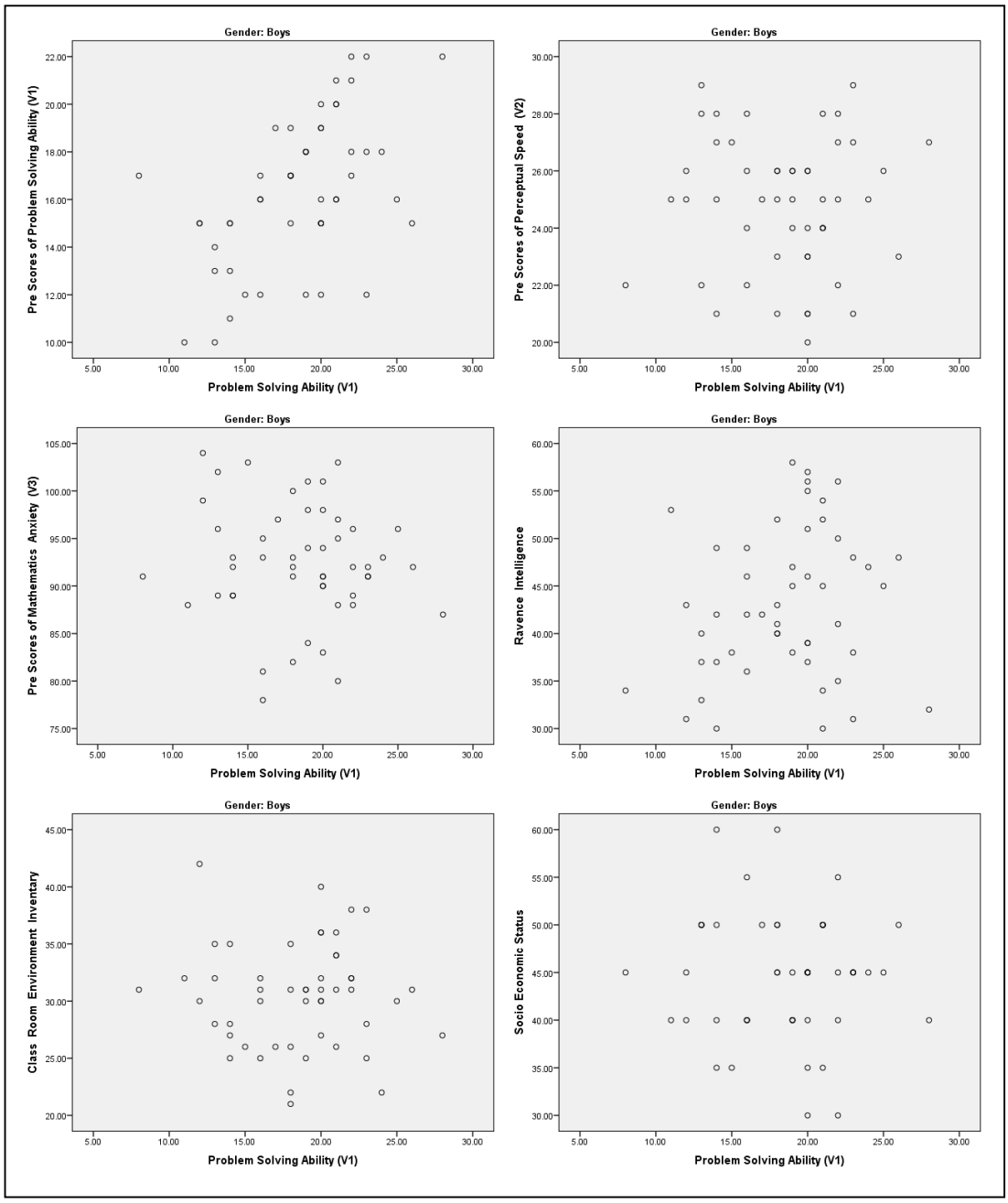


Figure 70

Scatter Plot of Perceptual Speed Against the Covariates for Boys

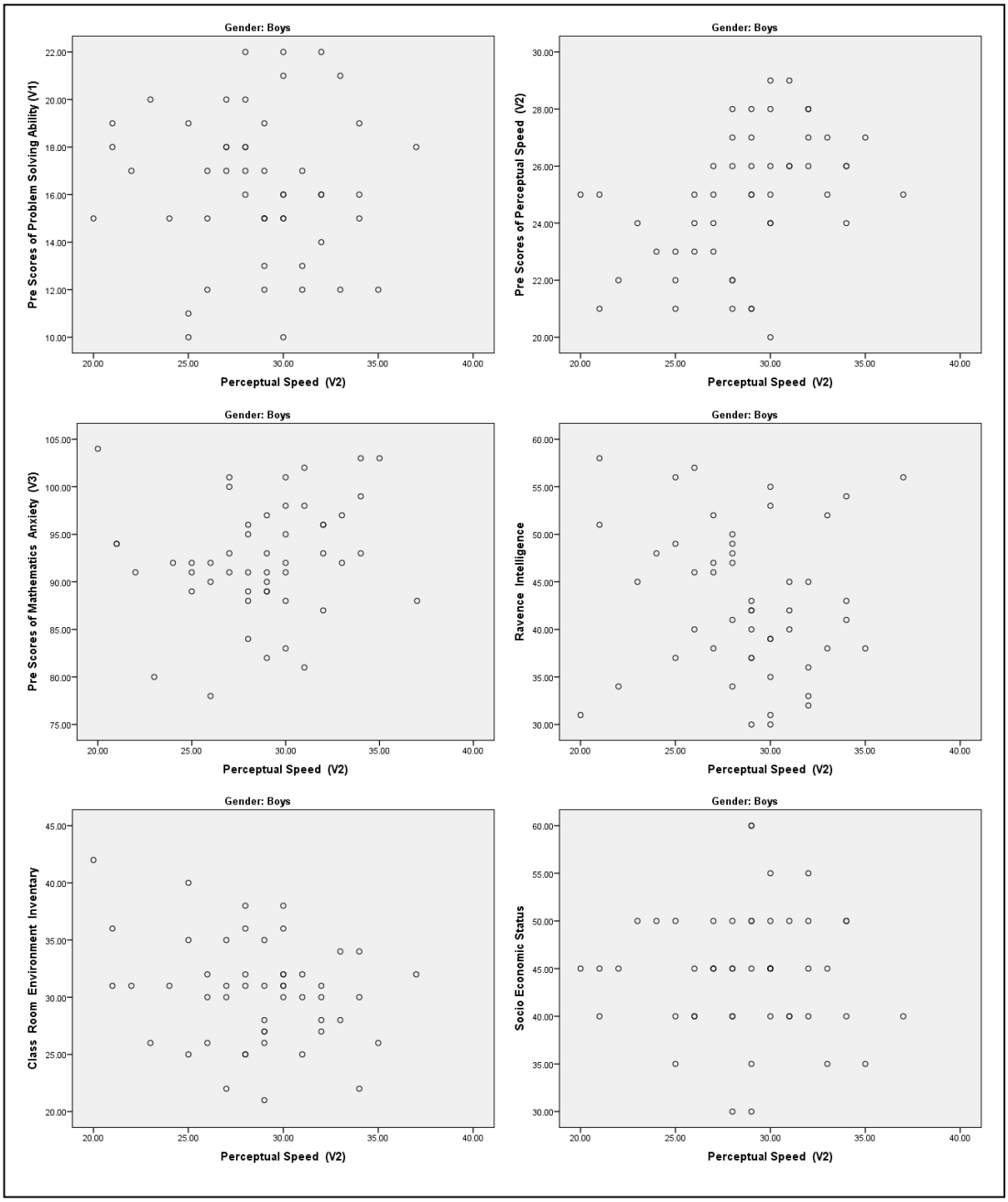
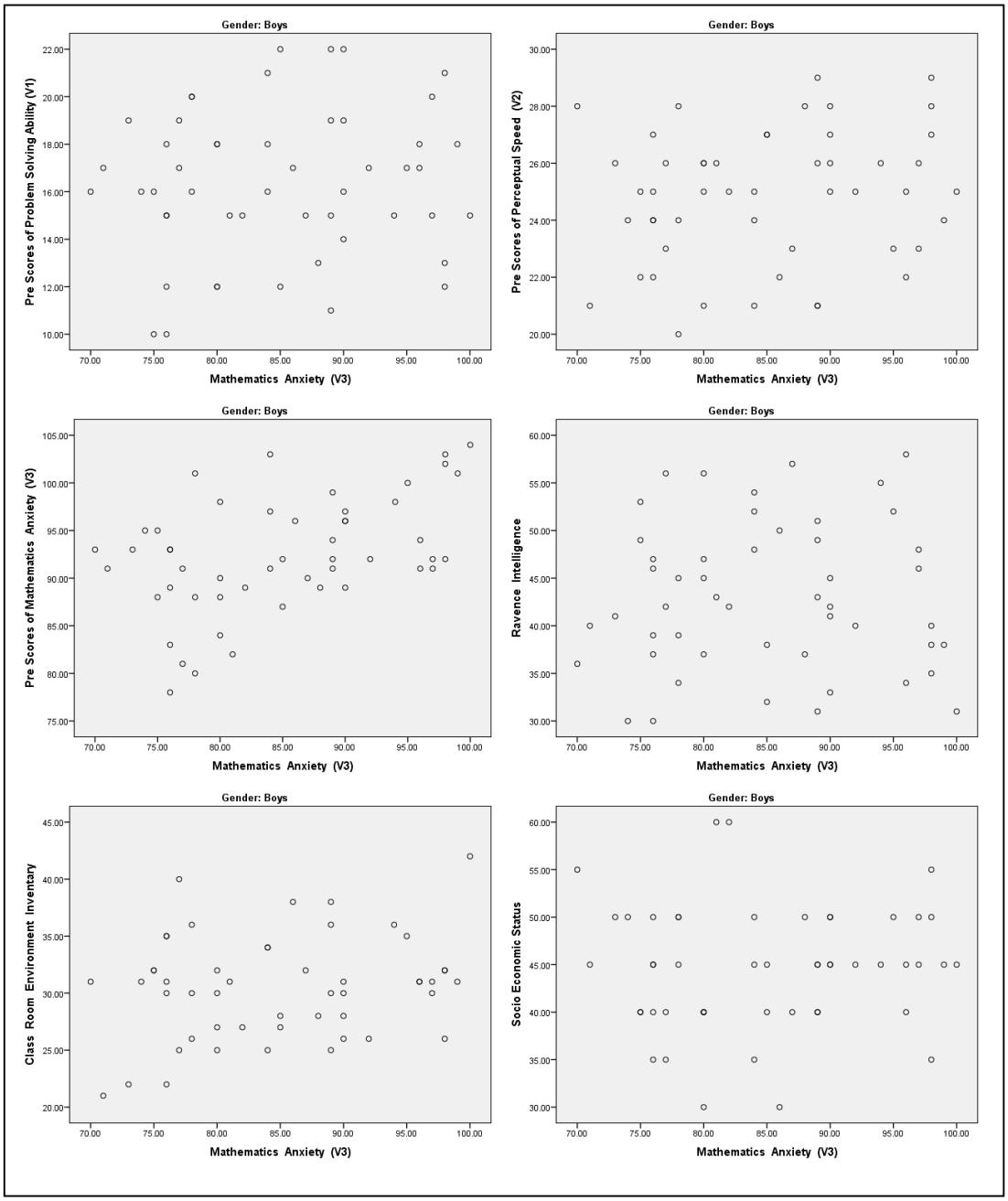


Figure 71

Scatter Plot of Mathematics Anxiety Against the Covariates for Boys



The visual observation of scatter plots given in the figure numbers; 69, 70 and 71 revealed that there are linear relationships between dependent variables and covariates for Boys.

The scatter plot of covariates and their combined effect against the dependent variables for Girls are given in figures 72, 73, and 74 below

Figure 72

Scatter Plot of Problem Solving Ability Against the Covariates for Girls

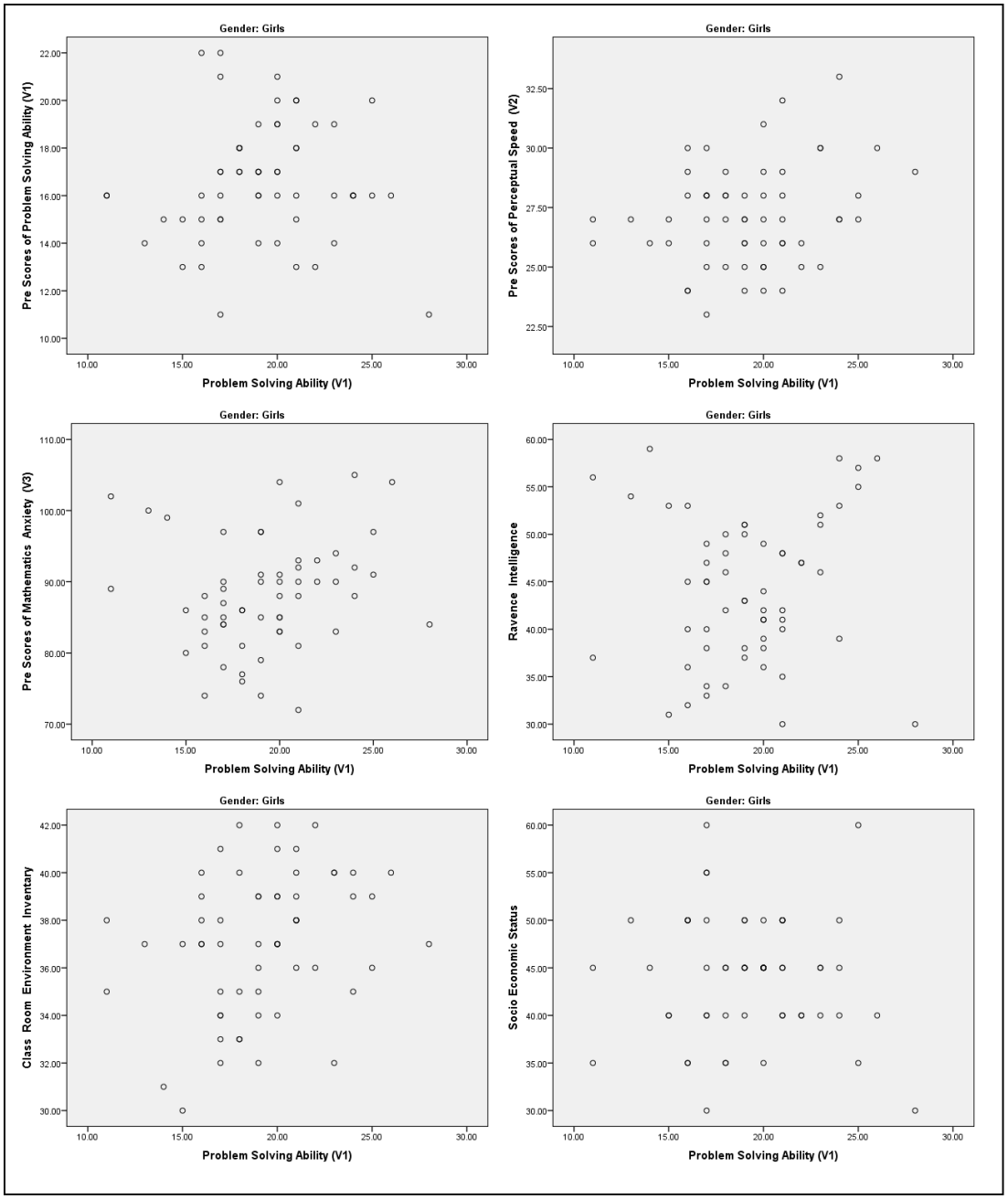


Figure 73

Scatter Plot of Perceptual Speed Against the Covariates for Girls

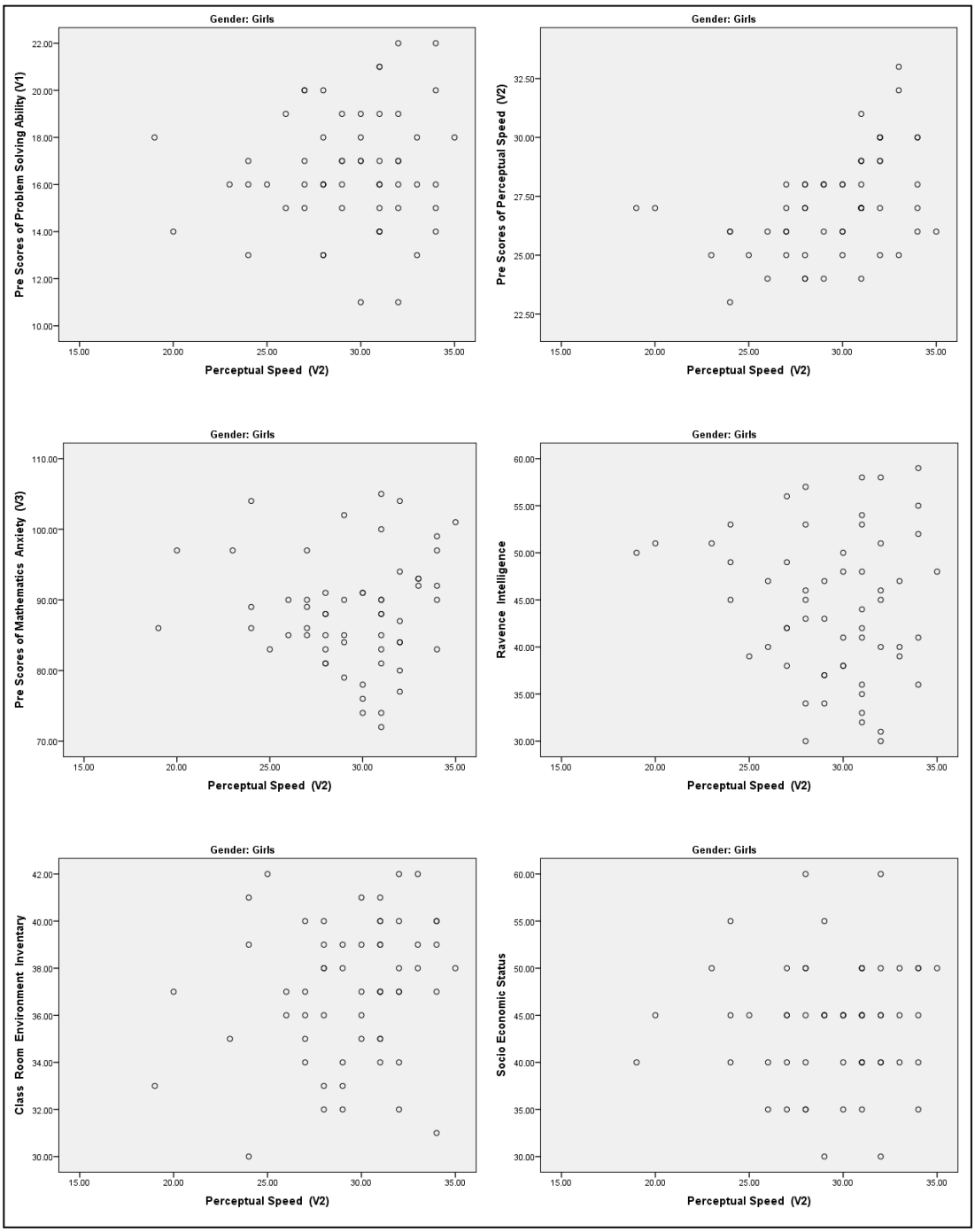
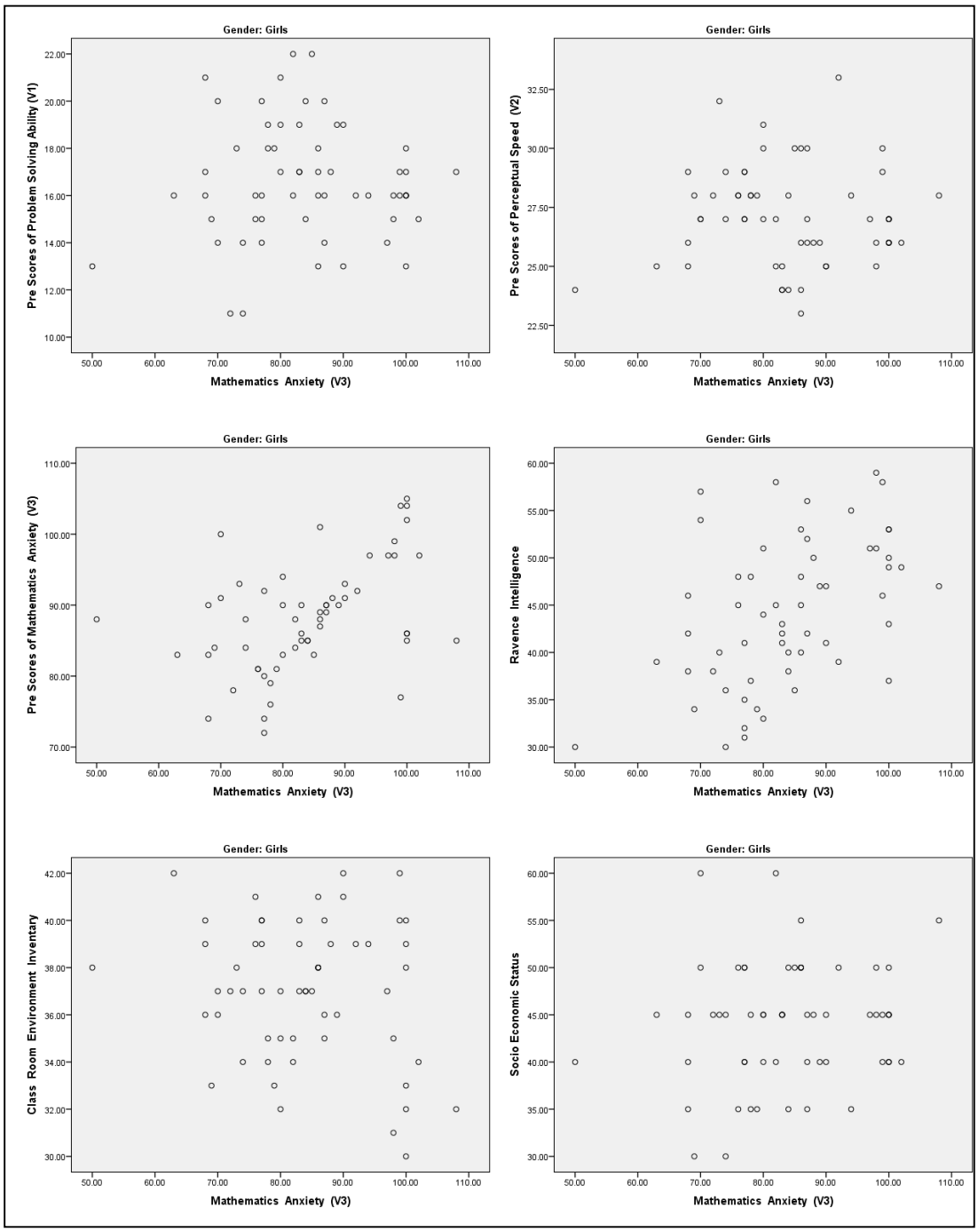


Figure 74

Scatter Plot of Mathematics Anxiety Against the Covariates for Girls



The visual observation of scatter plots given in the figure numbers; 72, 73 and 74 revealed that there are linear relationships between dependent variables and covariates for Girls.

Homogeneity of Variances

Levene's test is used to test if different samples have equal variances. Equal variances across samples are called homogeneity of variance. For analyzing covariance, assumptions like variances are equal across groups or samples have to follow. The Levene test can be used to verify that assumption. This tests the null hypothesis that the error variance of the dependent variable is equal across groups. Homogeneity of the variance of the experimental and control group on dependent variables problem solving ability, perceptual speed and mathematics anxiety were tested for the total sample, boys and girls.

Details of Leven’s test for all the dependent variables for total sample, boys and girls are described in the preceding section and presented in the following Table 82.

Table 82

Result of Levene's Test for Problem Solving Ability, Perceptual Speed and Mathematics Anxiety for Total Sample

Variable	Covariates	Levene's test F	Df1	Df2	Significant value
Problem solving ability	Pretest score	2.238	1	106	.138
	Perceptual speed	2.531	1	106	.115
	Mathematics anxiety	0.311	1	106	.578
	Nonverbal Intelligence	0.080	1	106	.778
	Classroom environment	0.617	1	106	.434
	SES	0.403	1	106	.527
	Total effect of covariates	0.305	1	106	.582
Perceptual speed	Pretest scores	2.980	1	106	.087
	Problem solving ability	3.192	1	106	.076
	Mathematics anxiety	3.886	1	106	.051
	Nonverbal Intelligence	2.624	1	106	.108
	Classroom environment	2.994	1	106	.086
	SES	2.589	1	106	.110
	Total effect of Covariates	2.109	1	106	.149
Mathematics anxiety	Pretest scores	3.864	1	106	.052
	Problem solving ability	0.373	1	106	.543
	Perceptual speed	0.358	1	106	.551
	Nonverbal Intelligence	3.071	1	106	.082
	Classroom Environment	0.857	1	106	0.357
	SES	0.153	1	106	0.696
	Total effect of Covariates.	0.369	1	106	0.545

Table 83

Result of Levene's Test for Problem solving ability, Perceptual Speed and Mathematics Anxiety for Boys

Variable	Covariates	Levene's test F	Df1	Df2	Significant value
Problem solving ability	Pretest score	1.707	1	48	.198
	Perceptual speed	1.380	1	48	.246
	Mathematics anxiety	3.381	1	48	.072
	Nonverbal Intelligence	2.049	1	48	.159
	Classroom environment	2.507	1	48	.120
	SES	3.495	1	48	.068
	Total effect of covariates	3.589	1	48	.064
Perceptual speed	Pretest scores	0.073	1	48	.788
	Problem solving ability	3.053	1	48	.086
	Mathematics anxiety	0.371	1	48	.546
	Nonverbal Intelligence	3.485	1	48	.068
	Classroom environment	2.779	1	48	.102
	SES	3.115	1	48	.084
	Total effect of Covariates	3.432	1	48	.070
Mathematics anxiety	Pretest scores	3.260	1	48	.076
	Problem solving ability	0.863	1	48	.358
	Perceptual speed	1.318	1	48	.257
	Nonverbal Intelligence	3.481	1	48	.068
	Classroom Environment	0.841	1	48	.364
	SES	1.894	1	48	.175
	Total effect of Covariates.	0.759	1	48	.388

Table 84

Result of Levene's Test for Problem solving ability, Perceptual Speed and Mathematics Anxiety for Girls

Variable	Covariates	Levene's test F	Df1	Df2	Significant value
Problem solving ability	Pretest score	0.243	1	56	.624
	Perceptual speed	1.186	1	56	.280
	Mathematics anxiety	0.715	1	56	.401
	Nonverbal Intelligence	0.559	1	56	.458
	Classroom environment	0.472	1	56	.495
	SES	0.758	1	56	.388
	Total effect of covariates	0.986	1	56	.325
Perceptual speed	Pretest scores	3.683	1	56	.060
	Problem solving ability	3.251	1	56	.076
	Mathematics anxiety	3.701	1	56	.059
	Nonverbal Intelligence	3.192	1	56	.079
	Classroom environment	3.959	1	56	.052
	SES	3.361	1	56	.072
	Total effect of Covariates	3.741	1	56	.058
Mathematics anxiety	Pretest scores	3.154	1	56	.081
	Problem solving ability	.002	1	56	.965
	Perceptual speed	.004	1	56	.948
	Nonverbal Intelligence	2.132	1	56	.150
	Classroom Environment	.495	1	56	.485
	SES	.710	1	56	.403
	Total effect of Covariates.	.015	1	56	.903

From the above tables, tableno.82, table no.83 and table no.84 it is clear that, all the significant values are greater than 0.05 level of significance. Hence the variance of the experimental group and the control group are equal. Hence the assumption of homogeneity of variance for ANCOVA is satisfied for the three dependent variable in case of the total sample, boys and girls.

The examinations of the major assumptions revealed that the basic assumption of homogeneity of variance for ANCOVA are met to a satisfactory extent for the total sample and subsamples. Hence the data can be subjected to ANCOVA.

To study whether there is any significant difference exist between experimental and control groups in terms of problem solving ability after adjusting for the pre-intervention differences if any, one–way ANCOVA was used. Every ANCOVA with significant F value was followed by Bonferroni's test of post hoc comparison. The details of covariance analysis of the dependent variable, problem solving ability for the total sample, boys and girls are presented in the following sections

Comparison of the Adjusted Mean Scores of Problem Solving Ability of Experimental and Control Group by Considering Pretest Perceptual Speed, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Total Sample

To study the relative effectiveness of the Braincompatible learning strategy and existing method of teaching in enhancing the problem solving ability of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed on the total sample, boys and girls. Linear

adjustments were made in the posttest scores of problem solving ability for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of problem solving ability for the total sample are presented in below table 85.

Table 85

Summary of Analysis of Covariance of Problem Solving Ability -Total Sample

Source of Variance		Covariates						
		Pretest problem solving	Pretest Perceptual speed	Pretest Mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	206.935	220.116	235.526	225.181	231.102	225.086	199.621
	Within groups	1173.856	1284.441	1299.891	1277.263	1279.815	1304.334	1094.369
Df	Between groups	1	1	1	1	1	1	1
	Within groups	105	105	105	105	105	105	100
Mean Square	Between groups	206.935	220.116	235.526	225.181	231.102	225.086	199.621
	Within groups	11.180	12.233	12.380	12.164	12.189	12.422	10.944
Total		40031.00	40031.00	40031.00	40031.00	40031.00	40031.00	40031.00
F		18.510	17.994	19.025	18.511	18.960	18.120	18.241
Sig.		.000**	.000**	.000**	.000**	.000**	.000**	.000**
Partial Eta Squared		.150	.146	.153	.150	.153	.147	.154

**: Significant at 0.01 level of significance

ANCOVA table no. 85 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 105) = 18.510, significant value = 0.000, partial Eta squared = 0.150; F (1, 105) =17.994, significant value = 0.000, partial Eta squared =0.146; F (1, 105) =19.025, significant value = 0.000, partial Eta squared=0.153; F (1, 105) = 18.511, significant value=0.000, partial Eta squared=0.150; F (1, 105) =18.960, significant value = 0.000, partial Eta squared =0153; and F (1, 105) =18.120, significant value = 0.000, partial Eta squared = 0.147;F (1, 100) =18.241, significant value =0.000, partial Eta squared =0.154. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in problem solving ability scores between the control group and experimental group is significant. Hence the difference in problem solving ability scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing problem solving ability. To check the adjustment mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Problem Solving Ability of Experimental and Control Group for Total Sample

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of problem solving ability, the test of

significance of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of problem solving ability for of Total sample are presented in the Table 86.

Table 86

Data and Results of Bonferroni's Test of post Hoc comparison between the Adjusted Means of Problem Solving Ability -Total Sample

Covariates	Experimental group (N=54)	Control group (N=54)	Mean Difference	SE	T
	Adjusted Mean	Adjusted Mean			
Pre –test Scores of Problem Solving Ability	20.266	17.493	2.773*	.645	.000**
Pre -test Scores of Perceptual Speed	20.309	17.450	2.859*	.674	.000**
Pretest Scores of Mathematics Anxiety	20.382	17.377	3.005*	.689	.000**
Nonverbal Intelligence	20.324	17.435	2.888*	.671	.000**
Classroom Environment	20.343	17.417	2.926*	.672	.000**
Socio Economic Status	20.325	17.434	2.891*	.679	.000**
Combined effect	20.277	17.482	2.795*	.654	.000**

**: Significant at 0.01 level of significance

Table no. 86 displays For each covariates, Pretest Scores of Problem Solving Ability, Pretest Scores of Perceptual Speed, Pretest Scores of Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socioeconomic Status, and Combined effect, the table displays the adjusted means for both the experimental group and the control group, along with the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 20.266, and for the control group is 17.493, with a significant mean difference of 2.773 (SE = .645, *t* = .000**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 20.309, while the control group has an adjusted mean of 17.450, resulting in a significant mean difference of 2.859 (SE = .674, *t* = .000**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 20.382, and for the control group is 17.377, with a significant mean difference of 3.005 (SE = .689, *t* = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 20.324, and the control group has an adjusted mean of 17.435, resulting in a significant mean difference of 2.888 (SE = .671, *t* = .000**).

Classroom Environment: The adjusted mean for the experimental group is 20.343, and for the control group is 17.417, with a significant mean difference of 2.926 (SE = .672, *t* = .000**).

Socioeconomic Status: The experimental group has an adjusted mean of 20.325, and the control group has an adjusted mean of 17.434, resulting in a significant mean difference of 2.891 (SE = .679, *t* = .000**).

Combined effect: The adjusted mean for the experimental group is 20.277, and for the control group is 17.482, with a significant mean difference of 2.795 (SE = .654, *t* = .000**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of problem solving ability scores among

control and experimental group when controlling covariates individually and taken together are less than 0.01 level of significance. So it can be said that the difference in adjusted mean scores is significant. When comparing adjusted means it is seen that adjusted mean scores are comparatively high in the experimental group so it can infer that new instructional strategy is more effective in improving problem solving ability score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Problem Solving Ability of Experimental and control Group by Considering, Pretest Perceptual Speed, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Boys

To study the relative effectiveness of the Braincompatible learning strategy and existing method of teaching in enhancing the problem solving ability of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed on boys. Linear adjustments were made in the posttest scores of problem solving ability for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of problem solving ability for boys are presented in below table 87.

Table 87

Summary of Analysis of Covariance of Problem Solving Ability - Boys

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	82.588	104.330	118.733	101.108	103.300	101.054	81.788
	Within groups	526.402	738.125	713.681	712.566	738.197	738.387	487.135
Df	Between groups	1	1	1	1	1	1	1
	Within groups	47	47	47	47	47	47	42
Mean Square	Between groups	82.588	104.330	118.733	101.108	103.300	101.054	81.788
	Within groups	11.200	15.705	15.185	15.161	15.706	15.710	11.598
Total		17955.00	17955.00	17955.00	17955.00	17955.00	17955.00	17955.00
F		7.374	6.643	7.819	6.669	6.577	6.432	7.052
Sig.		.009**	.013*	.007**	.013*	.014*	.015*	.011*
Partial Eta Squared		.136	.124	.143	.124	.123	.120	.144

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

ANCOVA table no.87, gives the F values corresponding to comparison of Control group and Experimental group as F (1, 47) =7.374, significant value = 0.009, partial Eta squared =0.136; F (1, 47) =6.643, significant value = 0.013, partial Eta squared =0.124; F (1, 47) =7.819, significant value = 0.007, partial Eta squared=0.143; F (1, 47) = 6.669, significant value=0.013, partial Eta squared=0.124; F (1, 47) =6.577, significant value = 0.014, partial Eta squared =0.123;and F (1, 47) =6.432, significant value = 0.015, partial Eta squared = 0.120; F (1, 42) =7.052, significant value =0.011, partial Eta squared =0.144. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant. since all the significant values are less than0.05 and 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in problem solving ability scores between the control group and experimental group is significant. Hence the difference in problem solving ability scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing problem solving ability for boys. To check the adjustment mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Problem Solving Ability of Experimental and Control Group for Boys

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of problem solving ability, the test of

significance of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of problem solving ability for boys are presented in the Table 88.

Table 88

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Problem Solving Ability – Boys

Covariates	Experimental group (N=26)	Control group (N=24)	Mean Difference	SE	t
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	19.738	17.159	2.580*	.950	.009**
Pretest Scores of Perceptual Speed	19.894	16.990	2.904*	1.127	.013*
Pretest Scores of Mathematics Anxiety	20.003	16.872	3.131*	1.120	.007**
Nonverbal Intelligence	19.867	17.019	2.847*	1.103	.013*
Classroom Environment	19.900	16.983	2.916*	1.137	.014*
Socio Economic Status	19.876	17.009	2.867*	1.130	.015*
Combined effect	19.805	17.086	2.719*	1.024	.011*

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

Table no.88 indicate, For each covariates and their Combined effect, the table shows the adjusted means for both the experimental group and the control group, along with the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability : The adjusted mean for the experimental group is 19.738, and for the control group is 17.159, resulting in a significant mean difference of 2.580 (SE = .950, *t* = .009**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 19.894, while the control group has an adjusted mean of 16.990, yielding a significant mean difference of 2.904 (SE = 1.127, *t* = .013*).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 20.003, and for the control group is 16.872, with a significant mean difference of 3.131 (SE = 1.120, *t* = .007**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 19.867, and the control group has an adjusted mean of 17.019, resulting in a significant mean difference of 2.847 (SE = 1.103, *t* = .013*).

Classroom Environment: The adjusted mean for the experimental group is 19.900, and for the control group is 16.983, with a significant mean difference of 2.916 (SE = 1.137, *t* = .014*).

Socioeconomic Status: The experimental group has an adjusted mean of 19.876, and the control group has an adjusted mean of 17.009, resulting in a significant mean difference of 2.867 (SE = 1.130, *t* = .015*).

Combined effect: The adjusted mean for the experimental group is 19.805, and for the control group is 17.086, with a significant mean difference of 2.719 (SE = 1.024, *t* = .011*).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of problem solving ability scores among control and experimental group when controlling covariates individually and taken together are less than 0.01 and less than 0.05 level of significance So it can be said that the difference in adjusted mean scores is significant.. When comparing adjusted means it is seen that adjusted mean scores are comparatively high in the Experimental group so it can infer that new instructional strategy is

more effective in enhancing problem solving ability score than the existing teaching method

Comparison of the Adjusted Mean Scores of Problem Solving Ability of Experimental and Control Group by Considering, Pretest Perceptual Speed, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Girls

To study the relative effectiveness of the Braincompatible learning strategy and Existing method of teaching in enhancing the problem solving ability of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed for girls. Linear adjustments were made in the posttest scores of problem solving ability for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of problem solving ability for girls are presented in below table 89.

Table 89

Summary of Analysis of Covariance of Problem Solving Ability - Girls

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	128.013	101.614	117.084	127.987	97.756	129.197	59.715
	Within groups	550.372	535.862	547.781	545.421	527.615	548.036	490.695
Df	Between groups	1	1	1	1	1	1	1
	Within groups	55	55	55	55	55	55	50
Mean Square	Between groups	128.013	101.614	117.084	127.987	97.756	129.197	59.715
	Within groups	10.007	9.743	9.960	9.917	9.593	9.964	9.814
Total		22076.00	22076.00	22076.00	22076.00	22076.00	22076.00	22076.00
F		12.793	10.429	11.756	12.906	10.190	12.966	6.085
Sig.		.001**	.002**	.001**	.001**	.002**	.001**	.017*
Partial Eta Squared		.189	.159	.176	.190	.156	.191	.108

**: Significant at 0.01 level of significance

ANCOVA table no.89 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 55) =12.793, significant value = 0.001, partial Eta squared =0.189; F (1, 55) =10.429, significant value = 0.002, partial Eta squared =0.159; F (1, 55) =11.756, significant value = 0.001, partial Eta squared=0.176; F (1, 55) =12.906, significant value=0.001, partial Eta squared=0.190; F (1, 55) =10.190, significant value = 0.002, partial Eta squared =0.156; and F (1, 55) =12.966, significant value = 0.001, partial Eta squared = 0.191; F (1, 50) =6.085, significant value =0.017, partial Eta squared =0.108. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in problem solving ability between the control group and experimental group is significant. Hence the difference in problem solving ability scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Braincompatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing problem solving ability for girls. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Problem Solving Ability of Experimental and Control Group for Girls

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of problem solving ability, the test of significance of the difference between adjusted mean was used with each ANCOVA.

The details, of post hoc comparison of adjusted mean scores of problem solving ability of girls s are presented in the Table 90.

Table 90

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Problem Solving Ability – Girls

Covariates	Experimental group (N=28)	Control group (N=30)	Mean Difference	SE	T
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	20.747	17.770	2.977*	.832	.001**
Pretest Scores of Perceptual Speed	20.619	17.889	2.731*	.846	.002**
Pretest Scores of Mathematics Anxiety	20.705	17.808	2.897*	.845	.001**
Nonverbal Intelligence	20.745	17.772	2.973*	.828	.001**
Classroom Environment	20.590	17.916	2.675*	.838	.002**
Socio Economic Status	20.752	17.765	2.987*	.829	.001**
Combined effect	20.358[b]	18.133	2.225*	.902	.017*

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

Table no.90 shows, For each covariates and their combined effect, the table presents the adjusted means for both the experimental group and the control group, alongside the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 20.747, and for the control group is 17.770, resulting in a significant mean difference of 2.977 (SE = .832, *t* = .001**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 20.619, while the control group has an adjusted mean of 17.889, yielding a significant mean difference of 2.731 (SE = .846, *t* = .002**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 20.705, and for the control group is 17.808, with a significant mean difference of 2.897 (SE = .845, t = .001**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 20.745, and the control group has an adjusted mean of 17.772, resulting in a significant mean difference of 2.973 (SE = .828, t = .001**).

Classroom Environment: The adjusted mean for the experimental group is 20.590, and for the control group is 17.916, with a significant mean difference of 2.675 (SE = .838, t = .002**).

Socioeconomic Status: The experimental group has an adjusted mean of 20.752, and the control group has an adjusted mean of 17.765, resulting in a significant mean difference of 2.987 (SE = .829, t = .001**).

Combined effect: The adjusted mean for the experimental group is 20.358, and for the control group is 18.133, with a significant mean difference of 2.225 (SE = .902, t = .017*).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of problem solving ability scores of Girls among control and experimental group when controlling covariates individually and taken together are less than 0.01 and less than 0.05 level of significance So it can be said that the difference in adjusted mean scores is significant. When comparing adjusted means it is seen that adjusted mean scores are comparatively high in the experimental group so it can infer that new instructional strategy is more effective in improving problem solving ability score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Perceptual Speed of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Total Sample

To study the relative effectiveness of the Braincompatible learning strategy and Existing method of teaching in enhancing the perceptual speed of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed on the total sample, boys and girls. Linear adjustments were made in the posttest scores of perceptual speed for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of perceptual speed for the total sample are presented in below Table 91.

Table 91

Summary of Analysis of Covariance of Perceptual Speed -Total Sample

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	385.146	354.325	391.384	387.971	386.114	386.329	334.103
	Within groups	965.812	745.286	958.993	950.936	964.508	965.078	724.797
Df	Between groups	1	1	1	1	1	1	1
	Within groups	105	105	105	105	105	105	100
Mean Square	Between groups	385.146	354.325	391.384	387.971	386.114	386.329	334.103
	Within groups	9.198	7.098	9.133	9.057	9.186	9.191	7.248
Total		92644.00	92644.00	92644.00	92644.00	92644.00	92644.00	92644.00
F		41.872	49.919	42.853	42.839	42.034	42.032	46.096
Sig.		.000**	.000**	.000**	.000**	.000**	.000**	.000**
Partial Eta Squared		.285	.322	.290	.290	.286	.286	.316

**: Significant at 0.01 level of significance

ANCOVA table no.91 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 105) =41.872, significant value = 0.000, partial Eta squared =0.285; F (1, 105) =49.919, significant value = 0.000, partial Eta squared =0.322; F (1, 105) =42.853, significant value = 0.000, partial Eta squared=0.290; F (1, 105) =42.839, significant value=0.000, partial Eta squared=0.290; F (1, 105) =42.034, significant value = 0.000, partial Eta squared =0.286; and F (1, 105) =42.032, significant value = 0.000, partial Eta squared = 0.286; F (1, 100) =49.096, significant value =0.000, partial Eta squared =0.316. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in perceptual speed scores between the control group and experimental group is significant. Hence the difference in perceptual speed scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Braincompatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing perceptual speed. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Perceptual Speed of Experimental and Control Group for Total Sample

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of perceptual speed, the test of significance

of the difference between adjusted mean was used with each ANCOVA. The details of post hoc comparison of adjusted mean scores of perceptual speed for Total sample are presented in the Table 92.

Table 92

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Perceptual Speed -Total Sample

Covariates	Experimental group (N=54)	Control group (N=54)	Mean Difference	SE	t
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	30.966	27.182	3.784*	.585	.000**
Pretest Scores of Perceptual Speed	30.888	27.260	3.628*	.513	.000**
Pretest Scores of Mathematics Anxiety	31.011	27.137	3.874*	.592	.000**
Nonverbal Intelligence	30.970	27.178	3.791*	.579	.000**
Classroom Environment	30.965	27.183	3.782*	.583	.000**
Socio Economic Status	30.968	27.180	3.787*	.584	.000**
Combined effect	30.882	27.266	3.616*	.533	.000**

**: Significant at 0.01 level of significance

Table no.92 indicate, For each covariate Pretest Scores of Problem Solving ability, Pretest Scores of Perceptual Speed, Pretest Scores of Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socioeconomic Status, and Combined effect, the table displays the adjusted means for both the experimental group and the control group, along with the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 30.966, and for the control group is 27.182, with a significant mean difference of 3.784 (SE = .585, *t* = .000**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 30.888, while the control group has an adjusted mean of 27.260, resulting in a significant mean difference of 3.628 (SE = .513, *t* = .000**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 31.011, and for the control group is 27.137, with a significant mean difference of 3.874 (SE = .592, *t* = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 30.970, and the control group has an adjusted mean of 27.178, resulting in a significant mean difference of 3.791 (SE = .579, *t* = .000**).

Classroom Environment: The adjusted mean for the experimental group is 30.965, and for the control group is 27.183, with a significant mean difference of 3.782 (SE = .583, *t* = .000**).

Socioeconomic Status: The experimental group has an adjusted mean of 30.968, and the control group has an adjusted mean of 27.180, resulting in a significant mean difference of 3.787 (SE = .584, *t* = .000**).

Combined effect: The adjusted mean for the experimental group is 30.882, and for the control group is 27.266, with a significant mean difference of 3.616 (SE = .533, *t*= .000**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of perceptual speed scores among control and experimental group when controlling covariates individually and taken together are less than 0.01 level of significance. So it can be said that the difference in adjusted mean scores is significant. When comparing adjusted means it is seen that

adjusted mean scores are comparatively high in the experimental group so it can be infer that new instructional strategy is more effective in improving perceptual speed score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Perceptual Speed of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Boys

To study the relative effectiveness of the Braincompatible learning strategy and Existing method of teaching in enhancing the perceptual speed of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed on boys. Linear adjustments were made in the posttest scores of perceptual speed for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table. The data and result of covariance analysis of perceptual speed for the boys are presented in below Table 93.

Table 93

Summary of Analysis of Covariance of Perceptual Speed - Boys

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment Inventory	SES	Combined effect
Sum of Squares	Between groups	168.273	193.902	152.804	166.425	143.245	165.215	142.815
	Within groups	502.467	352.191	505.689	499.604	490.703	507.332	296.757
Df	Between groups	1	1	1	1	1	1	1
	Within groups	47	47	47	47	47	47	42
Mean Square	Between groups	168.273	193.902	152.804	166.425	143.245	165.215	142.815
	Within groups	10.691	7.493	10.759	10.630	10.440	10.794	7.066
Total		41800.00	41800.00	41800.00	41800.00	41800.00	41800.00	41800.00
F		15.740	25.876	14.202	15.656	13.720	15.306	20.213
Sig.		.000**	.000**	.000**	.000**	.001**	.000**	.000**
Partial Eta Squared		.251	.355	.232	.250	.226	.246	.325

**: Significant at 0.01 level of significance

ANCOVA table no. 93, gives the F values corresponding to comparison of Control group and Experimental group as F (1, 47) =15.740, significant value = 0.000, partial Eta squared =0.251; F (1, 47) =25.876, significant value = 0.000, partial Eta squared =0.355; F (1, 47) =14.202, significant value = 0.000, partial Eta squared=0.232; F (1, 47) =15.656, significant value=0.000, partial Eta squared=0.250; F (1, 47) =13.720, significant value = 0.001, partial Eta squared =0.226; and F (1, 47) =15.306, significant value = 0.000, partial Eta squared = 0.246; F (1, 42) =20.213, significant value =0.000, partial Eta squared =0.325. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in perceptual speed scores between the control group and experimental group is significant. Hence the difference in perceptual speed scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing perceptual speed for boys. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Perceptual Speed of Experimental and Control Group for Boys

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of perceptual speed, the test of significance

of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of perceptual speed for boys are presented in the Table 94.

Table 94

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Perceptual Speed – Boys

Covariates	Experimental group (N=26)	Control group (N=24)	Mean Difference	SE	*t*
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	30.447	26.765	3.682*	.928	.000**
Pretest Scores of Perceptual Speed	30.580	26.622	3.959*	.778	.000**
Pretest Scores of Mathematics Anxiety	30.385	26.833	3.552*	.942	.000**
Nonverbal Intelligence	30.433	26.780	3.653*	.923	.000**
Classroom Environment Inventory	30.328	26.894	3.434*	.927	.001**
Socio Economic Status	30.439	26.774	3.666*	.937	.000**
Combined effect	30.405	26.812	3.593*	.799	.000**

**: Significant at 0.01 level of significance

Table no.94, for each covariates and their Combined effect, the table displays the adjusted means for both the experimental group and the control group, alongside the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 30.447, and for the control group is 26.765, resulting in a significant mean difference of 3.682 (SE = .928, *t* = .000**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 30.580, while the control group has an adjusted mean of 26.622, yielding a significant mean difference of 3.959 (SE = .778, *t* = .000**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 30.385, and for the control group is 26.833, with a significant mean difference of 3.552 (SE = .942, *t* = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 30.433, and the control group has an adjusted mean of 26.780, resulting in a significant mean difference of 3.653 (SE = .923, *t* = .000**).

Classroom Environment: The adjusted mean for the experimental group is 30.328, and for the control group is 26.894, with a significant mean difference of 3.434 (SE = .927, *t* = .001**).

Socioeconomic Status: The experimental group has an adjusted mean of 30.439, and the control group has an adjusted mean of 26.774, resulting in a significant mean difference of 3.666 (SE = .937, *t* = .000**).

Combined effect: The adjusted mean for the experimental group is 30.405, and for the control group is 26.812, with a significant mean difference of 3.593 (SE = .799, *t* = .000**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of perceptual speed scores of Boys among control and experimental group when controlling covariates individually and taken together are less than 0.01 level of significance. So it can be said that the difference in adjusted mean scores is significant. When comparing adjusted means it is seen that adjusted mean scores are comparatively high in the experimental group so it can

infer that new instructional strategy is more effective in improving perceptual speed score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Perceptual Speed of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Mathematics Anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Girls

To study the relative effectiveness of the Brain compatible learning strategy and Existing method of teaching in enhancing the perceptual speed of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed for girls. Linear adjustments were made in the posttest scores of perceptual speed for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of perceptual speed for girls are presented in below table 95.

Table 95

Summary of Analysis of Covariance of Perceptual Speed - Girls

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	224.477	162.119	236.315	229.117	203.308	227.425	135.780
	Within groups	433.600	375.145	427.754	426.996	433.704	436.043	361.765
Df	Between groups	1	1	1	1	1	1	1
	Within groups	55	55	55	55	55	55	50
Mean Square	Between groups	224.477	162.119	236.315	229.117	203.308	227.425	135.780
	Within groups	7.884	6.821	7.777	7.764	7.886	7.928	7.235
Total		50844.00	50844.00	50844.00	50844.00	50844.00	50844.00	50844.00
F		28.474	23.768	30.385	29.512	25.782	28.686	18.766
Sig.		.000**	.000**	.000**	.000**	.000**	.000**	.000**
Partial Eta Squared		.341	.302	.356	.349	.319	.343	.273

**: Significant at 0.01 level of significance

ANCOVA table no. 95, gives the F values corresponding to comparison of Control group and Experimental group as F (1, 55) =28.474, significant value = 0.000, partial Eta squared =0.341; F (1, 55) =23.768, significant value = 0.000, partial Eta squared =0.302; F (1, 55) =30.385, significant value = 0.000, partial Eta squared=0.356; F (1, 55) =29.512, significant value=0.000, partial Eta squared=0.349; F (1, 55) =25.782, significant value = 0.000, partial Eta squared =0.319; and F (1, 55) =28.686, significant value = 0.000, partial Eta squared = 0.343; F (1, 50) =18.766, significant value =0.000, partial Eta squared =0.273. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant. since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in perceptual speed scores between the control group and experimental group is significant. Hence the difference in perceptual speed scores among control and experimental groups is not attributed to chance due to any of the controlling variables, but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in enhancing perceptual speed for girls. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Perceptual Speed of Experimental and Control Group for Girls

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of perceptual speed, the test of significance

of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of perceptual speed for of girls are presented in the Table 96.

Table 96

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Perceptual Speed – Girls

Covariates	Experimental group (N=28)	Control group (N=30)	Mean Difference	SE	t
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	31.453	27.511	3.942*	.739	.000**
Pretest Scores of Perceptual Speed	31.198	27.749	3.449*	.707	.000**
Pretest Scores of Mathematics Anxiety	31.543	27.427	4.116*	.747	.000**
Nonverbal Intelligence	31.471	27.493	3.978*	.732	.000**
Classroom Environment	31.409	27.552	3.857*	.760	.000**
Socio Economic Status	31.464	27.501	3.963*	.740	.000**
Combined effect	31.149	27.794	3.356*	.775	.000**

**: Significant at 0.01 level of significance

Table no.96 indicate, For each covariates and combined effect, the table displays the adjusted means for both the experimental group and the control group, alongside the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 31.453, and for the control group is 27.511, resulting in a significant mean difference of 3.942 (SE = .739, *t* = .000**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 31.198, while the control group has an adjusted mean of 27.749, yielding a significant mean difference of 3.449 (SE = .707, *t* = .000**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 31.543, and for the control group is 27.427, with a significant mean difference of 4.116 (SE = .747, *t* = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 31.471, and the control group has an adjusted mean of 27.493, resulting in a significant mean difference of 3.978 (SE = .732, *t* = .000**).

Classroom Environment: The adjusted mean for the experimental group is 31.409, and for the control group is 27.552, with a significant mean difference of 3.857 (SE = .760, *t* = .000**).

Socioeconomic Status: The experimental group has an adjusted mean of 31.464, and the control group has an adjusted mean of 27.501, resulting in a significant mean difference of 3.963 (SE = .740, *t* = .000**).

Combined effect: The adjusted mean for the experimental group is 31.149, and for the control group is 27.794, with a significant mean difference of 3.356 (SE = .775, *t* = .000**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of perceptual speed scores of Girls among control and experimental group when controlling covariates individually and taken together are less than 0.01 level of significance. So it can be said that the difference in adjusted mean scores is significant.. When comparing adjusted means it is seen that adjusted mean scores are comparatively high in the experimental group so it can infer that new instructional strategy is more effective in improving perceptual speed score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Mathematics Anxiety of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Perceptual Speed, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Total Sample

To study the relative effectiveness of the Brain compatible learning strategy and Existing method of teaching in reducing the mathematics anxiety of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed on the total sample, boys and girls. Linear adjustments were made in the posttest scores of mathematics anxiety for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of mathematics anxiety for the total sample are presented in below table 97.

Table 97

Summary of Analysis of Covariance of Mathematics Anxiety -Total Sample

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	1001.227	994.524	1659.134	1013.172	980.593	944.420	1744.530
	Within groups	10254.178	10270.207	7381.277	9334.820	10297.935	10204.846	6580.340
Df	Between groups	1	1	1	1	1	1	1
	Within groups	105	105	105	105	105	105	100
Mean Square	Between groups	1001.227	994.524	1659.134	1013.172	980.593	944.420	1744.530
	Within groups	97.659	97.811	70.298	88.903	98.076	97.189	65.803
Total		780909.00	780909.00	780909.00	780909.00	780909.00	780909.00	780909.00
F		10.252	10.168	23.601	11.396	9.998	9.717	26.511
Sig.		.002**	.002**	.000**	.001**	.002**	.002**	.000**
Partial Eta Squared		.089	.088	.184	.098	.087	.085	.210

**: Significant at 0.01 level of significance

ANCOVA table no. 97 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 105) =10.252, significant value = 0.002, partial Eta squared =0.089; F (1, 105) =10.168, significant value = 0.002, partial Eta squared =0.088; F (1, 105) =23.601, significant value = 0.000, partial Eta squared=0.184; F (1, 105) =11.396, significant value=0.001, partial Eta squared=0.098; F (1, 105) =9.998, significant value= 0.002, partial Eta squared =0.087; and F (1, 105) =9.717, significant value = 0.002, partial Eta squared = 0.085;F (1, 100) =26.511, significant value =0.000, partial Eta squared =0.210. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in mathematics anxiety scores between the control group and experimental group is significant. Hence the difference in mathematics anxiety scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Braincompatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in reducing mathematics anxiety. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Mathematics Anxiety of Experimental and Control Group for Total Sample

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of mathematics anxiety, the test of

significance of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of Mathematics anxiety for Total sample are presented in the Table 98.

Table 98

Data and Results of Bonferroni's Test of post Hoc Comparison between the Adjusted Means of Mathematics Anxiety -Total Sample

Covariates	Experimental group (N=54)	Control group (N=54)	Mean Difference	SE	t
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	81.366	87.467	-6.101*	1.905	.002**
Pretest Scores of Perceptual Speed	81.378	87.455	-6.077*	1.906	.002**
Pretest Scores of Mathematics Anxiety	80.428	88.405	-7.977*	1.642	.000**
Nonverbal Intelligence	81.353	87.480	-6.127*	1.815	.001**
Classroom Environment	81.403	87.430	-6.028*	1.906	.002**
Socio Economic Status	81.456	87.378	-5.922*	1.900	.002**
Combined effect	80.285	88.548	-8.263*	1.605	.000**

**: Significant at 0.01 level of significance

For each covariate the table no. 90 provides the adjusted means for both the experimental group and the control group, alongside the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 81.366, and for the control group is 87.467, resulting in a significant mean difference of -6.101 (SE = 1.905, *t* = .002**).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 81.378, while the control group has an adjusted mean of 87.455, yielding a significant mean difference of -6.077 (SE = 1.906, *t* = .002**).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 80.428, and for the control group is 88.405, with a significant mean difference of -7.977 (SE = 1.642, *t* = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 81.353, and the control group has an adjusted mean of 87.480, resulting in a significant mean difference of -6.127 (SE = 1.815, *t* = .001**).

Classroom Environment: The adjusted mean for the experimental group is 81.403, and for the control group is 87.430, with a significant mean difference of -6.028 (SE = 1.906, *t* = .002**).

Socioeconomic Status: The experimental group has an adjusted mean of 81.456, and the control group has an adjusted mean of 87.378, resulting in a significant mean difference of -5.922 (SE = 1.900, *t* = .002**).

Combined effect: The adjusted mean for the experimental group is 80.285, and for the control group is 88.548, with a significant mean difference of -8.263 (SE = 1.605, *t* = .000**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of mathematics anxiety scores among control and experimental group when controlling covariates individually and taken together are less than 0.01 level of significance So it can be said that the difference in adjusted mean scores is significant.. When comparing adjusted means it is seen that adjusted mean scores are comparatively low in the experimental group so it can infer

that new instructional strategy is more effective in reducing mathematics anxiety than the existing teaching method.

Comparison of the Adjusted Mean Scores of Mathematics Anxiety of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Perceptual Speed, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates for Boys

To study the relative effectiveness of the Brain compatible learning strategy and Existing method of teaching in reducing mathematics anxiety of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed for boys. Linear adjustments were made in the posttest scores of mathematics for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of mathematics anxiety for boys are presented in below table 99

Table 99

Summary of Analysis of Covariance of Mathematics Anxiety - boys

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	424.162	368.263	638.894	404.563	328.786	394.052	607.339
	Within groups	3098.149	3078.893	2132.437	3154.730	3050.820	3155.928	1942.532
Df	Between groups	1	1	1	1	1	1	1
	Within groups	47	47	47	47	47	47	42
Mean Square	Between groups	424.162	368.263	638.894	404.563	328.786	394.052	607.339
	Within groups	65.918	65.508	45.371	67.122	64.911	67.147	46.251
Total		364470.00	364470.00	364470.00	364470.00	364470.00	364470.00	364470.00
F		6.435	5.622	14.082	6.027	5.065	5.868	13.131
Sig.		.015*	.022*	.000**	.018*	.029*	.019*	.001**
Partial Eta Squared		.120	.107	.231	.114	.097	.111	.238

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

ANCOVA table no.99 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 47) =6.435, significant value = 0.015, partial Eta squared =0..120; F (1, 47) =5.622, significant value = 0.022, partial Eta squared =0.107; F (1, 47) =14.082, significant value = 0.000, partial Eta squared=0.231; F (1, 47) =6.027, significant value=0.018, partial Eta squared=0.114; F (1, 47) =5.065, significant value = 0.029, partial Eta squared =0.097; and F (1, 47) =5.868, significant value = 0.019, partial Eta squared = 0.111; F (1, 42) =13.131, significant value =0.001, partial Eta squared =0.238. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.05 and 0.01 level of significance. Hence it can be said that even after controlling the effect of these covariates the difference in mathematics anxiety scores between the control group and experimental group is significant. Hence the difference in mathematics anxiety scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result. So the new instructional strategy is more effective in reducing mathematics anxiety for boys. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Mathematics Anxiety of Experimental and Control Group for Boys

To find out whether experimental and control groups differ significantly in terms of adjusted means posttest scores of mathematics anxiety, the test of significance of the difference between adjusted mean was used with each ANCOVA.

The details, of post hoc comparison of adjusted mean scores of mathematics anxiety for of boys are presented in the Table 100.

Table 100

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Mathematics Anxiety – Boys

Covariates	Experimental group (N=26)	Control group (N=24)	Mean Difference	SE	T
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	82.154	88.000	5.846*	2.305	.015*
Pretest Scores of Perceptual Speed	82.341	87.797	5.455*	2.301	.022*
Pretest Scores of Mathematics Anxiety	81.474	88.737	7.263*	1.935	.000**
Nonverbal Intelligence	82.226	87.922	5.695*	2.320	.018*
Classroom Environment	82.463	87.666	5.203*	2.312	.029*
Socio Economic Status	82.243	87.904	5.661*	2.337	.019*
Combined effect	81.404	88.813	7.409*	2.045	.001**

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

Table no.100 indicate, For each covariates and their combined effect, the table displays the adjusted means for both the experimental group and the control group, along with the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 82.154, and for the control group is 88.000, resulting in a significant mean difference of 5.846 (SE = 2.305, *t* = .015*).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 82.341, while the control group has an adjusted mean of 87.797, yielding a significant mean difference of 5.455 (SE = 2.301, t = .022*).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 81.474, and for the control group is 88.737, with a significant mean difference of 7.263 (SE = 1.935, t = .000**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 82.226, and the control group has an adjusted mean of 87.922, resulting in a significant mean difference of 5.695 (SE = 2.320, t = .018*).

Classroom Environment: The adjusted mean for the experimental group is 82.463, and for the control group is 87.666, with a significant mean difference of 5.203 (SE = 2.312, t = .029*).

Socioeconomic Status: The experimental group has an adjusted mean of 82.243, and the control group has an adjusted mean of 87.904, resulting in a significant mean difference of 5.661 (SE = 2.337, t = .019*).

Combined effect: The adjusted mean for the experimental group is 81.404, and for the control group is 88.813, with a significant mean difference of 7.409 (SE = 2.045, t = .001**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of mathematics anxiety scores of boys among control and experimental group when controlling covariates individually and taken together are less than 0.01and less than 0.05 level of significance So it can be said that the difference in adjusted mean scores is significant.. When comparing adjusted means it is seen that adjusted mean scores are comparatively low in the experimental group so it can infer that new instructional strategy is more effective in reducing mathematics anxiety score than the existing teaching method.

Comparison of the Adjusted Mean Scores of Mathematics Anxiety of Experimental and Control Group by Considering Pretest Problem Solving Ability, Pretest Perceptual Speed, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status as Covariates Girls

To study the relative effectiveness of the Brain Compatible learning strategy and Existing method of teaching in reducing mathematics anxiety of coastal area Secondary School Students after adjusting for pretest differences, ANCOVA were employed for girls. Linear adjustments were made in the posttest scores of mathematics anxiety for the individual as well as a combined effect of the covariates namely pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, Nonverbal Intelligence, Classroom Environment, Socio-Economic Status, the five ANCOVA was described in a single table The data and result of covariance analysis of mathematics anxiety for girls are presented in below table 101.

Table101

Summary of Analysis of Covariance of Mathematics Anxiety - Girls

Source of Variance		Covariates						
		Pretest problem solving	Pretest perceptual speed	Pretest mathematics anxiety	Nonverbal Intelligence	Classroom Environment	SES	Combined effect
Sum of Squares	Between groups	595.919	625.650	1046.435	626.616	448.419	596.619	905.799
	Within groups	7097.454	7069.141	5144.359	5321.936	6997.597	6940.300	4362.111
Df	Between groups	1	1	1	1	1	1	1
	Within groups	55	55	55	55	55	55	50
Mean Square	Between groups	595.919	625.650	1046.435	626.616	448.419	596.619	905.799
	Within groups	129.045	128.530	93.534	96.762	127.229	126.187	87.242
Total		416439.00	416439.00	416439.00	416439.00	416439.00	416439.00	416439.00
F		4.618	4.868	11.188	6.476	3.524	4.728	10.383
Sig.		.036*	.032*	.001**	.014*	$.066^{NS}$	.034*	.002**
Partial Eta Squared		.077	.081	.169	.105	.060	.079	.172

NS: Not significant at 0.05 level of significance

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

ANCOVA table no.101 gives the F values corresponding to comparison of Control group and Experimental group as F (1, 55) =4.618, significant value = 0.036, partial Eta squared =0.077, significant at 0.05level; F (1, 55) =4.868, significant value = 0.032, partial Eta squared =0.081, significant at 0.05 level; F (1, 55) =11.188, significant value = 0.001, partial Eta squared=0.169, significant at 0.01 level; F (1, 55) =6.476, significant value=0.014, partial Eta squared=0.105, significant at 0.05 level; F (1, 55) =3.524, significant value = 0.066, partial Eta squared =0.060, not significant at 0.05 level; and F (1, 55) =4.728, significant value = 0.034, partial Eta squared = 0.079, significant at 0.05 level; F (1, 50) =10.383, significant value =0.002, partial Eta squared =0.172, significant at 0.01 level. when considering the adjustments made on controlling the covariates pretest scores on problem solving ability, pretest scores on perceptual speed, pretest scores on mathematics anxiety, Nonverbal intelligence test score, Classroom environment inventory scores, Socio-Economic status score and combined effects of all these covariates are found to be significant since all the significant values are less than 0.05 and 0.01 level of significance except classroom environment. The influence of covariate classroom environment, with an F-value of 3.524 is not statistically significant. The significance of these F-values underscores the importance of considering these covariates in understanding the differences in the dependent variable. Hence it can be said that even after controlling the effect of these covariates the difference in mathematics anxiety scores between the control group and experimental group is significant except classroom environment. Hence the difference in mathematics anxiety scores among control and experimental groups is not attributed to chance due to any of the controlling variables but it can be said that it is because of the Brain compatible learning strategy given to the experimental group. The value of partial Eta squared also support and substantiate the result.. So the new instructional strategy is more effective in reducing mathematics anxiety for girls. To check the adjusted mean difference multiple comparison tests are conducted and the result is given below.

Post Hoc Comparison of Adjusted Means on Mathematics Anxiety of Experimental and Control Group for Girls

To find out whether experimental and control groups differ significantly in terms of adjusted mean posttest scores of mathematics anxiety, the test of significance of the difference between adjusted mean was used with each ANCOVA. The details, of post hoc comparison of adjusted mean scores of mathematics anxiety for girls are presented in the Table 102.

Table 102

Data and Results of Bonferroni's Test of Post Hoc Comparison between the Adjusted Means of Mathematics Anxiety – Girls

Covariates	Experimental group (N=28)	Control group (N=30)	Mean Difference	SE	t
	Adjusted Mean	Adjusted Mean			
Pretest Scores of Problem Solving Ability	80.626	87.049	6.423*	2.989	.036*
Pretest Scores of Perceptual Speed	80.444	87.219	6.776*	3.071	.032*
Pretest Scores of Mathematics Anxiety	79.469	88.129	8.661*	2.589	.001**
Nonverbal Intelligence	80.546	87.124	6.579*	2.585	.014*
Classroom Environment	80.985	86.714	5.729	3.051	.066NS
Socio Economic Status	80.628	87.047	6.419*	2.952	.034*
Combined effect	79.465	88.132	8.667*	2.690	.002**

NS: Not significant at 0.05 level of significance

*: Significant at 0.05 level of significance

**: Significant at 0.01 level of significance

Table no. 102 indicate, For each covariates and their combined effect, the table displays the adjusted means for both the experimental group and the control group, along with the mean difference, standard error (SE), and the corresponding *t*-value.

Pretest Scores of Problem Solving Ability: The adjusted mean for the experimental group is 80.626, and for the control group is 87.049, resulting in a significant mean difference of 6.423 (SE = 2.989, *t* = .036*).

Pretest Scores of Perceptual Speed: The experimental group has an adjusted mean of 80.444, while the control group has an adjusted mean of 87.219, yielding a significant mean difference of 6.776 (SE = 3.071, *t* = .032*).

Pretest Scores of Mathematics Anxiety: The adjusted mean for the experimental group is 79.469, and for the control group is 88.129, with a significant mean difference of 8.661 (SE = 2.589, *t* = .001**).

Nonverbal Intelligence: The experimental group has an adjusted mean of 80.546, and the control group has an adjusted mean of 87.124, resulting in a significant mean difference of 6.579 (SE = 2.585, *t* = .014*).

Classroom Environment: Although the mean difference is 5.729, the p-value (p = .066) suggests no significant difference between the experimental and control groups in this covariate.

Socioeconomic Status: The experimental group has an adjusted mean of 80.628, and the control group has an adjusted mean of 87.047, resulting in a significant mean difference of 6.419 (SE = 2.952, *t* = .034*).

Combined effect: The adjusted mean for the experimental group is 79.465, and for the control group is 88.132, with a significant mean difference of 8.667 (SE = 2.690, *t* = .002**).

The multiple comparison shows the results that all the significant values corresponding to adjusted mean scores of mathematics anxiety scores of Girls among control and experimental group when controlling covariates individually and

taken together are less than 0.01 and less than 0.05 level of significance except classroom environment. So it can be said that the difference in adjusted mean scores is significant.. When comparing adjusted means it is seen that adjusted mean scores are comparatively low in the experimental group. So it can infer that new instructional strategy is more effective in reducing mathematics anxiety score than the existing method of teaching.

From the findings of the results of mean difference analysis and analysis of covariance, it can be inferred that brain compatible learning strategy is more effective than existing method of teaching in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety of coastal area secondary school students for total sample, boys and girls.

Chapter 5

SUMMARY FINDINGS AND CONCLUSIONS

- *Study in Retrospect*
- *Major findings of the study*
- *Tenability of Hypotheses*
- *Conclusions*
- *Limitations of the Study*
- *Suggestions for Further Research*

SUMMARY FINDINGS AND CONCLUSIONS

This chapter discusses the study in brief. It covers restatement of the problem, variables, objectives, hypothesis, methodology, tools prepared and adopted and statistical techniques used for analysis of data.

Restatement of the Problem

The study was designed to compare the effect of Braincompatible learning strategy with that of the Existing method of teaching mathematics in enhancing problem solving ability, perceptual speed and reducing the mathematics anxiety of the coastal area secondary school students keeping this view in mind. The problem of the study is restated as the "**Effectiveness of Braincompatible Learning Strategy on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety among Students in Secondary Schools of Coastal Area.**"

Variables of the Study

The following independent, dependent, control and classificatory variables were selected for the study.

Independent Variable

The independent variable of the present study were two levels of instructional method.

Dependent Variables

- Problem solving ability.
- Perceptual speed.
- Mathematics Anxiety.

Control Variables

- Pre-experimental status in terms of problem solving ability in mathematics.
- Pre-experimental status in terms of perceptual speed in mathematics.
- Pre-experimental status in terms of mathematics anxiety.
- Nonverbal Intelligence.
- Socioeconomic status.
- Classroom environment

Classificatory variable

- Gender

Objectives of the Study

1. To study whether there exist any significant differences in the mean scores of problem solving ability and its sub-components (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. To study whether there exist any significant differences in the mean scores of perceptual speed and its sub-components (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithmetic operation test.) between the coastal area and non-coastal area secondary school students.
3. To study whether there exist any significant differences in the mean scores of mathematics anxiety and its sub-components (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Class room performance anxiety and Mathematics test anxiety.) between the coastal area and non-coastal area secondary school students.
4. To identify the prevailing strategies and methods in teaching mathematics and measure to overcome the constraints in implementing the strategies in teaching mathematics at the secondary level.

5. To compare the mean pretest scores, posttest scores and gain scores of the experimental group and control group in problem solving ability for the Total sample, Boys and Girls.
6. To compare the mean pretest scores, posttest scores and gain scores of the experimental group and control group in perceptual speed for the Total sample, Boys and Girls.
7. To compare the mean pretest scores, posttest scores and change scores of the experimental group and control group in mathematics anxiety for the Total sample, Boys and Girls.
8. To find out the effectiveness of Braincompatible learning strategy with that of Existing method of teaching on problem solving ability, perceptual speed and mathematics anxiety among coastal area secondary school students.

Hypotheses of the Study

1. There will be significant differences in the mean scores of problem solving ability and its subcomponents (sensing the problem, collect and classifies data, Analysis, Evaluation and Generalisation) between the coastal area and non-coastal area secondary school students.
2. There will be significant differences in the mean scores of Perceptual speed and its subcomponents (Geometric shape comparison test, Number comparison test, symbol comparison test and basic arithmetic operation test) between the coastal area and non-coastal area secondary school students.
3. There will be significant differences in the mean scores of mathematics anxiety and its subcomponents (Topics related anxiety, Concern about learning mathematics, Resolving problems in mathematics, Class room performance anxiety and Mathematics test anxiety.) between the coastal area and non-coastal area secondary school students.

4. There will be no significant difference in the mean pretest scores of the Problem solving ability of the experimental group and control group for Total sample, Boys and Girls.
5. There will be no significant difference in the mean pretest scores of Perceptual Speed of the experimental group and control group for Total sample, Boys and Girls.
6. There will be no significant difference in the mean pretest scores of Mathematics anxiety of the experimental group and control group for Total sample, Boys and Girls.
7. There will be significant difference in the mean pretest and posttest scores of Problem solving ability of the experimental group for Total sample, Boys and Girls.
8. There will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the experimental group for Total sample, Boys and Girls.
9. There will be significant difference in the mean pretest and posttest scores of Mathematics anxiety of the experimental group for Total sample, Boys and Girls.
10. There will be significant difference in the mean pretest and posttest scores of Problem solving ability of the control group for Total sample, Boys and Girls.
11. There will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the control group for Total sample, Boys and Girls.
12. There will be significant difference in the mean pretest and posttest scores of Mathematics anxiety of the control group for Total sample, Boys and Girls.
13. There will be significant difference in the mean posttest scores of Problem solving ability of the experimental group and control group for Total sample, Boys and Girls.

14. There will be significant difference in the mean posttest scores of Perceptual Speed of the experimental group and control group for Total sample, Boys and Girls.
15. There will be significant difference in the mean posttest scores of Mathematics anxiety of the experimental group and control group for Total sample, Boys and Girls.
16. There will be significant difference in the mean gain scores of Problem solving ability of the experimental group and control group for Total sample, Boys and Girls.
17. There will be significant difference in the mean gain scores of perceptual speed of the experimental group and control group for Total sample, Boys and Girls.
18. There will be significant difference in the mean gain scores of mathematics anxiety of the experimental group and control group for Total sample, Boys and Girls.
19. There will be significant difference in the adjusted mean scores of Problem solving ability of Experimental and control groups by considering Pretest Perceptual Speed, Pretest Mathematics anxiety, Non-verbal Intelligence, Class Room Environment and Socio-Economic Status as covariates for Total sample, Boys and Girls.
20. There will be significant difference in the adjusted mean scores of Perceptual Speed of the Experimental and control groups by considering Pretest Problem solving ability, Pretest Mathematics Anxiety, Non-verbal Intelligence, Class Room Environment and Socio-Economic Status as covariates for Total sample, Boys and Girls.
21. There will be significant difference in the adjusted mean scores of Mathematics anxiety between the Experimental and control groups by considering Pretest Problem solving ability, Pretest Perceptual Speed, Non-

verbal Intelligence, classroom environment and Socio-Economic Status as covariates for Total sample, Boys and Girls.

Methodology

The methodology adopted for the study is explained below in brief.

Design of the Study

The present study followed mixed methods. The preliminary survey on problem solving ability, Perceptual speed and mathematics anxiety of secondary school students; the preliminary survey of secondary school mathematics teachers and the experimental study. The researcher employed the Quasi-experimental design with the Pretest -posttest nonequivalent group design. This design incorporates one experimental group and one control group.

The present investigation aimed to compare the effectiveness of two methods of instruction on the enhancement of student's problem solving ability, perceptual speed and reduction of mathematics anxiety. The pretest-posttest nonequivalent group design of Quasi-experimental design was employed. The two groups were equated by problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socioeconomic status. The experimental group is taught through Braincompatible learning strategy and the control group is taught through the Existing method of teaching.

The layout of the design is as follows

The pretest-posttest Non-equivalent- Group design (Best & Kahn, 2006)

O1 X O2

O3 C O4

O1 O3 = pretests

O2 O4 =posttest

X exposure of the group to an experimental (treatment) variable

C exposure of a group to the control condition

O observation or test administered.

Sample of the Study

- In the preliminary survey of secondary school students, the investigator collected data from a sample of 400 Secondary school students, of which 149 were coastal area secondary school students and 251 were non-coastal areas secondary school students in Kozhikode district.
- In the preliminary survey of secondary school mathematics teachers, the investigator collected data from 30 secondary school mathematics teachers from Kozhikode district.
- In the experimental study, the two intact classes of Standard VIII were selected from two different coastal area secondary schools from the Kozhikode district. Two intact classes from Umbichy Hajee Higher Secondary School with 54 students from standard VIII were selected as experimental group and two intact classes from Government Vocational Higher Secondary School from Payyanakkal with 54 students were selected as control group respectively.

Tools used for the Study

- Questionnaire on Teacher's perception towards prevailing strategies and methods, constraints and suggestions in Teaching Mathematics (Aruna & Lisheetha, 2019).
- lesson transcript for Braincompatible learning strategy (Aruna& Lisheetha, 2020)
- Lesson Transcript for the Existing Method of Teaching (Aruna & Lisheetha, 2020)
- The Test of Problem Solving Ability. (Aruna & Lisheetha, 2019).
- Test of Perceptual Speed (Aruna & Lisheetha, 2019)
- Mathematics Anxiety Scale (Aruna & Lisheetha, 2019)

Tools Used for Equating the Groups

- Standard progressive matrices test (Raven, 1958).
- Classroom Environment Inventory (Aruna, Sureshan & Unnikrishnan, 1998.)
- Socio-Economic Status Scale (Aruna & Sumi, 2010.)

Statistical Techniques used for the Study

- ***Basic Descriptive Statistics***

  Basic descriptive statistics such as mean, median, mode, standard deviation, skewness, and kurtosis were used to calculate each variable in the study for the total sample, boys and girls separately.

- ***Mean difference Analysis***

  Mean difference analysis was used in the preliminary survey for analyzing the variables component wise and in the experimental study it was employed to check whether there exists any significant difference between the experimental group and control group.

- ***Percentage Analysis***

  Percentage analysis was used to find out teacher's perceptions towards prevailing strategies, methods and constraints in teaching mathematics.

- ***Single Factor ANCOVA***

  Single factor ANCOVA was employed to study the main effect of the independent variable and to avoid the unnecessary influence of the other uncontrolled independent variables.

- ***Effect Size. (Cohen's d and Partial Eta Squared)***

  Effect size is a simple way of quantifying the effectiveness of a particular intervention relative to some comparison and may therefore said to be a true

measure of the significance of the difference. It is an important tool in reporting and interpreting effectiveness, (Cohen's d. 2002)

- ***Bonferroni's Post Hoc Analysis***

  Bonferroni's Post Hoc analysis was conducted to find out the statistical significance of the dependent variable by controlling the covariates.

Major Findings of the Study

Both the quantitative and qualitative analysis of data and findings of the study are sequentially presented below.

The findings are mainly summarized in three heads (i)Findings of the preliminary survey on problem solving ability, perceptual speed and mathematics anxiety of secondary school students.(ii) Findings of the preliminary survey of secondary school mathematics teachers and (iii) findings of the experiment.

Findings of the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

The preliminary survey was conducted to compare the problem solving ability, perceptual speed and mathematics anxiety of Secondary school students between coastal area and non-coastal area. Following are the results of the preliminary survey.

The Comparison of Problem Solving Ability and its Subcomponents between Coastal Area and Non-Coastal Area Secondary School Students

The mean difference scores of Problem solving ability between Coastal area and non-coastal area secondary school students obtained is 6.918 Found to be significant at 0.01 level. This reveals that there exist significant difference in the mean scores of coastal areas secondary school students and non-coastal area

secondary school students for the total sample. The mean difference score of problem solving ability based on coastal area and non-coastal area are given below.

Total sample

($M_{\text{coastal area}} = 20.153$; $M_{\text{Noncoastal area}} = 23.972$; $t=6.918$; $p<0.01$)

Component-wise mean difference analysis of problem solving ability between coastal area and non-coastal area are as follows

Sensing the problem

($M_{\text{coastal area}}=4.853$; $M_{\text{Non-coastal area}}=5.248$;$t=2.647$; $p<0.05$)

Collect and classifies data.

($M_{\text{coastal area}} = 3.940$; $M_{\text{Non-coastal area}} = 5.232$; $t=8.144$;$p<0.01$)

Analysis

($M_{\text{coastal area}} = 3.600$; $M_{\text{Non-coastal area}} = 4.228$; $t=3.758$; $p<0.01$)

Evaluation

($M_{\text{coastal area}} = 5.220$; $M_{\text{Non-coastal area}} = 5.896$; $t=3.447$; $p<0.001$)

Generalisation

($M_{\text{coastal area}} = 2.540$; $M_{\text{Non-coastal area}} = 3.368$; $t=5.049$; $p<0.01$)

The result shows the problem solving ability of the total sample of students from coastal area and noncoastal area secondary school indicating a statistically significant difference at the 0.01 level.

The problem solving ability components such as sensing the problem Indicate a significant difference at 0.05 level and all other components such as, collect and classify data, analysis, evaluation and generalization indicating statistically significant difference at 0.01 level.

Hence the level of problem solving ability for the total sample and component-wise indicated statistically significant difference and students from

noncoastal area secondary schools demonstrate significantly higher problem solving ability compared to students from coastal area secondary schools in total and in component-wise.

From (fig.no.3 & fig. no.4), the graphical representation of mean difference analysis. The X-axis of the graph represents the components of the variable problem solving ability (sensing the problem, collect and classifies data, analysis, evaluation and generalisation) of two groups- coastal area students and Non coastal area students. The Y axis represents the mean scores of the components of the variable problem solving ability of two groups. The mean scores of the Non-coastal area samples were higher than those of the coastal area sample for the components of the variable problem solving ability. For total sample, The X axis of the graph represents the variable problem solving ability of two groups. The Y axis represents the mean scores of problem solving ability of two groups for total sample. So it can be conclude that Non coastal area secondary students have higher problem solving ability in total and in component wise as compared to the coastal area secondary students.

Comparison of Perceptual Speed and its Component between Coastal Area and Non-coastal Area Secondary School Students

The mean difference scores of Perceptual speed between Coastal area and non-coastal area secondary school students obtained is 26.010 Found to be significant at 0.01 level. This reveals that there is significant difference in the mean scores of coastal areas secondary school students and non-coastal area secondary school students for the total sample. The mean difference score of perceptual speed between coastal area and non-coastal area are given below.

Total sample

($M_{\text{coastal area}} = 17.113$; $M_{\text{Non-coastal area}} = 29.092$; $t = 26.010$; $p<0.01$)

Component-wise mean difference analysis of perceptual speed between coastal area and non- coastal area are as follows

Geometrical shape comparison

$M_{\text{coastal area}} = 3.913$; $M_{\text{Non-coastal area}} = 7.672$; $t = 22.103$; $p<0.01$)

Number comparison

($M_{\text{coastal area}} = 3.820$; $M_{\text{Non-coastal area}} = 6.892$; $t = 18.488$; $p<0.01$)

Symbol comparison

($M_{\text{coastal area}} = 3.393$; $M_{\text{Non-coastal area}} = 5.808$; $t = 11.565$; $p<0.01$)

Basic arithmetic operation

($M_{\text{coastal area}} = 5.987$; $M_{\text{Non-coastal area}} = 8.720$; $t = 13.044$; $p<0.001$)

The result shows that perceptual speed of the total sample of students from coastal area and noncoastal area secondary schools indicating a statistically significant difference at the 0.01 level.

The perceptual speed components of sub-tests such as geometrical shape comparison, Number comparison, symbol comparison and basic arithmetic operation Indicating statistically significant difference at 0.01 level.

Hence the level of perceptual speed for the total sample and in component-wise indicates statistically significant difference at 0.01 level and students from noncoastal area secondary schools demonstrate significantly higher perceptual speed compared to students from coastal area secondary schools in total and component-wise.

From (fig no.5, & fig no. 6), the graphical representation of mean difference analysis. The X-axis of the graph represents the components of the variable perceptual speed (shape comparison test, number comparison test, symbol comparison test and basic arithmetic operation test) of two groups. Coastal area students and Non coastal area students. The Y axis represents the mean scores of the components of the variable perceptual speed of two groups. The mean scores of the Non-coastal area samples were higher than those of the coastal area sample for the components of the variable

perceptual speed. For total sample the X axis of the graph represents the variable perceptual speed of two groups. The Y axis represents the mean scores of perceptual speed of two groups for total sample. So it can be conclude that Non coastal area secondary students have higher perceptual speed in total and in component wise as compared to the coastal area secondary students.

Comparison of Mathematics Anxiety and its Components for the Coastal Area and Non-coastal Area Secondary School Students

The mean difference in scores of mathematics anxiety between coastal area and non-coastal area secondary school students was 5.376, which was found to be significant at 0.01 level. This reveals a significant difference in the mean scores of coastal areas secondary school students and non-coastal area secondary school students for the total sample. The mean difference score of mathematics anxiety between the coastal and non-coastal areas is given below.

Total sample

($M_{\text{coastal area}} = 103.347$; $M_{\text{Non-coastal area}} = 96.168$; $t=5.376$; $p<0.01$)

Component-wise mean difference analysis mathematics anxiety between coastal areas and noncoastal areas are as follows

Topics related anxiety

($M_{\text{coastal area}} = 18.613$; $M_{\text{Non-coastal area}} = 16.872$; $t=4.526$; $p<0.05$)

Concern about learning mathematics

($M_{\text{coastal area}} = 20.253$; $M_{\text{Non-coastal area}} = 18.680$; $t=3.330$; $p<0.01$)

Resolving problems in mathematics

($M_{\text{coastal area}} = 20.513$; $M_{\text{Non-coastal area}} = 19.628$; $t=2.881$; $p<0.01$)

Classroom performance anxiety

($M_{\text{coastal area}} = 22.660$; $M_{\text{Non-coastal area}} = 20.436$; $t=6.581$; $p<0.01$)

Mathematics test anxiety

($M_{\text{coastal area}} = 21.307$; $M_{\text{Non-coastal area}} = 20.552$; $t=2.121$; $p<0.05$)

The result shows that mathematics anxiety for the total sample of students from coastal areas and non coastal area secondary schools indicates a statistically significant difference at the 0.01 level.

The mathematics anxiety component such as mathematics test anxiety Indicates a significant difference at 0.05 level and all other components such as Topic-related anxiety, concern about learning mathematics, resolving problems in mathematics and classroom performance anxiety indicating a statistically significant difference at 0.01 level.

Hence the level of mathematics anxiety for the total sample and component-wise indicated statistically significant difference and students from noncoastal area secondary schools demonstrated significantly lower mathematics anxiety as compared to students from coastal area secondary schools in total and component-wise.

From (fig.no.7 & fig.no.8), the graphical representation of mean difference analysis; The X-axis of the graph represents the components of the variable mathematics anxiety (Topics related anxiety, concern about learning mathematics, resolving problems in mathematics, class room performance anxiety and mathematics test anxiety) of two groups ;coastal area students and Non-coastal area students. The Y axis represents the mean scores of the components of the variable mathematics anxiety of two groups. The mean scores of the Non-coastal area samples were lower than those of the coastal area sample for the components of the variable mathematics anxiety. For total sample the X axis of the graph represents the variable mathematics anxiety of two groups. The Y axis represents the mean scores of mathematics anxiety of two groups for total sample. So, it can be concluded that Non-coastal area secondary students have lower mathematics anxiety in total and in component wise as compared to the coastal area secondary students.

Findings of the Preliminary Survey of Secondary School Mathematics Teachers

The preliminary survey was conducted to identify the prevailing strategies and methods adopted for teaching mathematics at the secondary school level, its constraints and suggestive measures to overcome the constraints. Following are the results of the Preliminary survey of secondary school mathematics teachers.

Prevailing Strategies and Methods Adopted for Teaching Mathematics at the Secondary Level

The questionnaire administrator during the preliminary survey of secondary school mathematics teachers revealed that the mathematics teachers were already practiced or at least aware of the majority of the strategies to teach mathematics. The most Practiced methods and strategies were**.**

- Assignments (97%)
- Problem solving (93%)
- Project (90%)
- Activity oriented (87%)
- Inductive -deductive (80%)
- Group instruction (80%)
- Problem based learning (77%)
- Seminars (77%)
- Analytic-synthetic (77%)
- Laboratory (77%)
- Computer assisted learning instruction (67%)
- Individualized instruction (67%)
- Co-operative learning (60%)
- Mentoring (53%)
- Heuristic (53%)

- Inclusive instruction (50%)
- Discovery (50%)

The least practiced methods and strategies were

- Blended learning (30%).
- Team teaching (30%).
- Mind maps (17%).
- Integrated instruction (17%).
- Graphic organizers (13%).
- Explicit instruction (13%).
- Collaborative learning (13%).
- Braincompatible learning (0%).

The mathematics teachers were aware of the benefits of these instructional methods and strategies

Constraints Experienced by the Mathematics Teachers at the Secondary Level

In this Session, the mathematics teachers revealed the constraints they felt while adopting these strategies and methods in their classrooms. Those constraints were categorized under three heads. They are from the part of students, From the part of teachers and general constraints. The major hindrances identified were

- Pre-requisite skills of students (87%)
- Time of reflection (83%)
- Lack of effort and interest by students (83%)
- Learning experience and resources (43%)
- Expert teachers (37%)
- Self-motivation (33%)
- Lack of training (17%)

Suggestive Measures to Overcome the Constraints and Alternative Solutions for Effective Teaching of Mathematics at the Secondary Level

In this session, the investigator obtained responses regarding the measures to overcome the constraints in implementing strategies and alternative solutions for effective teaching from mathematics teachers at the secondary level. The details are given below

- After covid pandemic lot of changes happened in children so bringing them back to education is a very difficult task for teachers. So we need to adopt different strategies and methods for teaching.
- For learning mathematics, it is necessary to have some basic qualities like attention, interest, patience and the basics of mathematics. In this generation, very few children have these minimum qualities and most of the children lack these basic qualities of learning mathematics so it is necessary to give importance to building such basic qualities among children of this generation
- Restrict the class strength to 1:15 or 1:20.
- Reduce the syllabus and textbook content.
- increase the duration of the class period from 40 minutes to one hour
- Revise the mathematics textbook, while revising the textbook give more importance to the exercise part of the textbook, give more problems based on the same models explained in the lesson; which will help the learners to understand the methods of solving the problems, learn the content thoroughly and students can improve their problem solving abilities.
- Provide proper training to teachers in new instructional strategies and ICT-based education.

Findings of Experiment

The following are the results of the experiment conducted to study the effectiveness of Braincompatible learning strategy in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety of coastal area secondary school students.

Mean Difference Analysis

Mean difference analysis was done to check whether there exists any significant difference between experimental and control groups on problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socioeconomic status among coastal area secondary school students.

Findings of Mean Difference Analysis Based on the Pretest Scores. Mean difference analysis based on the pretest scores of Experimental and control groups was carried out and the result and findings are given below

- Problem Solving Ability.

  Total pretest (M_{Exp}=16.630; M_{Ctrl}=16.296; t=0.621;p>0.05)

  Boys pretest (M_{Exp}=16.539; M_{Ctrl} = 16.083; t=0.513; p>0.05)

  Girls pretest (M_{Exp}=16.714; M_{Ctrl} = 16.467; t=0.376; p>0.05)

- Perceptual Speed

  Total pretest (M_{Exp}=26.185; M_{ctrl}=25.926; t=0.541; p>0.05)

  Boys pretest (M_{Exp}=24.615; M_{Ctrl} = 25.042; t=0.641; p>0.05)

  Girls pretest (M_{Exp}=27.643; M_{Ctrl} = 26.633; t=1.874; p>0.05)

- Mathematics Anxiety

  Total pretest (M_{Exp}=91.519; M_{Ctrl} = 88.833; t=1.938; p>0.05)

  Boys pretest (M_{Exp}=93.423; M_{Ctrl} = 91.375; t=1.206; p>0.05)

  Girls pretest (M_{Exp} = 89.750; M_{Ctrl} = 86.800; t=1.461; p>0.05)

- Non-verbal Intelligence

  Total pretest (M_{Exp}=43.833; M_{Ctrl} = 43.556; t=0.186; p>0.05)

  Boys pretest (M_{Exp} = 43.231; M_{Ctrl}=42.833; t=0.179; p>0.05)

  Girls pretest (M_{Exp}=44.393; M_{Ctrl} = 44.133; t = 0.127; p>0.05)

- Class Room Environment

  Total pretest (M_{Exp} = 33.926; M_{Ctrl} = 34.111; t=-0.191; p>0.05)

  Boys pretest (M_{Exp} =29.769; M_{Ctrl} = 31.250; t=1.150; p>0.05)

  Girls pretest (M_{Exp} =37.786; M_{Ctrl} = 36.400; t=1.832; p>0.05)

- Socio-Economic Status

  Total pretest (M_{Exp} = 43.982; M_{Ctrl}=44.630; t=-0.519; p>0.05)

  Boys pretest (M_{Exp}=43.846; M_{Ctrl} = 45.417; t=0.847; p>0.05)

  Girls pretest (M_{Exp} = 44.107; M_{Ctrl} = 44.000; t=0.063; p>0.05)

The findings of mean difference analysis suggest that the t values obtained by comparing the Experimental and control groups were not significant at 0.05 level. Hence it can be concluded that there exists no significant difference in the mean pretest scores of problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socioeconomic status of the experimental group and control group for the total sample, boys and girls.

From (fig.no.9 to fig no.26), The graphical representation of mean difference analysis evident that the bar charts used to compare the difference in the mean pretest scores of the two groups, Experimental and control group for the variables problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socioeconomic status for total sample, boys and girls; the X axis of the graph represents the variables of two groups; the Y axis represents the mean pretest scores of the variables of two groups for total sample, boys and girls. So it can be conclude that the graphical representation of mean pretest scores of variables of experimental and control groups shows that there is no significant difference in the

mean pretest scores of problem solving ability, perceptual speed, mathematics anxiety, nonverbal intelligence, classroom environment and socio economic status for total sample, boys and girls between the Experimental and control groups. Hence the coastal area secondary school students in the experimental and control group are almost equal for Total sample, boys and girls. Hence the graphical representation also supports the result of mean difference analysis of pretest scores of the variables of the Experimental and control group for total sample, boys and girls.

Findings of Mean Difference Analysis based on the Posttest Scores. The mean difference analysis based on the posttest scores of Experimental and Control groups was carried out and the results and findings are given below.

- Problem Solving Ability

  Total posttest (M_{Exp}=20.333; M_{Ctrl}=17.426; t=4.032; p<0.01)

  Boys posttest (M_{Exp}=19.885; M_{Ctrl} = 17.000; t=2.598; p<0.05)

  Girls posttest (M_{Exp}=20.750; M_{Ctrl} = 17.767; t=3.621; p<0.01)

- Perceptual Speed

  Total posttest (M_{Exp}=30.963; M ctrl=27.185; t=6.502; p<0.01)

  Boys posttest (M_{Exp}=30.423; M_{Ctrl} = 26.792; t=3.942; p<0.01)

  Girls posttest (M_{Exp}=31.464; M_{Ctrl} = 27.500; t=5.404 ; p<0.01)

- Mathematics Anxiety

  Total posttest (M_{Exp}=81.407; M_{Ctrl} = 87.426; t=3.172; p<0.01)

  Boys posttest (M_{Exp}=82.231; M_{Ctrl} = 87.917; t=2.477; p<0.05)

  Girls posttest (M_{Exp} = 80.643; M_{Ctrl} = 87.033; t=2.159; p<0.05)

The t-values obtained by comparing the mean Posttest scores of the Experimental and Control groups are significant. Hence it can be concluded that there exists a significant difference in problem solving ability, perceptual speed and mathematics anxiety for the Total sample, Boys and girls.

From (fig. no. 45 to fig. no. 53) The graphical representation used to compare the difference in the mean posttest scores among two groups ;Experimental and Control group for the variables problem solving ability, perceptual speed and mathematics anxiety for total sample, boys and girls; the X axis of the graph represents the two groups of the variables problem solving ability, perceptual speed and mathematics anxiety; the Y axis represents the mean posttest scores of the variables problem solving ability, perceptual speed and mathematics anxiety of two groups, experimental group and Control group. So it can be conclude that the graphical representation of mean posttest scores of problem solving ability of the experimental and Control group shows that there exist significant difference in the mean posttest scores of problem solving ability, perceptual speed and mathematics anxiety between the two groups. The mean posttest scores of the problem solving ability and perceptual speed of the Experimental group is greater than compared to the mean posttest score of Control group and mean posttest scores of mathematics anxiety is lower than the experimental group compared to the control group. Hence the graphical representation also supports the result of mean difference analysis of posttest scores of the variables of the Experimental and control group for total sample, boys and girls.

Findings of Mean Difference Analysis based on Gain Scores. Mean difference analysis based on the Gain scores of Experimental and Control groups were carried out and the results and findings are given below.

- Problem Solving Ability.

  Total gain score (M_{Exp}=3.704; M_{Ctrl}=1.130; t=3.592; p<0.01; d=0.990; Large)

  Boys gain score (M_{Exp}=3.346; M_{Ctrl} = 0.917; t=2.474; p<0.05; d=0.701; Medium)

  Girls gain score (M_{Exp}=4.036; M_{Ctrl} = 1.300; t=2.621; p<0.05; d=0.681; Medium)

- Perceptual Speed

  Total gain score (M_{Exp}=4.778; M ctrl=1.259; t=6.412; p<0.01; *d*=1.153; Large)

  Boys gain score (M_{Exp}=5.808; M_{Ctrl} = 1.750; t=5.187; p<0.01; *d*=1.464; Large)

  Girls gain score (M_{Exp}=3.821; M_{Ctrl} = 0.867; t=4.051; p<0.01; *d*=1.072; Large)

- Mathematics Anxiety

  Total change score (M_{Exp}=10.111; M_{Ctrl}= 1.407; t=5.277 ; p<0.01; *d*=1.304; Large)

  Boys change score (M_{Exp}=11.192; M_{Ctrl}= 3.458; t=4.014; p<0.01; *d*=1.144; Large)

  Girls change score (M_{Exp} = 9.107; M_{Ctrl}=-0.233; t=3.647; p<0.01; *d*=0.953; Large)

The t-values obtained by comparing the Mean Gain scores of problem solving ability, perceptual speed and Mean Change scores of mathematics Anxiety of coastal area secondary school students, are significant at.01 and.05 levels. Hence it can be concluded that there exists a significant difference in the mean gain scores of problem solving ability, perceptual speed and mean change scores in mathematics anxiety of coastal area secondary school students for the total sample, boys, and girls.

From (fig. no. 54 to fig.no.62), The graphical representation used to compare the difference in the mean gain scores among two groups ;Experimental and Control group for the variables problem solving ability, perceptual speed and mean change score of mathematics anxiety for total sample, boys and girls; the X axis of the graph represents the Experimental and control group for the variables

problem solving ability, perceptual speed and mathematics anxiety; the Y axis represents the mean gain scores of the variable problem solving ability, perceptual speed and mean change score of the variable mathematics anxiety of two groups, experimental group and Control group. so it can be conclude that the graphical representation of the comparison of gain scores of problem solving ability, perceptual speed and change scores of mathematics anxiety of the experimental and Control group for total sample, boys and girls shows that there exist significant difference in the mean gain scores of problem solving ability, perceptual speed and change scores in mathematics anxiety between the two groups. The mean gain scores of the problem solving ability, perceptual speed and mean change score of mathematics anxiety of the Experimental group is higher than the mean gain/change scores of Control group for total sample, boys and girls. Hence the graphical representation also supports the result of mean difference analysis of gain/change scores of the variables of the Experimental and control group for total sample, boys and girls.

Hence it can be concluded from the summary of the t-test values, that the t-values obtained for the pre- test did not indicate any significant difference. Hence it is concluded that the Experimental and Control groups are similar in terms of problem solving ability, perceptual speed and mathematics anxiety for the Total sample, boys and girls.

The t-values obtained for the posttest were found significant difference. The inference can be concluded that the Experimental group were compared to higher than the Control group in terms of problem solving ability, perceptual speed and lower in mathematics anxiety for the Total sample, boys and girls.

The t-values obtained for the gain/change scores were found significant differences. The inference can be concluded that the Experimental group found more improved than the Control group in terms of problem solving ability, perceptual speed and reduction of mathematics anxiety for the Total sample, boys and girls.

Braincompatible Learning Strategy is effective in enhancing the Problem Solving Ability of coastal area secondary school students for the Total sample, Boys and Girls belonging to the Experimental group

The posttest score in problem solving ability belonging to the coastal area secondary school students is greater than the pretest scores for the Total sample, boys and girls which indicates the improvement in problem solving ability after the intervention. The difference is significant between mean pretest and posttest scores of problem solving ability for the Total sample, boys, and girls.

Total pretest and posttest

$(M_{Pre} = 16.6301; M_{Post}=20.333; t(54) = 6.212; p<0.01)$

Boys pretest and posttest

$(M_{Pre} = 16.539; M_{Post}=19.885; t(26) = 4.815; p<0.01)$

Girls pretest and posttest

$(M_{Pre}=16.714; M_{Post}= 20.750; t(28) = 4.203; p<0.01)$

From (fig no. 27, fig. no. 28 and fig. no. 29) the graphical representation used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable problem solving ability for total sample, boys and girls; the X axis of the graph represents the two tests of the variable problem solving ability. The Y axis represents the mean pretest and posttest scores of the variable problem solving ability of the Experimental group for total sample, boys and girls. So it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of experimental group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the experimental group. The mean posttest scores of the experimental group is greater than the mean pretest score for total sample, boys and girls. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Experimental group for the total sample, boys and girls.

Hence it can be summed up by stating that the Braincompatible learning strategy is effective in enhancing the problem solving ability of the coastal area secondary school students for the Total sample, boys, and girls.

Braincompatible Learning Strategy is effective in enhancing the Perceptual Speed of coastal area secondary school students for the Total sample, Boys, and Girls belonging to the Experimental group

The posttest score in perceptual speed belonging to the coastal area secondary school students is greater than the pretest scores for the Total sample, boys, and girls which indicate the improvement in perceptual speed after intervention. The difference is significant between mean pretest and posttest scores of perceptual speed for the Total sample, boys and girls.

Total pretest and posttest

$(M_{Pre} = 26.185; M_{Post}=30.963; t(54) = 13.794; p<0.01)$

Boys pretest and posttest

$(M_{Pre} = 24.615; M_{Post} = 30.423; t(26) = 11.561; p<0.01)$

Girls pretest and posttest

$(M_{Pre}=27.643; M_{Post}= 31.464; t(28) = 9.357; p<0.01)$

From (fig no.30, fig.no.31 and fig.no.32) the graphical representation used to compare the difference in the mean scores among two tests; pretest and posttest of the Experimental group for the variable perceptual speed for total sample, boys and girls; the X axis of the graph represents the two tests of the variable perceptual speed; the Y axis represents the mean pretest and posttest scores of the variable perceptual speed of the Experimental group for total sample, boys and girls. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of experimental group shows that there exist significant difference in the mean pretest and posttest scores of perceptual speed in the experimental group. The mean posttest scores of the experimental group is greater

than the mean pretest scores for total sample, boys and girls. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Experimental group for the total sample, boys and girls.

Hence it can be summed up by stating that the Braincompatible learning strategy is effective in enhancing the perceptual speed of the coastal area secondary school students for the Total sample, boys and girls.

Braincompatible Learning Strategy is effective in reducing Mathematics Anxiety of coastal area secondary school students for the Total sample, Boys, and Girls belonging to the experimental group.

The posttest score in mathematics anxiety belonging to the coastal area secondary school students is less than the pretest scores for the Total sample, boys, and girls, which indicates the reduction in mathematics anxiety after intervention. The difference is significant between mean pretest and posttest scores of mathematics anxiety for the Total sample, boys and girls.

Total pretest and posttest

$$(M_{Pre} = 91.519; M_{Post}=81.407; t(54) = -7.692; p<0.01)$$

Boys pretest and posttest

$$(M_{Pre} = 93.423; M_{Post}=82.231; t(26) = 7.338; p<0.01)$$

Girls pretest and posttest

$$(M_{Pre}=89.750; M_{Post}=80.643; t(28) = 4.31; p<0.01)$$

From (fig no.33, fig.no.34. and fig.no.35) the graphical representation used to compare the difference in the mean scores among two tests- Pretest and posttest of the Experimental group for the variable mathematics anxiety for total sample, boys and girls. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean pretest and posttest scores of the variable mathematics anxiety of the Experimental group for total sample, boys

and girls. So it can be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of experimental group shows that there exist significant difference in the mean pretest and posttest scores of mathematics anxiety in the experimental group. The mean posttest scores of the experimental group is lower than the mean pretest score for total sample, boys and girls. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Experimental group for the total sample, boys and girls..

Hence it can be summed up by stating that the Braincompatible learning strategy is effective in reducing the mathematics anxiety of the coastal area secondary school students for the Total sample, boys, and girls.

The Existing Method of Teaching is effective in enhancing Problem Solving Ability of coastal area secondary school students for the Total sample, Boys and Girls belonging to the Control group.

The mean pretest scores and posttest scores of Problem solving ability of the control group for the total sample, boys and girls are as follows

Total pretest and posttest

(M_{Pre} = 16.296; M_{Post}=17.426; t (54) = 2.824; p<0.01)

Boys pretest and posttest

(M_{Pre} = 16.083; M_{Post}=17.000; t (24) = 1.326; p> 0.05)

Girls pretest and posttest

(M_{Pre}=16.467; M_{Post}=17.767; t (30) = 2.809; p<0.01)

From the findings, there exists a significant difference in the mean pretest and posttest scores of problem solving ability of the control group for the total sample and girls, but there exists no significant difference in the problem solving ability of boys of coastal area secondary school.

The mean posttest scores of problem solving ability of coastal area secondary school students belonging to the experimental group are greater than the mean pretest scores of problem solving ability of total sample, boys and girls. Hence Braincompatible learning strategy is effective in enhancing problem solving ability of coastal area secondary school students.

From (fig. no. 36, fig.no.37 and fig.no.38), the graphical representation used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable problem solving ability for Total sample, boys and girls; the X axis of the graph represents the two tests of the variable problem solving ability..The Y axis represents the mean scores of the two tests; of the variable problem solving ability of the Control group. so it can be conclude that the graphical representation of mean pretest and posttest scores of problem solving ability of Control group shows that there is significant difference in the mean pretest and posttest scores of problem solving ability in the control group for total sample and girls. For boys there is no significant difference in the mean pretest and posttest scores of the variable problem solving ability. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable problem solving ability of the Control group for the total sample, boys and girls.

The Existing method of Teaching is effective in enhancing the perceptual speed of coastal area secondary school students for the Total sample, Boys, and Girls belonging to the control group.

The mean pretest scores and posttest scores of the perceptual speed of the control group for the total sample, boys and girls are as follows

Total pretest and posttest

($M_{Pre} = 25.926$; M Post=27.185; $t(54) = 2.959$; $p<0.01$)

Boys pretest and posttest

(M_{Pre} = 25.042; M_{Post}=26.792; t (24) = 2.889; p<0.01)

Girls pretest and posttest

(M_{Pre}=26.633; M_{Post}=27.500; t (30) = 1.463; p> 0.05)

From the findings, there exists a significant difference in the mean pretest and posttest scores of perceptual speed of the control group for the total sample and boys; but there exists no significant difference in the perceptual speed of girls of coastal area secondary school.

The mean posttest scores of the perceptual speed of coastal area secondary school students belonging to the experimental group are greater than the mean pretest scores of the perceptual speed for the total sample, boys and girls. Hence Braincompatible learning strategy is effective in enhancing the perceptual speed of coastal area secondary school students.

From (Fig.no. 39, fig.no.40 and fig.no.41), the graphical representation used to compare the difference in the mean scores among two tests; pretest and posttest of the Control group for the variable perceptual speed for Total sample, boys and girls; the X axis of the graph represents the two tests of the variable perceptual speed.. The Y axis represents the mean scores of the two tests; of the variable perceptual speed of the Control group for total sample, boys and girls. So it can be conclude that the graphical representation of mean pretest and posttest scores of perceptual speed of Control group shows that there is significant difference in the mean pretest and posttest scores of perceptual speed in the control group for total sample and boys but there is no significant difference in girls for the variable perceptual speed. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable perceptual speed of the Control group for the total sample, boys and girls.

The Existing method of Teaching is effective in reducing mathematics anxiety of coastal area secondary school students for the Total sample, Boys and Girls belonging to the control group.

The mean pretest scores and posttest scores of mathematics anxiety of the control group for the total sample, boys and girls are as follows

Total pretest and posttest

$(M_{Pre} = 88.833; M_{Post}=87.426; t(54) = 1.413; p> 0.05)$

Boys pretest and posttest

$(M_{Pre} = 91.375; M_{Post}=87.917; t(24) = 3.045; p<0.01)$

Girls pretest and posttest

$(M_{Pre}=86.800; M_{Post}=87.033; t(30) = 0.156; p> 0.05)$

From the findings, there exists no significant difference in the mean pretest and posttest scores of mathematics anxiety of the control group for the total sample and girls; but there exists significant difference in the mathematics anxiety of boys of coastal area secondary school.

The mean posttest scores of mathematics anxiety of coastal area secondary school students belonging to the experimental group are lower than the mean pretest scores of mathematics anxiety of the total sample, boys and girls. Hence Braincompatible learning strategy is effective in reducing the mathematics anxiety of coastal area secondary school students.

From (fig. no. 42, fig.no.43 and fig.no.44), the graphical representation used to compare the difference in the mean scores among two tests. Pretest and posttest of the Control group for the variable mathematics anxiety for Total sample, boys and girls. The X axis of the graph represents the two tests of the variable mathematics anxiety. The Y axis represents the mean scores of the two tests; of the variable mathematics anxiety of the Control group for total sample, boys and girls. So it can

be conclude that the graphical representation of mean pretest and posttest scores of mathematics anxiety of Control group shows that there exist significant difference in the mean pretest and posttest scores of mathematics anxiety in the control group for boys only. But there is no significant difference in the variable mathematics anxiety for total sample and girls. Hence the graphical representation also supports the result of mean difference analysis of pretest and posttest scores of the variable mathematics anxiety of the Control group for the total sample, boys and girls.

Braincompatible learning strategy is more effective than the Existing method of teaching in enhancing problem solving ability of coastal area secondary school students for Total sample, Boys and Girls

Test of significance of the difference between mean pretest scores of problem solving ability belonging to the Experimental and Control groups of coastal area secondary school students indicate that the difference between the Experimental and Control groups is not significant for the Total sample, Boys and Girls. Hence the Experimental and Control groups are similar in their pre-experimental status in problem solving ability for the Total sample, boys and girls.

Total pretest (M_{Exp}=16.630; M_{Ctrl}=16.296; t(108)=0.621; p>0.05)

Boys pretest (M_{Exp}=16.539; M_{Ctrl}= 16.083; t(50)=0.513; p>0.05)

Girls pretest (M_{Exp}=16.714; M_{Ctrl}= 16.467; t (58)=0.376; p>0.05)

The posttest score of problem solving ability belonging to the Experimental group of coastal area secondary school students is greater than the posttest scores of the control group of coastal area secondary school students for the Total sample, boys and girls which indicates the improvement in problem solving ability after intervention. The difference is significant between mean pretest and posttest scores of problem solving ability for the Total sample, boys and girls.

Total posttest (M_{Exp}=20.333; M_{Ctrl}=17.426; t (108)=4.032; p<0.01)

Boys posttest (M_{Exp}=19.885; M_{Ctrl} = 17.000; t(50)=2.598; p<0.05)

Girls posttest (M_{Exp}=20.750; M_{Ctrl} = 17.767; t(58)=3.621; p<0.01)

The mean gain scores of the Experimental group in problem solving ability is greater than the Control group for the Total sample, boys and girls. The mean gain scores indicate the improvement after the intervention for the Experimental and Control group. There was statistical significance in the mean difference analysis for the Total sample, boys, and girls. It can be inferred from the effect size calculations and Cohen's d that the effect of Braincompatible learning strategy in enhancing the problem solving ability of coastal area secondary school students is large when compared to the existing method of teaching for Total sample but the effect is medium for boys and girls.

Total gain score

(M_{Exp}=3.704; M_{Ctrl}=1.130; t(108)=3.592; p<0.01; d=0.990; Large)

Boys gain score

(M_{Exp}=3.346; M_{Ctrl} = 0.917; t(50)=2.474; p<0.05; d=0.701; Medium)

Girls gain score

(M_{Exp}=4.036; M_{Ctrl} = 1.300; t(58)=2.621; p<0.05; d=0.681; Medium)

From (fig. no. 54, fig.no.55 and fig.no.56), the graphical representation used to compare the difference in the mean gain scores among two groups. Experimental and Control group for the variable problem solving ability for total sample, boys and girls; the X axis of the graph represents the two groups for the variable problem solving ability; the Y axis represents the mean gain scores of the variable problem solving ability of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of problem solving ability of the experimental and Control group for total sample, boys and girls shows that there is significant difference in the mean gain scores of problem solving ability between the two groups. The mean gain scores of the problem solving ability of the

Experimental group is compared to higher than the mean gain scores of Control group for total sample, boys and girls and the effect size is large for total sample and medium for boys and girls. The graphical representation also supports the result of mean difference analysis of gain scores of the variable problem solving ability of the Experimental and control group for total sample, boys and girls.

Braincompatible learning strategy is more effective than the Existing method of teaching in enhancing the perceptual speed of coastal area secondary school students for the Total sample, Boys and Girls.

Test of significance of difference between mean pretest scores of perceptual speed belonging to the Experimental and Control groups of coastal area secondary school students indicate that the difference between the Experimental and Control groups is not significant for the Total sample, Boys and Girls. Hence the Experimental and Control groups are similar in their pre-experimental status in perceptual speed for the Total sample, boys and girls.

Total pretest (M_{Exp}=26.185; M_{ctrl}=25.926; t(108)=0.541; p>0.05)

Boys pretest (M_{Exp}=24.615; M_{Ctrl} = 25.042; t(50)=0.641; p>0.05)

Girls pretest (M_{Exp}=27.643; M_{Ctrl} = 26.633; t(58)=1.874; p>0.05)

The posttest score of perceptual speed belonging to the Experimental group of coastal area secondary school students is greater than the posttest scores of the control group of coastal area secondary school students for the Total sample, boys and girls which indicates the improvement in perceptual speed after intervention. The difference is significant between mean pretest and posttest scores of perceptual speed for the Total sample, boys and girls.

Total posttest (M_{Exp}=30.963; M_{ctrl}=27.185; t(108)=6.502; p<0.01)

Boys posttest (M_{Exp}=30.423; M_{Ctrl} = 26.792; t(50)=3.942; p<0.01)

Girls posttest (M_{Exp}=31.464; M_{Ctrl} = 27.500; t(58)=5.404; p<0.01)

The mean gain scores of the Experimental group in perceptual speed were greater than compared to the Control group for the Total sample, boys and girls. The mean gain scores indicate the improvement after the intervention for the Experimental and Control group. There was statistical significance in the mean difference analysis for the Total sample, boys and girls. It can be inferred from the effect size calculations and Cohen's d that the effect of Braincompatible learning strategy in enhancing the perceptual speed of coastal area secondary school students is large when compared to the existing method of teaching for Total sample, boys and girls.

Total gain score

(M_{Exp}=4.778; M_{ctrl}=1.259; t (108) = 6.412; p<0.01; d=1.153; Large)

Boys gain score

(M_{Exp}=5.808; M_{Ctrl} = 1.750; t (50) = 5.187; p<0.01;d=1.464; Large)

Girls gain score

(M_{Exp}=3.821; M_{Ctrl} = 0.867; t (58) = 4.051; p<0.01; d=1.072; Large)

From (fig. no. 57, fig.no.58and fig.no.59), the graphical representation used to compare the difference in the mean gain scores among two groups; Experimental and Control group for the variable perceptual speed for total sample, boys and girls; the X axis of the graph represents the two groups for the variable perceptual speed; the Y axis represents the mean gain scores of the variable perceptual speed of two groups, experimental group and Control group. So it can be conclude that the graphical representation of the comparison of gain scores of perceptual speed of the experimental and Control group for total sample, boys and girls shows that there is significant difference in the mean gain scores of perceptual speed between the two groups. The mean gain scores of the perceptual speed of the Experimental group is higher than the mean gain scores of Control group for total sample, boys and girls and the effect size is large for total sample, boys and girls. The graphical representation also supports the result of mean difference analysis of gain scores of the variable perceptual speed of the Experimental and control group for total sample, boys and girls.

Braincompatible learning strategy is more effective than the Existing method of teaching in reducing mathematics anxiety of coastal area secondary school students for the Total sample, Boys and Girls.

Test of significance of the difference between mean pretest scores of mathematics anxiety belonging to the Experimental and Control groups of coastal area secondary school students indicate that the difference between the Experimental and Control groups is not significant for the Total sample, Boys and Girls. Hence the Experimental and Control groups are similar in their pre-experimental status in perceptual speed for the Total sample, boys and girls.

Total pretest (M_{Exp}=91.519; M_{Ctrl} = 88.833; t(108)=1.938; p>0.05)

Boys pretest (M_{Exp}=93.423; M_{Ctrl} = 91.375; t(50)=1.206; p>0.05)

Girls pretest (M_{Exp} = 89.750; M_{Ctrl} = 86.800; t(58)=1.461; p>0.05)

The posttest score of mathematics anxiety belonging to the Experimental group of coastal area secondary school students is compared to lower than the posttest scores of the control group of coastal area secondary school students for the Total sample, boys and girls which indicates the reduction in mathematics anxiety after intervention. The difference is significant between mean pretest and posttest scores of mathematics anxiety for the Total sample, boys, and girls.

Total posttest (M_{Exp}=81.407; M_{Ctrl} = 87.426; t(108)=3.172; p<0.01)

Boys posttest (M_{Exp}=82.231; M_{Ctrl} = 87.917; t(50)=2.477; p <0.05)

Girls posttest (M_{Exp} = 80.643; M_{Ctrl} = 87.033; t(58)=2.159; p<0.05)

The mean change scores of mathematics anxiety in the Experimental group is lower than compared to the Control group for the Total sample, boys and girls. The mean change scores indicate the reduction after the intervention for the Experimental and Control group. There was statistical significance in the mean difference analysis for the Total sample, boys and girls. It can be inferred from the effect size calculations and Cohen's d that the effect of Braincompatible learning strategy in reducing

mathematics anxiety of coastal area secondary school students is large when compared to the existing method of teaching for Total sample, boys and girls.

Total change score

(M_{Exp}=10.111; M_{Ctrl} = 1.407; t(108)=5.277; p<0.01; d=1.304; Large)

Boys change score

(M_{Exp}=11.192; M_{Ctrl} = 3.458; t(50)=4.014; p <0.01; d=1.144; Large)

Girls change score

(M_{Exp} = 9.107; M_{Ctrl} = -0.233; t(58)=3.647; p<0.01; d=0.953; Large)

From (fig.no. 60, fig.no.61 and fig.no.62), the graphical representation used to compare the difference in the mean change scores among two groups; Experimental and Control group for the variable mathematics anxiety for total sample, boys and girls. The X axis of the graph represents the two groups for the variable mathematics anxiety; the Y axis represents the mean change scores of the variable mathematics anxiety of two groups, experimental group and Control group. so it can be conclude that the graphical representation of the comparison of change scores of mathematics anxiety of the experimental and Control group for total sample, boys and girls shows that there exist significant difference in the mean change scores of mathematics anxiety between the two groups. The mean change scores of the mathematics anxiety of the Experimental group is higher than the mean change scores of Control group. The graphical representation also supports the result of mean difference analysis of change scores of the variable mathematics anxiety of the Experimental and control group for total sample, boys and girls and the effect size is large for total sample, boys and girls..

Analysis of Co-variance (ANCOVA)

Summary of ANCOVA of Problem Solving Ability for Total sample, Boys and Girls

The result of ANCOVA carried out on the dependent variable problem solving ability by considering pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, nonverbal intelligence, classroom environment,

socioeconomic status as covariates in the results of Bonferroni's post Hoc comparison are summarised in the Table 103

Table 103

ANCOVA Post Hoc Comparison of Problem Solving Ability

Sample	Covariate	F	Adjusted mean Experimental group	Adjusted mean Control group	t-value	Partial eta squared
Total Sample	Pretest problem solving ability	18.510	20.266	17.493	2.773	0.150
	Pretest perceptual speed	17.994	20.309	17.450	2.859	0.146
	Pretest mathematics anxiety	19.025	20.382	17.377	3.005	0.153
	NVI	18.5111	20.324	17.435	2.888	0.150
	CE	18.960	20.343	17.417	2.926	0.153
	SES	18.120	20.325	17.434	2.891	0.147
	Combined effect	18.241	20.277	17.482	2.795	0.154
Boys	Pretest problem solving ability	7.374	19.738	17.159	2.58	0.136
	Pretest perceptual speed	6.643	19.894	16.990	2.904	0.124
	Pretest mathematics anxiety	7.189	20.003	16.872	3.131	0.143
	NVI	6.669	19.867	17.019	2.847	0.124
	CE	6.577	19.900	16.983	2.916	0.123
	SES	6.432	19.876	17.009	2.867	0.120
	Combined effect	7.052	19.805	17.086	2.719	0.144
Girls	Pretest problem solving ability	12.793	20.747	17.770	2.977	0.189
	Pretest perceptual speed	10.429	20.619	17.889	2.731	0.159
	Pretest mathematics anxiety	11.756	20.705	17.808	2.897	0.176
	NVI	12.906	20.745	17.772	2.973	0.190
	CE	10.190	20.590	17.916	2.675	0.156
	SES	12.966	20.752	17.765	2.987	0.191
	Combined effect	6.085	20.358	18.133	2.225	0.108

From Table no.103, it is clear from the table that all the 'F' values obtained for the effect of Braincompatible learning strategy after Controlling the individual and combined effects of the five covariates show a significant difference between the experimental and control groups and the respective 't' values of adjusted means of problem solving ability where statistically significant for total sample, Boys and Girls; More over in all the cases greater adjusted mean scores of problem solving ability where associated with the experimental group. It shows that Braincompatible learning strategy is more effective than the Existing method of teaching in enhancing the problem solving ability of total sample, boys and girls.

Summary of ANCOVA of Perceptual Speed for Total sample, Boys and Girls

The result of ANCOVA carried out on the dependent variable perceptual speed by considering the pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, nonverbal intelligence, classroom environment, socioeconomic status as covariates in the results of Bonferroni's post Hoc comparison are summarised in the Table 104.

Table 104

ANCOVA Post Hoc Comparison of Perceptual Speed

Sample	Covariate	F	Adjusted mean Experimental group	Adjusted mean Control group	t-value	Partial eta squared
Total Sample	Pretest problem solving ability	41.872	30.966	27.182	3.784	0.285
	Pretest perceptual speed	49.919	30.888	27.260	3.628	0.322
	Pretest mathematics anxiety	42.853	31.011	27.137	3.874	0.290
	NVI	42.839	30.970	27.178	3.791	0.290
	CE	42.034	30.965	27.183	3.782	0.286
	SES	42.032	30.968	27.180	3.787	0.286
	Combined effect	46.096	30.882	27.266	3.616	0.316
Boys	Pretest problem solving ability	15.740	30.447	26.765	3.682	0.251
	Pretest perceptual speed	25.876	30.580	26.622	3.959	0.355
	Pretest mathematics anxiety	14.202	30.385	26.833	3.552	0.232
	NVI	15.656	30.433	26.780	3.653	0.250
	CE	13.720	30.328	26.894	3.434	0.226
	SES	15.306	30.439	26.774	3.666	0.246
	Combined effect	20.123	30.405	26.812	3.593	0.325
Girls	Pretest problem solving ability	28.474	31.453	27.511	3.942	0.341
	Pretest perceptual speed	23.768	31.198	27.749	3.449	0.302
	Pretest mathematics anxiety	30.385	31.543	27.427	4.116	0.356
	NVI	29.512	31.471	27.493	3.978	0.349
	CE	25.782	31.409	27.552	3.857	0.319
	SES	28.686	31.464	27.501	3.963	0.343
	Combined effect	18.766	31.149	27.794	3.356	0.273

From table no104; it is clear from the table that all the 'F' values obtained for the effect of Braincompatible learning strategy after Controlling the individual and combined effects of the five covariates show significant differences between the experimental and control groups and the respective 't' values of adjusted means of perceptual speed where statistically significant for total sample and Boys and Girls. Moreover, in all the cases, greater adjusted mean scores of perceptual speed were associated with the experimental group. It shows that Braincompatible learning strategy is more effective than the existing method of teaching in enhancing perceptual speed for the total sample, boys and girls.

Summary of ANCOVA of Mathematics Anxiety for Total sample, Boys and Girls

The result of ANCOVA carried out on the dependent variable mathematics anxiety by considering the pretest problem solving ability, pretest perceptual speed, pretest mathematics anxiety, nonverbal intelligence, classroom environment, socioeconomic status as covariates in the results of Bonferroni's post Hoc comparison are summarised in the Table 105.

Table 105

ANCOVA Post Hoc Comparison of Mathematics Anxiety

Sample	Covariate	F	Adjusted mean Experimental group	Adjusted mean Control group	t-value	Partial eta squared
Total Sample	Pretest problem solving ability	10.252	81.366	87.467	-6.101	0.089
	Pretest perceptual speed	10.168	81.378	87.455	-6.077	0.088
	Pretest mathematics anxiety	23.601	80.428	88.405	-7.977	0.184
	NVI	11.396	81.353	87.480	-6.127	0.098
	CE	9.998	81.403	87.430	-6.028	0.087
	SES	9.717	81.456	87.378	-5.922	0.085
	Combined effect	26.511	80.285	88.548	-8.263	0.210
Boys	Pretest problem solving ability	6.435	82.154	88.000	5.846	0.120
	Pretest perceptual speed	5.622	82.341	87.797	5.455	0.107
	Pretest mathematics anxiety	14.082	81.474	88.737	7.263	0.231
	NVI	6.027	82.226	87.922	5.695	0.114
	CE	5.065	82.463	87.666	5.203	0.097
	SES	5.868	82.243	87.904	5.661	0.111
	Combined effect	13.131	81.404	88.813	7.409	0.238
Girls	Pretest problem solving ability	4.618	80.626	87.049	6.423	0.077
	Pretest perceptual speed	4.868	80.444	87.219	6.776	0.081
	Pretest mathematics anxiety	11.188	79.469	88.129	8.661	0.169
	NVI	6.476	80.546	87.124	6.579	0.105
	CE	3.524	80.985	86.714	5.729	0.060
	SES	4.728	80.628	87.047	6.419	0.079
	Combined effect	10.383	79.465	88.132	8.667	0.172

From table no.105; It is clear from the table that all the 'F' values obtained for the effect of Braincompatible learning strategy after Controlling the individual and combined effects of the five covariates show significant differences between the experimental and control groups and the respective 't' values of adjusted means of mathematics anxiety were statistically significant for total sample, Boys and Girls. In all the cases low adjusted mean scores of mathematics anxiety were associated with the experimental group. It shows that Braincompatible learning strategy is more effective than the existing method of teaching in reducing mathematics anxiety for the total sample, boys and girls.

From the findings of the result of the Analysis of Covariance, it can be inferred that Braincompatible learning strategy is more effective than the existing method of teaching in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety of coastal area secondary school students for Total sample, Boys and Girls.

Tenability of Hypotheses

The tenability of the hypotheses formulated for the present study based on the major findings of the study

- The first hypothesis states that there will be significant differences in the mean scores of problem solving ability and its subcomponents between the coastal area and non-coastal area secondary school students.

  The findings of the study revealed that, statistically significant difference was found in the mean scores of problem solving ability and its five subcomponents (sensing the problem, collect and classify data, analysis, Evaluation and generalization) between the coastal area and non-coastal area secondary school students. **Therefore the first hypothesis is fully substantiated**

- The second hypothesis states that there will be significant differences in the mean scores of Perceptual speed and its subcomponents between the coastal area and non-coastal area secondary school students.

  The findings of the study revealed that statistically significant difference was found in themean scores of perceptual speed and its sub components (Number comparison, geometrical shape comparison, symbol comparison and basic arithmetic operations) between the coastal area and noncoastal area secondary school students. **Therefore the second hypothesis is fully substantiated**

- The Third hypothesis states that there will be a significant differences in the mean scores of mathematics anxiety and its subcomponents between the coastal area and non-coastal area secondary school students.

  The findings of the study revealed that, statistically significant difference was found in the mean scores of mathematics anxiety and its subcomponents. (Topic related anxiety, concern about learning mathematics, resolving problems in mathematics and class room performance anxiety) between coastal area and non coastal area secondary school students. **Therefore the third hypothesis is fully substantiated**

- The fourth hypothesis states that there will be no significant difference in the mean pretest scores of the Problem Solving Ability of the experimental group and control group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was not found in the mean Pretest scores of the problem solving ability between the experimental and control groups for Total sample, Boys and Girls. **Therefore the fourth hypothesis is fully substantiated.**

- The fifth hypothesis states that there will be no significant difference in the mean pretest scores of Perceptual Speed of the experimental group and control group for Total sample, Boys and Girls

  The result revealed that statistically significant difference was not found in the mean Pretest scores of the perceptual speed between the Experimental and Control groups for the Total sample, Boys and Girls. **Therefore the fifth hypothesis is fully substantiated.**

- The sixth hypothesis states that there will be no significant difference in the mean pretest scores of Mathematics Anxiety of the experimental group and control group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was not found in the mean Pretest scores of mathematics anxiety between the Experimental and Control groups for the Total sample, boys and girls. **Therefore the sixth hypothesis is fully substantiated.**

- The seventh hypothesis states that there will be significant difference in the mean pretest and posttest scores of Problem solving ability of the experimental group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores of problem solving ability of the Experimental group for Total sample, Boys and girls. **Therefore the seventh hypothesis is fully substantiated.**

- The eighth hypothesis states that there will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the experimental group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores of perceptual speed of the

Experimental group for Total sample, Boys and girls. **Therefore the Eighth hypothesis is fully substantiated.**

- The nineth hypothesis states that there will be significant difference in the mean pretest and posttest scores of Mathematics anxiety of the experimental group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores of Mathematics anxiety of the Experimental group for Total sample, Boys and girls. **Therefore the Ninth hypothesis is fully substantiated.**

- The tenth hypothesis states that there will be significant difference in the mean pretest and posttest scores of Problem solving ability of the control group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores for total sample and girls but there exist no significant difference in the boys. **Therefore the tenth hypothesis for total sample and girls are substantiated and for boys is rejected**

- The eleventh hypothesis states that there will be significant difference in the mean pretest and posttest scores of Perceptual Speed of the control group for Total sample, Boys and Girls

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores for total sample and boys but there exist no significance difference in the girls. **Therefore the Eleventh hypothesis for total sample and boys are substantiated and for girls is rejected.**

- The twelfth hypothesis states that there will be significant difference in the mean pretest and posttest scores of Mathematics anxiety of the control group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean pretest and posttest scores of boys but there exist no significance difference for the total sample and girls. **Therefore the Twelfth hypothesis for boys is substantiated and for total sample and girls are rejected.**

- The thirteenth hypothesis states that there will be significant difference in the mean posttest scores of Problem solving ability of the experimental group and control group for Total sample, Boys and Girls.

  The result revealed that statistically significant difference was found in the mean posttest scores of problem solving ability of the Experimental and Control groups for Total sample, Boys and girls. **Therefore the thirteenth hypothesis is fully substantiated.**

- The fourteenth hypothesis states that there will be significant difference in the mean posttest scores of Perceptual Speed of the experimental group and control group for Total sample, Boys and girls.

  The result revealed that statistically significant difference was found in the mean posttest scores of perceptual speed of the Experimental and Control groups for Total sample, Boys and girls. **Therefore the fourteenth hypothesis is fully substantiated.**

- The fifteenth hypothesis states that there will be significant difference in the mean posttest scores of Mathematics anxiety of experimental group and control group for Total sample, Boys and girls.

  The result revealed that statistically significant difference was found in the mean posttest scores of mathematics anxiety of the Experimental and

Control groups for Total sample, Boys and girls. **Therefore the fifteenth hypothesis is fully substantiated.**

- The sixteenth hypothesis states that there will be significant difference in the mean gain scores of problem solving ability of the experimental group and control group for Total sample, Boys and girls.

  The result revealed that statistically significant difference was found in mean gain scores of problem solving ability of the Experimental and Control groups for Total sample, Boys and girls. **Therefore the sixteenth hypothesis is fully substantiated.**

- The seventeenth hypothesis states that there will be significant difference in the mean gain scores of experimental group and control group on Perceptual Speed for Total sample, Boys and girls.

  The result revealed that statistically significant difference was found in the mean gain scores of perceptual speed of the Experimental and Control groups for Total sample, Boys and girls. **Therefore the seventeenth hypothesis is fully substantiated.**

- The eighteenth hypothesis states that there will be significant difference in the mean change scores of experimental group and control group on Mathematics Anxiety for Total sample, Boys and girls.

  The result revealed that statistically significant difference was found in the mean change scores of mathematics anxiety of the Experimental and Control groups for Total sample, Boys and girls. **Therefore the Eighteenth hypothesis is fully substantiated.**

- The nineteenth hypothesis states that there will be significant difference in the adjusted mean scores of Problem solving ability between the Experimental

and control groups by considering Pretest Perceptual Speed, Pretest Mathematics Anxiety, Non verbal Intelligence, Class Room Environment and Socio-Economic Status as covariates for Total sample, Boys and girls

Statistically significant difference was found in the adjusted mean scores of problem solving ability of the Experimental and Control groups after controlling the individual as well as combined effect of the covariates Pretest problem solving ability, Pretest perceptual speed, Pretest Mathematics anxiety, Non-Verbal Intelligence, Classroom Environment and Socio-Economic Status for Total sample, Boys and girls. **Therefore the Nineteenth hypothesis is fully substantiated**.

- The twentieth hypothesis states that there will be significant difference in the adjusted mean scores of Perceptual Speed between the Experimental and control groups by considering Pretest Problem solving ability, , Pretest Mathematics Anxiety, Non verbal Intelligence, Class Room Environment and Socio-Economic Status as covariates for Total sample, Boys and girls

  Statistically significant difference was found in the adjusted mean scores of the perceptual speed of the Experimental and Control groups after controlling the individual as well as the combined effect of the covariates Pretest Problem solving ability, Pretest Perceptual Speed, Pretest Mathematics anxiety, Non-Verbal Intelligence, Classroom Environment and Socio-Economic Status for Total sample, Boys and girls. **Therefore the twentieth hypothesis is fully substantiated.**

- The twenty first hypothesis states that There will be significant difference in the adjusted mean scores of Mathematics Anxiety between the Experimental and control groups by considering Pretest problem-solving ability, Pretest Perceptual Speed, Nonverbal Intelligence, classroom environment and Socio-Economic Status as covariates for Total sample, Boys and Girls.

Statistically significant difference was found in the adjusted mean scores of mathematics anxiety of the Experimental and Control groups after controlling the individual as well as the combined effect of the covariates Pretest Problem solving ability, Pretest Perceptual Speed, Pretest Mathematics anxiety, Non-Verbal Intelligence, Classroom Environment and Socio-Economic Status for Total sample, Boys and girls. **Therefore the twenty first hypothesis is fully substantiated.**

Conclusion

In the detailed analysis based on the objectives of the present study, the investigator reached some conclusions. The investigation of the mathematics performance of students in problem solving ability, perceptual speed and mathematics anxiety compared to the students in the coastal area and non-coastal area secondary school revealed that There exists significant difference in the performance of the coastal area and non-coastal area secondary school students in terms of problem solving ability, perceptual speed and mathematics anxiety. From the findings, it was revealed that students from the coastal area secondary school demonstrate significantly lower performance in problem solving ability and perceptual speed in mathematics and show higher mathematics anxiety compared to the students from the non-coastal area secondary school.

The detailed investigation of the prevailing system of instructional methods and strategies for teaching mathematics to secondary school students reveals that the teachers are aware of most of the instructional methods and strategies in teaching mathematics at the secondary level and they are using some of the methods and strategies in their mathematics class. However, there are some instructional strategies which are rarely used by the mathematics teachers. The mathematics teachers have identified and aware of the different constraints faced by them while implementing new methods and strategies in their mathematics class and they give some suggestive measures to overcome the constraints.

The main objective of the study is to check the effectiveness of Braincompatible learning strategy in enhancing problem solving ability, perceptual speed and in reducing mathematics anxiety of coastal area secondary school students. The major conclusions derived from the study after the analysis and summarisation are listed below.

The problem solving ability of students taught through the instructional strategy based on Braincompatible learning strategy is significantly higher than that of those taught through the Existing method of teaching for the Total sample and Subsamples based on gender. So it can be concluded that the Braincompatible learning strategy was more effective in enhancing problem solving ability of the coastal area secondary school students than the existing method of teaching irrespective of gender.

The perceptual speed of students taught through the instructional strategy based on Braincompatible learning strategy is significantly higher than that of those taught through the Existing method of teaching for the Total sample and Subsamples based on gender. So, it can be concluded that the Braincompatible learning strategy was more effective in enhancing the perceptual speed of the coastal area secondary school students than the Existing method of teaching irrespective of gender.

The mathematics anxiety of students taught through the instructional strategy based on Braincompatible learning strategy is significantly lower than that of those taught through the Existing method of teaching for the Total sample, boys and girls. So, it can be concluded that the Braincompatible learning strategy was effective in reducing mathematics anxiety of the coastal area secondary school students than the Existing method of teaching for Total sample, boys and girls.

The conclusion that can be derived from both qualitative and quantitative analysis of the present study is that the Braincompatible learning strategy is effective in enhancing the problem solving ability, perceptual speed and in reducing the

mathematics anxiety for Total samples and Subsamples based on gender of the coastal area secondary school students.

Limitations of the Study

- The preliminary survey of secondary school students from coastal areas and non-coastal areas was conducted in only one district of the state.
- The preliminary survey of secondary school mathematics teachers was conducted in only one district of the state with a sample of thirty secondary school mathematics teachers.
- Only Eighth standard students from coastal area government and aided schools were considered as the sample for the experimental study and did not considered secondary school students from Fisheries school.
- The study was delimited to three chapters in the standard VIII mathematics textbook; polygons, ratio, and area of quadrilaterals.
- The generalization of the findings was limited to coastal area secondary school students in the state of Kerala.

Suggestions for Further Research

- The survey of the comparison of coastal area and non-coastal area secondary school students is confined to only one district and can be extended to other districts also.
- The survey study can be extended to compare with government secondary schools in coastal areas and government fisheries secondary schools in Kerala.
- In-depth and detailed survey studies can be conducted to find out the constraints faced by teachers in instruction of secondary-level mathematics and how to overcome the constraints faced by them.

- The study can be replicated with different experimental designs and various receptive skills.
- The study can be replicated with other classes of primary, secondary, higher secondary, and college-level
- The study can be extended to other disciplines and the secondary schools affiliated with CBSE and ICSE.
- The study can be extended to teacher education levels among student teachers or teacher educators.
- The independent effect of other covariates can be investigated further on the mathematics anxiety.
- A longitudinal study on the effectiveness of Braincompatible learning can be conducted.

Chapter 6

RECOMMENDATIONS

RECOMMENDATIONS

Every nation's educational system strives to change every member of its populace. The only way to bring about transformation is to use an educational system to intentionally organize acts that bring out and develop each person's innate potential. Numerous studies and developments have placed teaching and learning on the path of change. Child-centered educational strategies are gaining increased attention from educators, experts and curriculum developers. To further support the students' learning, we have refined our teaching methods. Nowadays, the majority of educational research focuses on innovative approaches to teaching and learning that raise students' academic success and performance. Every learner is unique in terms of their physical and mental characteristics, and each has their preferred method of learning. It is common knowledge that learning is a psychological process.

Living on the coast offers a distinct social experience. Their way of living has changed as a result of the issues they are dealing with. The educational decline of students at the high school in the coastal area is a major issue. This puts them backward in a state of economic, political, cultural, etc. The majority of students who attend secondary schools in the coastal region feel that mathematics is a very difficult subject to learn but Mathematics is one of the most fundamental and challenging subjects to acquire because it is a subject that every student should need in their everyday lives as well as in their future. In addition to students physically participating in the class, it is critical to engage students' thoughts and ideas in the teaching-learning process to increase the quality of mathematics education. Teaching methods must consider student developmental requirements.

In the classroom, teaching and learning that take into account the demands and developmental principles of the human brain are implemented through the use

of Brain Compatible methods for teaching and learning.The present study is an attempt to compare the effectiveness of instructional strategy based on Brain Compatible learning over the Existing method of teaching in terms of problem solving ability, perceptual speed and mathematics anxiety among coastal area secondary school standard VIII students. Based on the findings of the study the investigator proposed some recommendations. The educational implications of the study merged with the recommendations are presented in the following section.

General Recommendation based on the Preliminary Survey on Problem Solving Ability, Perceptual Speed and Mathematics Anxiety of Secondary School Students

- The preliminary survey of secondary school students revealed that there exists a significant difference in problem solving ability and perceptual speed in mathematics between the coastal area and non-coastal area Secondary school students. Secondary school students in non-coastal areas show higher performance compared to the coastal areas students. These findings of the study implied the necessity of using different teaching-learning strategies for better performance in mathematics of secondary school students, especially in the coastal area
- The study revealed that despite all curricular reforms or revisions, still there remains anxiety among students toward mathematics. This emphasizes the need to create a learning environment where the students can learn mathematics without fear or tension.

General Recommendations based on the Preliminary Survey of Secondary School Mathematics Teachers

- The major constraints raised by the mathematics teachers of secondary school are the lack of basic mathematical skills and competencies among students. So

it is necessary to provide some bridge courses for the basics of mathematics to secondary school students at the beginning of each academic year will help to improve their mathematical skills and competency.

- The other constraints faced by the mathematics teachers of secondary school are the lack of attention, interest, and patience of students. To improve their attention, interest and patience teachers need to implement suitable methods and strategies for teaching mathematics based on the difficulty of the content.The Brain Compatible learning strategy can be applied as an effective strategy for improving students' interest and participation and developing basic mathematical skills and competencies at the secondary level.

Recommendations based on Experimental Study

For Classroom

- The positive effect of the Brain Compatible learning approach over the Existing method of instructional practices among coastal area secondary school students is shown in this study.
- Brain compatible learning strategy is a useful strategy for enhancing the performance of coastal area students in mathematics
- Brain Compatible learning strategy provides chunks of information, by dividing complicated mathematics topics in to manageable, smaller chunks to help coastal area students to understand the mathematical content easily and effectively.
- Brain Compatible learning strategy provides a threat-free ambiance for learners creating a more friendly atmosphere among coastal area students and teachers.

- Coastal area students actively participate in classroom activities either as group leaders, performers or learners. Thus, by implementing Brain Compatible learning strategy, we can reduce mathematics anxiety among secondary school students in coastal areas. This may lead to reduce the dropout rate of students due to anxiety toward mathematics

- Perceptual speed in mathematics is very essential for learners in the classroom to understand the mathematics contents effectively. The sensory preferences in Brain Compatible learning strategy will help to improve the perceptual speed in mathematics of coastal area secondary school students. Perceptual speed in mathematics is very essential for learners in the classroom to understand the mathematics contents Fastly and effectively.

- Brain Compatible learning provides freedom to the students to see one context from multiple perspectives without any restriction; each student enjoys the freedom to use their intellect as their will and ability. It creates curiosity among the learners and each student enjoys the freedom to use their intellect as their will and ability helpful in motivating students to bring new ideas of learning mathematics and it will encourage a positive attitude towards learning mathematics.

- The problem solving ability in mathematics is very essential for learning mathematics and mathematical problem solving is an ongoing technique used throughout one's lifetime. Brain Compatible learning helps to improve the problem solving ability among coastal area students, which will enhance their higher-order thinking and it will help them to solve problems that they are facing in their real-life situations.

- Brain compatible learning strategy provides physical activities in the classroom. Coastal area secondary school students are more interested in

doing physical activities these activities help the learners be more active throughout the teaching-learning process in the classroom.

- The study also revealed that Brain compatible learning strategy has significant advantage over the Existing method of teaching irrespective of gender in teaching mathematics to coastal area secondary school students. As we all know mathematics is a very difficult subject for most students so it can be said that by implementing Brain Compatible learning strategy we can enhance the mathematical abilities and reduce mathematics anxiety of coastal area secondary school students.

For Policymakers

- The present study can be utilized while framing government policies for enhancing educational practices in general and mathematics in particular.
- The study can be taken as a basis for making policies on the institutional or government level in resolving the constraints in teaching and learning difficult mathematics topics among coastal area secondary school students.
- Brain compatible learning strategy can be used as the most effective method for the differently abled or children with special needs.

For Teachers and Teacher Educators

- The prospective teachers at all levels may be oriented with the Brain Compatible learning strategy so that they can use it during their practice teaching as well as when they are enrolled as teachers in the institutions.
- Brain Compatible learning strategy can be incorporated as an essential input in the various Inservice programs of teachers. Training can be given to mathematics teachers on how to use Brain Compatible learning strategies in their classrooms for better learning outcomes.

Other Recommendations

- Brain Compatible learning strategy is one of the most effective approaches for students to enhance problem solving ability and perceptual speed in mathematics which will help to improve their mathematics ability at higher levels of education.
- As we all know we are following the same syllabus and curriculum for all students who are studying under the state government schools. While preparing the syllabus and curriculum for secondary school students it will be better, if we consider the capability of coastal area students.

Conclusion

The primary issue that coastal secondary schools deal with educational backwardness. Children living in coastal areas confront several issues from their communities that prevent them from receiving a good education. Although they will enrol in classes, they are unable to attend them effectively. Students' poor mathematics performance rises as a result of this circumstance. Innovative teaching-learning techniques must be implemented in secondary schools in the coastal region to achieve this. Since most students in coastal areas find mathematics to be one of the more challenging topics, we must use effective teaching and learning tactics while instructing math classes. The present study shows the positive impact of Brain Compatible learning strategy in enhancing problem solving ability, perceptual speed and reducing mathematics anxiety among secondary school students in the coastal area. An environment of friendliness between students and instructors is fostered via Brain Compatible learning practices. Thus by applying Brain Compatible learning technique, we can increase the quality of mathematics instruction in coastal areas.

REFERENCES

REFERENCES

Ackerman, P. L., & Ackerman, B. (2007). Explorations of perceptual speed abilities in the context of assessment methods, cognitive abilities and individual differences during skill acquisition. *Journal of Experimental Psychology, 3*(4), 249-272. http://psycnet.apa.org.

Ackerman, P. L., & Cianciolo, A. T. (2000). Cognitive, perceptual speed, and psychomotor determinants of individual differences during skill acquisition. *Journal of Experimental Psychology: Applied, 6*, 259–290.

Adams, J., Kaczmarczyk, S., Picton, P., & Demian, P. (2009). Problem solving and creativity in Engineering: turning novices into professionals. *Enhancing the Learner Experience in Higher Education, 1*(1).

Aggarwal, J. C. (1966). *Educational research: An introduction*. Arya Book Depot.

Aggarwal, J. C. (1995). *Teacher and education in a developing society*. Vikas Publishing House.

Aggarwal, J. C. (1995). *Theory and principles of education*. Vikas Publishing House.

Aiken, L. R. (2003). *Psychological testing and assessment*. Pearson Education Group.

Akira, M., Naomi, P., & Friedman, N.P. (2001). Visuo-spatial working memory, executive functioning, and spatial abilities related? A latent – variable analysis. *Journal Experimental Psychology, 130*(4). http://www.apa.org.

Aldous., & Carol, R. (2006). *The effect of pair problem solving techniques incorporating Polya's problem solving strategies on undergraduate students performance in chemistry.* https://files.eric.ed.gov/fulltext/ED495502.

Amjad, A. I., Habib, M., & Saeed, M. (2022). Effect of brain-based learning on students' mathematics performance at elementary level. *Pakistan Journal of Social Research*, *4*(03), 38-51.

Amtheim, R. (1997). *Visual thinking*. Berkeley.

Anderson, J. R. (1993). Problem solving and learning. *American Psychologist*, *48*(1), 35.

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of educational objectives*. Longman.

Anupamamol, M.K. (2018). *Development of brain compatible learning design in biotechnology for higher secondary school students* [Doctoral dissertation, Department of Education, University of Kerala]. http://hdl.handle.net/10603/421539

Aravind, A.M. (2019). *Effectiveness of blended learning approach on listening and speaking skills in English, English language anxiety and learner satisfaction of secondary school students* [Doctoral dissertation. Department of Education. University of Calicut]. http://hdl.handle.net/10603/324486

Aruna, P.K., Sureshan, K., & Unnikrishnan, M. (1998). *Classroom environment inventory*. Department of Education, University of Calicut.

Aruvee, E., & Vintere, A. (2023). Overcoming mathematical anxiety to promote progress in mathematics during undergraduate engineering studies at university. *22nd International Scientific Conference Engineering for Rural Development.* https://doi.org/10.22616/ERDev.2023.22.TF215

Asch, M. (2002). *Text book of cognitive psychology*. IVY Publishing House.

Ashcraft, M. H. (2002). Math anxiety: Personal, educational and cognitive consequences. *Current Directions in Psychological Sciences, 11*(5), 181-185.

Ashcraft, M. H., & Kirk, E. P. (1998). *The relationships among working memory, math anxiety, math competence, and attitudes toward math* [Unpublished manuscript].

Ashcraft, M. H., Kirk, E. P., & Hopko, D. (1998). On the cognitive consequences of mathematics anxiety. In C. Donlan (Ed.), *The development of mathematical skills* (pp. 175-196). Psychology Press.

Ashcraft, M.H., & Krause, J.A. (2007). Working memory, math performance and math anxiety. *Psychonomic Bulletin & Review*, *14*(2), 243-248.

Bada, A. A., & Jita, L. C. (2022). Integrating brain-based learning in The science classroom: A systematic review. *International Journal of Pedagogy and Teacher Education*, *6*(1), 24-36. https:dx.doi.org/10.20961/ijpte.V_{6i} 1.57377.

Baloglu, M., & Kocak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. *Personality and Individual Differences*, *40*(7), 1325-1335.

Baloglu, M., & Zelhart, P.F. (2010). Psychometric properties of the revised mathematics anxiety rating scale. *The Psychological Record, 57* (4), 8.

Bandura, A. (1997). *Social learning theory.* Prentice Hall.

Barczi, K. (2013). Applying co-operative techniques in teaching problem solving. *CEPS Journal, 3*(4), 61–78.

Battle, J., & George, L. (1985). Comparing achievement ability with visual memory and visual association. *Reading Horizons, 25*(2), 87-94. http://www.eric.ed.gov.

Bay-Williams, J. M., & Stokes, L.A. (2017). The role of concepts and procedures in developing fluency. In D. Spangler & J. Wanko (Eds.), *Enhancing professional practice with research behind principles to actions*. NCTM.

Bay-Williams, J. M., & Stokes-Levine, A. (2017). Teaching to build procedural fluency. *Enhancing Classroom Practice with Research Behind Principles to Actions*, 61-72.

Becktold, T. H. (2001). Brain based instruction in correctional settings: Strategies for teachers. *Journal of Correctional Education*, 95-97.

Beilock, S. L., & Maloney, E. A. (2015). Math anxiety: A factor in math achievement not to be ignored. *Policy Insights from the Behavioral and Brain Sciences*, *2*(1), 4-12.

Bennet, E. L., Diamond, M.C., Krech, D., & Roaenweig, M. (1967). Chemical and anatomical plascticity of the brain. *Science, 164*, 825-826.

Berg, K.F. (1993). *Structured cooperative learning ad achievement in a high school mathematics class.* https://files.eric.ed.gov/fulltext/ED19923/96.

Bessant, K.C. (1995). Factors associated with types of mathematics anxiety in college students. *Journal for Research in Mathematics Education*, 327-345.

Best, J.W., & Kahn, J. V. (2010). *Research in education* (10th ed.). Prentice Hall of India Pvt. Ltd.

Bhat, I. A. (2022). *Academic achievement in mathematics of secondary school students in relation to self confidence, mathematical anxiety and problem solving ability* [Doctoral dissertation, Department of Education, Annamalai University]. http://hdl.handle.net/10603/401466

Bindhu, N.H. (2021). *Problem solving ability among 9th standard students in relation to their emotional intelligence and achievement in mathematics* [Doctoral dissertation, Department of Education, Annamalai University]. http://hdl.handle.net/10603/392178

Bindu, P.V. (1990). A study of 'the effect of cognitive variables on achievement in mathematics of secondary school students. *Journal of Educational Research and Extension*, 140-147.

Binulal, K. R., & Aravind, A. (2013). Brain based learning–feel the difference in meaningful learning. *Asian Journal of Research in Social Sciences and Humanities, 3* (9), 228-232.

Bloom, B. S. (1956). *Taxonomy of educational objectives*. David McKay Company, INC.

Bloom, B.S. (1979). *Taxonomy of educational objectives, Hand Book No.1 Cognitive domain*. Longman Group Ltd.

Bowker, R., & Richard, S.T. (1981). The influence of Perceptual Speed on performance versus paper-and-pencil measures of Spatial Ability. Technical report 1981-4. https://files.eric.ed.gov/fulltext/ED200630

Bransford, J. D., & Stein, B.S. (1993). *The ideal problem solver: A guide for improving thinking, learning, and creativity (2nd ed.).* W.H. Freeman.

Brewster, B. J., & Miller, T. (2023). Reflections on mathematics ability, anxiety, and interventions. *International Electronic Journal of Mathematics Education*, *18*(2), em0729. https://doi.org/10.29333/iejme/12822

Brownell (1942). *Developing problem solving ability with multiple condition problem*. https://files.eric.ej.gov/fulltext/EJ268866

Bryce, A. (1994). Perceptual speed, learning and information retrieval performance. *Proceedings of the 17th SIGIR Conference*, 71-80.

Buckley, G. J. (2010). *The impact of early vitamin A supplementation on the cognitive and motor development of school-aged children in rural Nepal*. The Johns Hopkins University.

Buzan, T. (1974). *Use both sides of your brain*. E. P. Dutton.

Caine, G., & Caine, R. (2000). *The brain, education and the competitive edge*. Scarecrow.

Caine, G., & Caine, R. N. (1994). *Making connections: Teaching and the human brain*. Addison-Wesley.

Caine, R. (2000). Building a bridge from research to classroom. *Educational Leadership*, *60*, 70-73.

Caine, R. N. (2005). *12 Brain/mind learning principles in action: The field book for making connections, teaching, and the human brain*. Corwin Press.

Caine, R. N., & Caine, G. (1991*). Making connections: Teaching and the human brain*. Association for Supervision and Curriculum Development.

Caine, R. N., & Caine, G. (1997). *Education on the edge of possibility*. Association of Supervision and Curriculum Development.

Caine, R., & Anderson, J. (2003). *Raising test scores by aligning teaching with the California standards for the teaching profession.* Manuscript Submitted for Publication.

Caine, R.N. (2009). *Brain/mind learning principles in action*. Corwin Press.

Caine, R.N., & Caine, G. (1990). Understanding a brain based approach to learning and teaching. *Educational Leadership*, *48*(2), 66-70.

Caine, R.N., Caine, G., McClintic, C., & Klimek, K. (2005). *12 brain/mind learning principles in action*. Corwin Press.

Campell, D.T., & Stanley, W.C. (1963). Experimental and quasi experimental designs for research on teaching. In N.L. Gage (Ed.), *Handbook of research on teaching*. R and M C Nally and co.

Capel, S., Leask, M., & Turner, T. (1999). *Learning to teach in the secondary school* (2nd ed.). Routledge

Carthey, H.J. (1993). Relationship between learning styles and academic achievement and brain hemispheric dominance and academic performance in business and accounting courses. https://files.eric.ed.gov/fulltext/ED 374412

Charters, W. W., & Good, C. V. (1945). The dictionary of education. *The Phi Delta Kappan*, *27*(1), 5-7.

Chinta, S. R. (2018). *Towards understanding dyslexia in a language with transparent orthography Investigation of perceptual and phonological abilities in Telugu native speakers* [Doctoral dissertation, Department of Cognitive Science, International Institute of Information Technology, Hyderabad]. http://hdl.handle.net/10603/325083

Clark, E., Tullo, D., & Bertone, A. (2021). Perceptual reasoning skills mediate the relationship between attention and math proficiency in individuals with a neurodevelopmental condition. *Research in Developmental Disabilities*, *111*, 103880. https://doi.org/10.1016/J.RIDD.2021.103880

Closser, A. H., Chan, J. Y. C., & Ottmar, E. (2023). Resisting the urge to calculate: The relation between inhibitory control and perceptual cues in arithmetic performance. *Quarterly Journal of Experimental Psychology*, *76*(12), 2690-2703. https://doi.org/10.1177/17470218231156125

Cobb, P., Wood, T., & Yackel, E. (1991) A constructivist approach to second grade mathematics. In V. Glaserfield (Ed.), *Radical constructivism in mathematics education*. E Kluwer Academic Publishers.

Cohen, L., Manion, L., & Morrison, K. (1996). *A guide to teaching practice* (4th ed.). Routledge.

Cohn, J. L., & Seim, R. (1978). *Perceptual and Intellectual factors affecting number concept development in retarded and non retarded children*. *American Journal of Mental Deficiency*, *83*(1), 9-15. http://www.ncbi.nlm.nih.gov.

Connell, J.D. (2005). *Brain-based strategies to reach every learner*. Scholastic Inc.

Cowles, H. M. (2015). Hypothesis bound: Trial and error in the nineteenth century. *Isis*, *106*(3), 635-645.

Craig, D. (2003). Brain-compatible learning: Principles and applications in athletic training. *Journal of Athletic Training, 38*(4), 342–350.

Cui, F., Liao, X., Yang, J., & Liu, J. (2023). The neural mechanism of the impact of mathematical anxiety on the math conceptual knowledge: Evidence from a resting-state fMRI study. *Acta Psychologica Sinica*, *55*(6), 968.

D'Amato, M., & Yuan. (2015). Using a brain based approach to collaborative teaching and learning with Asians. *New Directions for Teaching and Learning*, *143,* 41-60. http://dx.doi.org/10.1002/tl.20135

D'Arcangelo, M. (1998). The brains behind the brain. *Educational Leadership, 56*(3), p. 20-25.

Davidson, J. E., & Sternberg, R.J. (2003). *The psychology of problem solving*. Cambridge University Press.

Davis, A. (2004). The credentials of brain-based learning. *Journal of Philosophy of Education, 38* (1), 21-36. https://doi.org/10.1111/j.0309-8249.2004.00361.x

Davis, G. A. (1966). Current status of research and theory in human problem solving. *Psychological Bulletin*, *66*(1), 36.

Deans, C., & Larsen, E. (2022). Brain-based learning: Beliefs and practice in one Australian primary school implementing a neuroscience pedagogical framework. *Australian Journal of Teacher Education (Online)*, *47*(10), 18-38.

Della, N. C. (1986). Huge learning jumps show potency of brain based instruction. *Phi Delta Kappan, 68,* 43-48.

Derenne, A. (2022). Edward Thorndike. In *Encyclopedia of Animal Cognition and Behavior* (pp. 2211-2217). Springer International Publishing.

Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions, 8*(1), 33.

Devine, A., Hill, F., Carey, E., & Szűcs, D. (2018). Cognitive and emotional math problems largely dissociate: Prevalence of developmental dyscalculia and mathematics anxiety. *Journal of Educational Psychology*, *110*(3), 431.

Dewey, J. (1922). An analysis of reflective thought. *The Journal of Philosophy*, 29-38.

Dewey, J. (2022). *How we think*. DigiCat.

Diaz, A. M. (1992). *The thinking brain: The neurobiology of learning and learning problems for teachers and parents.* ASCD.

Dilip, S., & Vinodkumar, S. (2023). *Mathematical problem solving ability among secondary school students in relation to mathematical aptitude and mathematical self concept* [Doctoral dissertation, Faculty Education, Banaras Hindu University]. http://hdl.handle.net/10603/543320

Doeben-Henisch, G. (2019). *Review of A. Newell & HA Simon, 'Human Problem Solving (1972)', Chapter 1:'Introduction', Version 1.4: A review from a philosophical point of view*. Frankfurt University of Applied Sciences.

Dominowski, R. L., & Bourne Jr, L. E. (1994). History of research on thinking and problem solving. In *Thinking and problem solving* (pp. 1-35). Academic Press.

Dowker, A. (2019). Mathematics anxiety and performance. In *Mathematics Anxiety* (pp. 62-76). Routledge.

Dreger, R. M., & Aiken Jr, L. R. (1957). The identification of number anxiety in a college population. *Journal of Educational Psychology*, *48*(6), 344.

Drudu, P., & Pramod, S. (2020). *A study on mathematics performance in relation to intelligence, creativity, attitude towards mathematics, mathematics anxiety and socio economic status among XI standard students in higher secondary schools* [Doctoral dissertation, Department of Education, University of Madras]. http://hdl.handle.net/10603/278524

Duncker, K., & Lees, L. S. (1945). On problem-solving. *Psychological Monographs*, *58*(5), i.

Ebel, R. L., & Frisbie, D. A. (1991). *Essentials of educational measurement* (5th ed.). Prentice-Hall.

Edelenbosch, R., Kupper, F., Krabbendam, L., & Broerse, J. E. W. (2015). Brain-based learning and educational neuroscience: Boundary work. *Mind, Brain, and Education, 9*, 40–49. https://doi.org/10.1111/mbe.12066.

Edwards, A. L. (1957). *Techniques of attitude scale construction*. Vakils, Feffer and Simons Inc.

Edwards, B. (1979). *Drawing on the right side of the brain*. Tarcher.

Elsayed, A. M. (2022). The effect of using a strategy based on brain-compatible learning theory in the development of numerical sense skills of the basic education students in Oman. *European Journal of Social Sciences*, *47*(2), 183-195.

Elsayed, A. M., & Almahri, A. M. (2023). Developing mathematics achievement and inductive reasoning: A proposed technique according to brain compatible learning theory. *Journal of Higher Education Theory & Practice*, *23*(17).

El-Wakeel, H. A., Abdellatif, R., Eldardiry, D. H., Al-Saleh, D. F., Shukri, M. I., & Ansari, K. M. (2022). Brain-based learning in design and visual arts education: A bibliometric assessment of Scopus indexed literature. *F1000 Research*, *11*.

Elwick, A. (2014). *An awareness of neuroscience in education: Can learning about the brain transform pupils' motivation to learn?* CfBT Educational Trust.

Epstain, J. (1998). *Cognitive development in an integrated mathematics and science programme.* https://files.eric.ed.gov/fulltext/ED467856).

Erlauer, L. (2003). *The brain-compatible classroom: using what we know about learning to improve teaching.* Association for Supervision and Curriculum Development.

Ersoy, E. (2016). Problem solving and its teaching in mathematics. *The Online Journal of New Horizons in Education*, *6*(2), 79-87.

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion*, *6,* 409-434.

Eysenck, M.W. (Ed.). (1994). *The Blackwell dictionary of cognitive psychology.* Blackwell Publishers.

Fang, S., & Zhou, X. (2022). Form perception speed is critical for the relationship between non-verbal number sense and arithmetic fluency. *Intelligence*, *95*, 101704. https://doi.org/10.1016/j.intell.2022.101704

Findell, B., Swafford, J., & Kilpatrick, J. (Eds.). (2001). *Adding it up: Helping children learn mathematics*. National Academies Press.

Finlayson, M. (2014). Addressing math anxiety in the classroom. *Improving Schools*, *17*(1), 99-115.

Firmansyah, M. A., & Syarifah, L. L. (2023). Mathematical problem solving ability in view of learning styles. *Prima: Jurnal Pendidikan Matematika*, *7*(1), 58-66. https://doi.org/10.31000/prima.v7i1.7217

Fisher. (1990). *Teaching children to think*. Nelson Thornes Ltd.

Fitriana, H., & Waswa, A. N. (2024). The influence of a realistic mathematics education approach on students' mathematical problem solving ability. *Interval: Indonesian Journal of Mathematical Education*, *2*(1), 29-35. https://doi.org/10.37251/ijome.v2i1.979

Fleming, N. D., & Mills, C. (1992). Helping students understand how they learn. *The Teaching Professor, 7* (4), 137-155.

Foulds, O., Azzopardi, L., & Halvey, M. (2020, March). Reflecting upon perceptual speed tests in information retrieval: limitations, challenges, and recommendations. In *Proceedings of the 2020 Conference on Human Information Interaction and Retrieval* (pp. 234-242). https://doi.org/10.1145/3343413.3377982

Foulds, O., Suglia, A., Azzopardi, L., & Halvey, M. (2020, July). Predicting perceptual speed from search behaviour. In *Proceedings of the 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval* (pp. 1989-1992). http://doi.org/10.1145/3397271.3401210

Francis, F. T., & Musthafa. (2013). Effectiveness of brain based learning strategy on achievement in economics of higher secondary school. *Innovative Thoughts International Research Journal, 1* (1).

Fülöp, É. (2021). Developing problem-solving abilities by learning problem-solving strategies: an exploration of teaching intervention in authentic mathematics classes. *Scandinavian Journal of Educational Research*, *65*(7), 1309-1326.

Gabbard, C., Caçola, P., & Rodrigues, L. P. (2008). A new inventory for assessing affordances in the home environment for motor development (AHEMD-SR). *Early Childhood Education Journal*, *36*, 5-9.

Gabriel, G. (2023). *Perceptual-motor training for mathematical ability in preadolescent children: A systematic review of intervention studies.* PsyArXiv. https://doi.org/10.31234/osf.io/tsh42

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences.* Basic Books.

Garret, H. E. (2005). *Statistics in psychology and education*. McKay Company.

Geist, E. (2010). The anti-anxiety curriculum: Combating math anxiety in the classroom. *Journal of Instructional Psychology*, *37*(1).

Ghatak, A., & Mittal, K. (2019). A review based study on problem-solving ability of school students in relation to their academic achievement. *International Journal of Education*, *6* (2), 644-649.

Gibeau, R. M., Maloney, E. A., Béland, S., Lalande, D., Cantinotti, M., Williot, A., ..., & Cousineau, D. (2023). The correlates of statistics anxiety: Relationships with spatial anxiety, mathematics anxiety and gender. *Journal of Numerical Cognition*, *9*(1), 16-43.

Gibson, E. (2006). The interaction of top–down and bottom–up statistics in the resolution of syntactic category ambiguity. *Journal of Memory and Language*, *54*(3), 363-388.

Gibson, E. A. F. (1991). *A computational theory of human linguistic processing: Memory limitations and processing breakdown*. Carnegie Mellon University.

Gibson, J. J. (1966). A theory of direct visual perception. In J. Royce, W. Rozenboom (Eds.). *The Psychology of Knowing.* Gordon & Breach.

Gilhooly, K. J. (1990). Cognitive psychology and medical diagnosis. *Applied Cognitive Psychology*, *4*(4), 261-272.

Gilhooly, K. J., & Fioratou, E. (2009). Executive functions in insight versus non-insight problem solving: An individual differences approach. *Thinking & Reasoning*, *15*(4), 355-376.

Gilhooly, K. J., & Green, A. J. K. (1988). The use of memory by experts and novices. In *Advances in Psychology* (Vol. 55, pp. 379-395). North-Holland.

Gilhooly, K. J., & Murphy, P. (2005). Differentiating insight from non-insight problems. *Thinking & Reasoning*, *11*(3), 279-302.

Ginsburg, B. M., & Fantuzzo, J.W. (1998). An evaluation of the relative effectiveness of NCTM standard based intervention for low achieving urban elementary students. *Journal of Educational Psychology, 90,* 560-569.

Gireeshkumar, K. (2020). Effectiveness of brain compatible learning on achievement in social studies among high school students. *Journal of Emerging Technologies and Innovative Research*, *7*(7).

Gnambs, T., Scharl, A., & Rohm, T. (2021). Comparing perceptual speed between educational contexts. *Psychological Test Adaptation and Development*. https://doi.org/10.1027/2698-1866/a000013

Good, C.V. (1972). *Dictionary of education* (3rd ed.). McGraw Hill.

Good, C.V. (Ed.) (1973). *Dictionary of education*. McGraw HillBook Company

Gopinath, S., & Lertlit, S. (2017). The implementation of Polya's model in solving problem-questions in mathematics by grade 7 students. *Suranaree Journal of Social Science*, *11*(1), 47-59.

Green, A. J., & Gilhooly, K. (2005). Problem solving. *Cognitive Psychology*, 301-333.

Greeno, J. G. (1980). Psychology of learning, 1960–1980: One participant's observations. *American Psychologist*, *35*(8), 713.

Greeno, J. G. (1987). Instructional representations based on research about understanding. *Cognitive Science and Mathematics Education*, 61-88.

Greeno, J. G. (1989). Situations, mental models, and generative knowledge. *Complex Information Processing: The Impact of Herbert A. Simon*, 285-318.

Greeno, J. G. (2012). A view of mathematical problem solving in school. In *Toward a unified theory of problem solving* (pp. 69-98). Routledge.

Greeno, J. G., Magone, M. E., & Chaiklin, S. (1979). Theory of constructions and set in problem solving. *Memory & Cognition*, *7*, 445-461.

Greens, L., & Schulman.L. (1982). *Developing problem solving ability with multiple condition problems*. https://files.eric.ej.gov/fulltext/No.EJ 268866)

Gregory, G. H., & Parry, T. (2006). *Designing brain-compatible learning*. Corwin Press.

Gregory, R. (1970). Concepts and mechanisms of perception. Duckworth.

Gregory, R. L. (1997). Knowledge in perception and illusion. Philosophical transactions of the Royal Society of London. *Series B: Biological Sciences*, *352*(1358), 1121-1127.

Gugerty, L. (2006, October). Newell and Simon's logic theorist: Historical background and impact on cognitive modeling. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 50, No. 9, pp. 880-884). SAGE Publications.

Guilford, J. P. (1965). *Fundamental statistics in psychology and education* (4th ed.) McGraw Hill Book Company.

Guilford, J.P. (1967). *The nature of human intelligence*. McGraw Hill.

Haris, M.C. (2020). *Effectiveness of Anchored instructional approach on emotional regulation and process skills in social science among secondary school students of Kerala* [Doctoral dissertation, Department of Education, University of Calicut]. http://hdl.handle.net/10603/332320

Hart, L. A. (1983). *Human brain and human learning*. Longman.

Hart, L.A. (1978). *Human brain and human learning*. Longman.

Hayes, J. R., & Flower, L. (1981). *Uncovering cognitive processes in writing: An introduction to protocol analysis*. ERIC Clearinghouse.

Hayes, J.R. (1989). *The complete problem solver* (2nd ed.). Erlbaum.

Hayes-Roth, F. (1978). *Learning by example* (pp. 27-38). Springer US.

Hegarty, M., Mayer, R. E., & Monk, C. A. (1995). Comprehension of arithmetic word problems: A comparison of successful and unsuccessful problem solvers. *Journal of Educational Psychology*, *87*(1), 18.

Hembree, R. (1990). The nature, effects and relief of mathematics anxiety. *Journal for Research in Mathematics Education,* 33-46.

Ho, H.Z., Senturk, D., Lam, A.G., Zimmer, J. M., Hong, S., Okamoto, Y., …., & Wang, C.P. (2000). The affective and cognitive dimensions of math anxiety: A cross-national study. *Journal of Research in Mathematics Education,* 362-379. https://doi.org/10.2307/749811

Hodges, A. (2013). *The impact of brain based strategies: One schools' perspective*. Walden University.

Holloway, I.D., & Ansari, D. (2009). Mapping numerical magnitude on the symbols: The numerical distance effect and individual difference in children's mathematics achievement. *Journal of Experimental Child Psychology, 103* (1), 17-29. https://doi.org/10.1016/j.jecp.2008.04.001

Holt., Rinehart., & Winston. (2003). *Britannica mathematics in context, comparing quantities.* A Harcourt Education Company

Hornby., Turnbull, J., Lea, D., Parkinson, D., Phillips, P., Francis, B., Webb, S., Bull, V., & Ashby, M. (Eds.) (2010). *Oxford Advanced Learner's Dictionary.* Oxford University Press.

Jang, C. S., Lim, D. H., You, J., & Cho, S. (2022). Brain-based learning research for adult education and human resource development. *European Journal of Training and Development*, *46*(5/6), 627-651. https://doi.org/10.1108/EJTD-02-2021-0029.

Jensen, E. (2008). *Brain based learning: The new paradigm of teaching.* Corwin Press.

Jithin, V. (2019). *Effectiveness of brain based learning strategy and accelerated learning strategy on achievement in social science of standard IX students* [M.Ed. dissertation]. Department of Education, University of Calicut, Kerala.

Jordan, N.C., Glutting, J., & Ramineni, C. (2010). The importance of number sense to mathematics achievement in first and third grades. *Learn Individual Differences, 1*, *20*(2), 82–88.

Jusra, H., & Iskandar, L. A. (2020). An analysis of students' attitudes towards mathematical problem solving ability. *Kalamatika: Jurnal Pendidikan Matematika*, *5*(2), 181-194.

Kandemir, M.A., & Gur, H. (2007). Creativity training in problem solving: A model of creativity in mathematics teacher education. *New Horizons in Education, 55* (3), 107-122.

Karlina, A. (2022). Students' problem-solving ability in solving mathematical problems based on Polya's method as a criterion for measuring learning results. *Alifmatika: Jurnal Pendidikan dan PembelajaranMatematika*, *4*(2), 176-191.

Kaur, J., & Vipinder, N. (2023). *Effect of webbased instructions on mathematical computation skills and mathematics anxiety of slow learners in relation to attitude towards mathematics* [Doctoral dissertation, Department of Education. Punjab University].

Kaur, P. (2021). *Effect of three tiered approach on achievement in mathematics and mathematical anxiety of primary school students* [Doctoral dissertation, Department of Education, Panjab University]. http://hdl.handle.net/10603/380835

Khalid, M., Saad, S., Hamid, S. R. A., Abdullah, M. R., Ibrahim, H., & Shahrill, M. (2020). Enhancing creativity and problem solving skills through creative problem solving in teaching mathematics. *Creativity Studies*, *13*(2), 270-291.

Kilpatrick, J. (1987). Problem formulating: Where do good problems come from? In A. H. Schoenfeld (Ed.), *Cognitive science and mathematics education.* Lawrence Erlbaum.

King. (2009). Importance of mathematics in school education. *Journal of Mathematics Education, 4*(8).

Kinsley, J. (2002). A four stage model of mathematical learning. *Mathematics Educator.* https://files.eric.ej.gov/fulltext/EJ649574.

Kolb, D. A. (1984). *Experimental learning*. Prentice Hall.

Konecki, L.R, & Schiller, E. (2003). *Brain-based learning and standards-based elementary science* (Report No. SP041386). https://files.eric.ed.gov/fulltext/ED472624.pdf

Koşar, G. (2018). Brain-compatible learning: from students perspectives. *European Journal of English Language Teaching*. https://doi.org/10.46827/EJEL.V0I0.1780

Koul, L. (1997). *Methodology of educational research*. Vikas Publishing House Pvt. Ltd

Krichevets, A. N., Shvarts, A. Y., & Chumachenko, D. V. (2014). Perceptual action of novices and experts in operating visual representations of a mathematical concept. *Journal of higher school of Economics, 11*(3), 55-78.

Krishnamurthy, S. (2019). *Perceptual speed and school environment as predictors of mathematics achievement: A study at IX class level* [Doctoral dissertation, Department of Education, Dravidian University]. http://hdl.handle.net/10603/472584

Kulp, M. T., Earley, M. J., Mitchell, G. L., Timmerman, L. M., Frasco, C. S., & Geiger, M. E. (2004). Are visual perceptual skills related to mathematics ability in second through sixth grade children? *Focus on Learning Problems in Mathematics, 26*(4), 44-51.

Kulsum, N. U., & Kristayulita, K. (2019). Student problem solving analysis by step john dewey reviewed from learning style. *IJECA-International Journal of Education and Curriculum Application*, *2*(2), 20-30.

Kumar, H.B.C. (2021). *The effect of active learning strategies on achievement in mathematics and problem-solving ability among secondary school students* [Doctoral dissertation, Department of Education, University of Mysore]. http://hdl.handle.net/10603/392854

Lagoudakis, N., Vlachos, F., Christidou, V., & Vavougios, D. (2022). The effectiveness of a teaching approach using brain-based learning elements on students' performance in a Biology course. *Cogent Education*, *9*(1), 2158672. https://doi.org/10.1080/2331186X.2022.2158672.

Lazarus, J. (2017). OAME/NCTM Report–The 2017 NCTM Annual Meeting And Exposition. *Submission of Articles*, 8.

Li, S. X., & Cai, Y. C. (2014). The effect of numerical magnitude on the perceptual processing speed of a digit. *Journal of Vision*, *14*(12), 18-18. http://doi.org/10.1167/14.12.18

Liebert, R.M., & Morris, L. W. (1967). Cognitive and emotional components of test anxiety: a distinction and some initial data. *Psychological Reports*, *20*(3), 975- 978.

Lindberg, D. C. (1982). On the applicability of mathematics to nature: Roger Bacon and his predecessors. *The British Journal for the History of Science*, *15*(1), 3-25.

Lisheetha, P. V., & Aruna, P. K. (2018). *Relationship between intelligence and problem solving ability in mathematics of dyscalculia students and normal students at secondary school level in Kozhikode district* (Unpublished M.Ed. dissertation). Department of Education, University of Calicut.

Liu, H., Yaojiang, S., Emma, A., & Scott, R. (2018). Anxiety in rural Chinese children and adolescents: comparisons across provinces and among subgroups. *International Journal of Environmental Research and Public Health, 15*(10), 2087.

Luchins, A. S. (1942). Mechanization in problem solving: The effect of Einstellung. *Psychological Monographs*, *54*(6), i.

Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education*, 520-540. https://doi.org/10.2307/749772

MacLean, P. D. (1977). The triune brain in conflict. *Psychotherapy and Psychosomatics, 28*(1/4), 207-220.

Mandler, G., & Sarason, S.B. (1952). A study of anxiety and learning. *The Journal of Abnormal and Social Psychology, 47*(2), 166.

Mangal, S. K. (2006). *Statistics in psychology and education*. Prentice Hall of India Pvt. Ltd.

Marr, D. (2010). *Vision: A computational investigation into the human representation and processing of visual information*. MIT press.

Marsh-Henry, Z. (2020). *Assessing the relationship between academic anxiety and maths performance effects amongst young adults*. Institute of Psychological Sciences, University of Leeds. http://dx.doi.org/10.13140/RG.2.2.22039.39846

Martorella, P. H. (1978). John Dewey: Problem solving and history teaching. *The Social Studies*, *69*(5), 190-194.

Mastoni, E., Sumantri, M. S., & Ibrahim, N. (2019). A preliminary study of brain-based learning (BBL) and intrapersonal intelligence in junior high school mathematics learning. *Universal Journal of Educational Research*, *7*(9A), 147-154. https://doi.org/10.31580/apss.v4i3.815.

Mayer, R. E. (1987). Learnable aspects of problem solving: Some examples. *Applications of Cognitive Psychology: Problem Solving, Education, and Computing*, 109-122.

Mayer, R. E. (1987). The elusive search for teachable aspects of problem solving. In. J.A. Glover, & R.R. Ronning (Eds.), *Historical foundations of educational psychology* (pp. 327-347). Springer US.

Mayer, R. E. (1993). Understanding individual differences in mathematical problem solving: Towards a research agenda. *Learning Disability Quarterly*, *16*(1), 2-5.

Mayer, R. E. (2019). Problem solving. In *Oxford research Encyclopedia of Education*.

Mayzner, M. S., & Tresselt, M. E. (1966). Anagram solution times: A function of multiple-solution anagrams. *Journal of Experimental Psychology*, *71*(1), 66.

McDermott, J. (1988). Preliminary steps towards Taxonomy of problem solving methods. In S. Marcus (Ed.), *Automating knowledge acquisition for expert systems* (pp.225–255). Kluwer Academic Publishers.

McMillan, J. H., & Schumacher, S. (2010). *Research in education: Evidence based inquiry* (7th ed.). Pearson.

McMillan, J. H., & Shumacher, S. (1989). *Research in education: Conceptual introduction.* Harper Collins Publishers.

Milan, L. (2021). *A study of problem solving ability, aptitude and interest in the achievement of mathematics among secondary school students* [Doctoral dissertation, Department of education, University of Mysore]. http://hdl.handle.net/10603/392206

Morency, A., & Wepman, J. M. (1973). Early perceptual ability and later school achievement. *The Elementary School Journal, 73*(6), 323-327. http://www.jstor.org.

Munz, D.C., & Smouse, A.D. (1968). Interaction effects of item-difficulty sequence and achievement- anxiety reaction on academic performance. *Journal of Educational Psychology, 59*(5), 370.

Nanda, R. A., & Usman, U. (2022). Mathematical problem-solving ability of junior high school students. *International Journal of Trends in Mathematics Education Research*, *5*(1), 53-60. https://doi.org/10.33122/ijtmer.v5i1.109

Nandhini, M. (2022). *Mathematics anxiety self efficacy hemisphericity in relation to academic achievement in mathematics of higher secondary school students* [Doctoral dissertation, Department of Education, University of Madras]. http://hdl.handle.net/10603/460477

National Council of Teachers of Mathematics (NCTM). (1989). *Curriculum and evaluation standards for school mathematics.* Author

National Council of Teachers of Mathematics (NCTM). (1989). *Professional standards for school mathematics*. Author.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics.* Author.

National Council of Teachers of Mathematics. (2014), *Principles to actions*. Retrieved from https://www.nctm.org/uploadedFiles/Standards_and_Positions/PtAExecutive#wline Summary.pdf.

National Council of Teachers of Mathematics. (2018). *Catalyzing change in high school mathematics: Initiating critical conversations.* NCTM.

National Council of Teachers of Mathematics. (2020), *Standards for mathematics teacher preparation.* Retrieved from https://www.nctm.org/standards-and-positions /CAEP-standards/.

National Research Council, Center for Education, Committee on Science, & Mathematics Teacher Preparation. (2001). *Educating teachers of science, mathematics, and technology: New practices for the new millennium*. National Academies Press.

National Research Council, Mathematical Sciences Education Board. (1989). *Everybody counts: A report to the nation on the future of mathematics education*. National Academic Press.

Navneet, K. (2021). *Effect of self regulated learning strategies on achievement in mathematics and motivational beliefs in relation to mathematical anxiety and mathematical creativity* [Doctoral dissertation, Department of Education, Punjab University]. http://hdl.handle.net/10603/363397

Nerney, G. (1979). The gestalt of problem-solving: An interpretation of Max Wertheimer's 'productive thinking'. *Journal of Phenomenological Psychology*, *10*(1), 56.

Newstead, K. (1998). Aspects of children's mathematics anxiety. *Educational Studies in Mathematics, 36(1), 53-71.*

Olaoluwa, S. A., & Ayantoye, C. A. (2016). Impact of brain-based instructional strategy on academic performance of deaf students in mathematics in Oyo School of Handicapped, Nigeria. *World*, *3*(2), 447-459. https://doi.org/10.22158/WJER.V3N2P447

Olowa, O.W. (2009). Effects of the problem solving and subject matter approaches on the problem solving ability of secondary school agricultural education. *Journal of STEM Teacher Education, 46*(1), 33-47.

Ongcoy, P. J. B., Jasmin, D. R. A., Guiamal, I. P., Guinita, S. S., & Iligan, A. M. M. (2023). Experiences and mathematics anxiety of STEM students. *Journal of Mathematics and Science Teacher*, *3*(1).

Ornstein, P., Coffman, J., Grammer, J., San Souci, P., & McCall, L. (2010). Linking the classroom context and the development of children's memory skills. In *Handbook of research on schools, schooling and human development* (pp. 42-59). Routledge.

Oxford Dictionary of English (3rd ed.) (2010). Oxford University Press, China Translation & Printing Services Ltd, China.

Oxford, R. L. (1990). *Language learning strategies: What every teacher should know.* Heinle & Heinle.

Parvathy, K. (2002). *A study of problem solving ability in mathematics of IX standard students of Palakkad district* [M.Ed. dissertation, Farook Training College]. https://find.uoc.ac.in/Record/186127

Paul, A. (2017). *Effect of brain-based learning strategy and circles of learning strategy on achievement in mathematics and self-efficacy of standard VII students* [Doctoral dissertation, Department of Education, University of Calicut, Kerala]. http://hdl.handle.net/10603/221579

Peters, K.J., Dana, M., & Carlsen, A.N. (2024). Visual perceptual processing is unaffected by cognitive fatigue. *Consciousness and Cognition*, *119*. 103666. https://doi.org/10.1016/j.concog.2024.103666

Polya, G. (1962). *Mathematical discovery on understanding, learning, and teaching problem solving* (Vol. II). Wiley.

Polya, G. (1973). *How to solve it*. Princeton University Press.

Polya, G., & Pólya, G. (2014). *How to solve it: A new aspect of mathematical method* (Vol. 34). Princeton University Press.

Ponetti, G., & Wallymahmed, A. H. (2023). A meta-analysis on the impact of intervention on mathematics anxiety among (young) adults. *Research Square*. https://doi.org/10.21203/rs.3rs-2250521/VI

Powell, S. R., Driver, M. K., & Julian, T. E. (2015). The effect of tutoring with nonstandard equations for students with mathematics difficulty. *Journal of Learning Disabilities*, *48*(5), 523-534.

Praseeja, E.J. (2007). *Extent of problem solving in mathematics among secondary school pupils under sarvasikshaabhiyan* (Unpublished M.Ed. dissertation). Department of Education, University of Calicut.

Pratikno, H., & Retnowati, E. (2018). How Indonesian students use the Polya's general problem solving steps. *Southeast Asian Mathematics Education Journal*, *8*(1), 39-48.

Preethi, E.R. (2008*). Relative efficiency of problem solving ability mathematics interest and awareness in the utility of mathematics in predicting achievement in mathematics of secondary pupils of Kerala* (Unpublished M.Ed. dissertation). University of Calicut.

Pribram, K. H. (2013). *Brain and perception: Holonomy and structure in figural processing*. Psychology Press.

Procopio, M., Fernández-Cézar, R., Fernandes-Procopio, L., & Yánez-Araque, B. (2024). Neuroscience-based information and communication technologies development in elementary school mathematics through games: A case study evaluation. *Education Sciences*, *14*(3), 213.

Radin, B. A. (2006). *Challenging the performance movement: Accountability, complexity, and democratic values*. Georgetown University Press.

Radin, L., Dömötor, R., Duffus, P., Kleinsorgen, C., Kuhar, M., Mandoki, M., ..., & Steinberg, E. (2018). *Soft skills curriculum for implementation in veterinary higher education*. SOFT VETS.

Radin, M. A., & Orlova, O. (2018, May). University level teaching styles with high school students and international teaching and learning. In *Society. Integration, Education-Proceedings of the International Scientific Conference* (Vol. 1, pp. 464-475).

Raju, B. S. (2004). Teaching problem solving in Mathematics. *Edutrack, 3*(6).

Ramalu, P. (2023). *Problem solving ability in mathematics of secondary students in relation to their attitude towards mathematics, mental health and mathematics anxiety in Adilabad district: A study*. [Doctoral dissertation, Department of education, Swami Ramanand Teerth Marathwada University]. http://hdl.handle.net/10603/515279

Rasheed, S.A.L., & Hanafy, A. A. M. (2023). Effects of brain-based instruction on executive function and habits of mind among young children at-risk for learning disabilities. *Applied Neuropsychology: Child*, 1-8. https://doi.org/10.1080/21622965.2022.2161904.

Raven, J. C. (1965). *Raven's progressive matrices*. Psychological Corporation.

Raven, J.C. (1958). *Standard progressive matrices Sets A, B, C and E*. M.K. Lewis and Coll. Ltd.

Roark, B.M. (1998). *Different learning styles: visual us non-visual learners mean raw score in the vocabulary, comprehension, mathematical computation and mathematical concepts*. https://eric.ed.gov/?id=ED430774.

Rohde, T. E. (2008). *An examination of how visual perception abilities influence mathematics achievement* [Doctoral dissertation, Department of Psychology Case]. http://drc.ohiolink.edu.

Roth, I., & Frisby, J. P. (1986). *Perception and representation: A cognitive approach*. Open University Press.

Roth, M. S., & Romeo, J. B. (1992). Matching product category and country image perceptions: A framework for managing country-of-origin effects. *Journal of International Business Studies*, *23*, 477-497.

Ryan, M., Fitzmaurice, O., & Johnson, P. (2023). Investigating mathematics anxiety among mature students in service mathematics courses using the mathematics anxiety scale UK. *International Journal of Mathematical Education in Science and Technology*, 1-25. http://doi.org/10.1080/0020739X.2023.2179950.

Safitri, E. F., Asmar, A., & Musdi, E. (2023). Analysis of mathematics problem-solving ability of students in solving material system of three variable linear equations (SPLTV) class X SMA. In *AIP Conference Proceedings* (Vol. 2698, No. 1). AIP Publishing. http://dx.doi.org/10.1063/5.0122558

Safitri, M., & Suryani, N. (2022). Analysis of metacognitive ability in mathematics problem solving of SMA students at Ngemplak Boyolali. *Journal of Mathematics and Mathematics Education*, *12*(2), 72-82. http://dx.doi.org/10.20961/jmme.v12i2.64432

Salim, S. K., & Ameer, L.F.J.A. (2022). The impact of an instructional-learning design based on the brain-compatible model in systemic thinking among first intermediate grade female students in Mathematics. *International Journal of Early Childhood Special Education*, *14*(3), 885-892.

Santosa, A., & Huda, N. (2023). Analysis of mathematics problem solving ability students based on mathematical resilience and gender. *Asian Journal of Education and Social Studies*, *46*(4), 1-11.

Sarabjeet. (2022). *Effect of peer tutoring strategy on mathematics achievement of 9th graders in relation to mathematics self concept and anxiety* [Doctoral dissertation, Department of Education, Punjab University]. http://hdl.handle.net/10603/540595

Sathishkumar, N. (2023). *A study on mathematics performance in relation to attitude towards mathematics interest in mathematics and mathematics anxiety* [Doctoral dissertation, Department of Education, Annamalai University]. http://hdl.handle.net/10603/511446

Scheibel, D. (1994). Graffiti and "film school" culture: Displaying alienation. *Communications Monographs*, *61*(1), 1-18.

Scheibel, D. (1996). *Appropriating bodies: Organ (izing) ideology and cultural practice in medical school.* Digital Commons @ LMU & LLS Citation

Schoenfeld, A. H. (1987). Pólya, problem solving, and education. *Mathematics Magazine*, *60*(5), 283-291.

Schoenfeld, A. H. (1992). Learning to think mathematically: Problem solving, metacognition and sense-making in mathematics. In D. Grouws (Ed.), *Handbook for research on mathematics teaching and learning* (pp. 334–370). Macmillan.

Sevindir, H. K., Yazici, C., & Yazici, V. (2014). Mathematics anxiety of secondary school students: A case study for Kocaeli area. *Procedia-Social and Behavioral Sciences*, *152*, 630-636.

Shukry-Balaa, R., & El-Hassan, K. (2018). The effect of brain-compatible strategies on problem solving performance of grade 4 and 5 Lebanese students. *European Scientific Journal, ESJ*, *14*(19), 149-166. http://dx.doi.org/10.19044/esj.2018.v14n19p149

Simon, H. A., & Newell, A. (1974). Thinking processes. *Contemporary Developments in Mathematical Psychology*, *1*, 101-104.

Sini, S., & Sudheeshkumar, P.K. (2006). *Effectiveness of brain-compatible learning on achievement in biology of secondary school pupils* [MEd dissertation, Department of Education, University of Calicut].

Siska, E., & Fauzi, M. A. (2023). Literatur study of students mathematical problem solving abilities on higher order thinking skill questions from various learning models. *ZERO: Jurnal Sains, Matematika dan Terapan*, *6*(2), 127-132. http://dx.doi.org/10.30829/zero.v6i2.14676

Smetackova, I. (2015). Gender stereotypes, performance and identification with math. *Procedia-Social and Behavioral Sciences*, *190*, 211-219.

Smilkstein, R. (2011). *We're born to learn: Using the brain's natural learning process to create today's curriculum*. Corwin Press.

Smith, E, E., & Kossiyn, S, M. (2015). *Cognitive psychology, mind and brain*. Pearson India Education Services Pvt. Ltd.

Soltis, J. F. (1971). John Dewey. *The encyclopedia of education*, *3*, 81-85.

Sowder, L. (2013). Cognitive psychology and mathematical problem solving: A discussion of mayer's Paper 1. In *Teaching and Learning Mathematical Problem Solving* (pp. 139-145). Routledge.

Steele, D. F., & Arth, A. A. (1998). Lowering anxiety in the math curriculum. *The Education Digest, 63*(7), 18.

Sternberg, R. J. (1999). *Cognitive psychology* (2nd ed.). Harcourt Brace.

Sternberg, R.J. (1985). *Beyond IQ: A triarchic theory of human intelligence.* Cambridge University Press.

Sternberg, R.J. (1986). *Intelligence applied? Understanding and increasing your intellectual skills.* Harcourt Brace Jovanovich.

Sternburg, R, J., & Davidson, J. E. (2003). *The psychology of problem solving*. Cambridge University Press.

Sumana, B. (2019). *A study of the role of concepts in perceptual experience* [Doctoral dissertation, Department of Philosophy, Jadavpur University]. http://hdl.handle.net/10603/357400

Sunitha, T.P. (2015). *Effectiveness of cognitively guided instructional strategy on mathematics anxiety and achievement in mathematics of upper primary school students* [Doctoral dissertation, Department of Education, University of Calicut]. http://hdl.handle.net/10603/205737

Supu, M. E., Djakaria, I., & Zakiyah, S. (2023). *Improving mathematical problem-solving ability through means-ends analysis.* In *E3S Web of Conferences* (Vol. 400, p. 03005). *EDP Sciences*.

Surur, M., Efrianti, S., Yuliana, D., & Puspitasari, Y. (2021). An intensive exploration of students' problem-solving abilities using a problem-solving learning model. In *2nd Annual conference on blended learning, educational technology and Innovation (ACBLETI 2020)* (pp. 454-457). Atlantis Press.

Taneja, S. (2016). *Spatial ability and perceptual speed of high school students as predictors of achievement in mathematics* [Doctoral dissertation, Department of Education, Maharshi Dayanand University]. http://hdl.handle.net/10603/207005

Taylor, B. A., & Fraser, B. J. (2012). Learning environment, mathematics anxiety and sex differences. *Curriculum and Teaching*, *27*(1), 5-20.

Thakur, R. (2020). *Study of visual perceptual skill, attentional skill and their correlation with the reading skill of hearing impaired children* [Doctoral dissertation, Faculty of Health Sciences, Chitkara University Punjab]. http://hdl.handle.net/10603/301848

Thambi, T. (2018). *Effectiveness of an instructional strategy based on path smoothing model on creative problem solving ability perceptual speed and achievement in mathematics of students at secondary level* [Doctoral dissertation, Department of Education Mahatma Gandhi University]. http://hdl.handle.net/10603/255193

Thomassen, L. C., Rabolli, V., Masschaele, K., Alberto, G., Tomatis, M., Ghiazza, M., ..., & Fubini, B. (2011). Model system to study the influence of aggregation on the hemolytic potential of silica nanoparticles. *Chemical Research in Toxicology*, *24*(11), 1869-1875.

Thompson, R. A. (1984). Language, the brain, and the question of dichotomies. *American Anthropologist*, *86*(1), 98-105.

Tobias, S. (1985). Test anxiety: Inference, defective skills and cognitive capacity. *Educational Psychologist, 20*(3), 135-142.

Tobias, S. (1992). The impact of test anxiety on cognition and school learning. In K.A. Hagtvet (Ed.), *Advances in test anxiety research (pp. 18-31).* Swets & Zeitlinger

Tresselt, M. E. (1968). A re-examination of anagram problem solving. *Transactions of the New York Academy of Sciences*, *30*(8 Series II), 1112-1119.

Trezise, K., & Reeve, R. A. (2014). Cognition-emotion interactions: Patterns of change and implications for math problem solving. *Frontiers in Psychology, 5, Article 840*. https://doi.org/10.3389/fpsyg.2014.00840

Trezise, K., & Reeve, R. A. (2014). Working memory, worry, and algebraic ability. *Journal of Experimental Child Psychology*, *121*, 120-136.

Tripathi, P. N. (2008). Developing mathematical understanding through multiple representations. *Mathematics Teaching in the Middle School*, *13*(8), 438-445.

Ulum, H., & Küçükdanacı, T. (2022). The relationship between mathematics anxiety and mathematics achievement: Meta analysis study. *Research on Education and Psychology*, *6*(2), 193-206.

Vecchione, F., Giancola, M., Palmiero, M., Boccia, M., D'Amico, S., & Piccardi, L. (2023). Field dependence-independence mediates the association between visual perception and mathematics: A cross-sectional study in children and preadolescents. *European Journal of Developmental Psychology*, *20*(5), 854-874. https://doi.org/10.1080/17405629.2023.2224552.

Vidad, D. C., & Quimbo, M. A. T. (2021). Students' problem-solving difficulties and coping strategies in mathematics: A model-building study. *International Journal of Learning, Teaching and Educational Research*, *20*(9), 136-173.

Vipul. (2022). *Effect of brain based learning programme on mathematics anxiety and academic achievement of secondary school students in relation to their learning styles* [Doctoral dissertation, Department of Education, Panjab University]. http://hdl.handle.net/10603/542042

Viswanatham, J. (2022). *A study on problem solving abilities and anxiety in mathematics among secondary school students in relation to academic performance* [Doctoral dissertation, Faculty of Education, Osmania University]. http://hdl.handle.net/10603/469680

Vock, M., & Holling, H. (2005). The measurement of visuo-spatial and verbal-numerical working memory: Development of IRT-based scales. *Intelligence, 36*(2), 161-182. https://doi.org/10.1016/j.intell.2007.02.004.

Vukovic, R. K., Kieffer, M. J., Bailey, S. P., & Harari, R. R. (2013). Mathematics anxiety in young children: Concurrent and longitudinal associations with mathematical performance. *Contemporary Educational Psychology, 38*(1), 1-10. https://doi.org/10.1016/j.cedpsych.2012.09.001

Vukovic, R. K., Roberts, S. O., & Green Wright, L. (2013). From parental involvement to children's mathematical performance: The role of mathematics anxiety. *Early Education & Development*, *24*(4), 446-467.

Wahyuni, R., Juniati, D., & Wijayanti, P. (2024). Mathematics anxiety in mathematics education: A bibliometrics analysis. *Journal of Education and Learning (EduLearn)*, *19*(1), 380-393. https://doi.org/10.11591/edulearn.v19i1.21768

Webb, N.L. (1979). Processes, conceptual knowledge and mathematical problem solving ability. *Journal for Research in Mathematics Education, 10,* 83-93.

Webster's Dictionary of English Language. (1989). Crown Publishers.

Weiskrantz, L. (1982). Comparative aspects of studies of amnesia. *Philosophical Transactions of the Royal Society of London Biological Sciences*, *298*(1089), 97-109. https://doi.org/10.1098/rstb.1982.0075

Weiskrantz, L. (2000). Blindsight: Implications for the conscious experience of emotion. *Cognitive Neuroscience of Emotion*, 277-295.

Wertheimer, M. (2017). *Max Wertheimer and gestalt theory*. Routledge.

Wiantara, I. G. N. O., Astawan, I. G., & Renda, N. T. (2020). Brain based learning using media crossword puzzle enhances students understanding of concepts and thinking skills. *Jurnal Pendidikan Dan Pengajaran*, *53*(2), 156-167. https://doi.org/10.23887/jpp.v 53i2.25120.

Widodo, S., Santia, I., Katminingsih, Y., & Handayani, A. D. (2023). Increasing students' mathematical problem solving ability through realistic mathematics education (RME). *International Journal of Research and Review*, *10*(1), 68-76. https://doi.org/10.52403/ijrr.20230109

Wigfield, A., & Meece, J. L. (1988). Math anxiety in elementary and secondary school students. *Journal of Educational Psychology*, *80*(2), 210-216.

Wiley, J. (2011). Problem solving and creative thinking. *Learning and Individual Differences, 21*(4) 458-462.

Wine, J. (1971). Test anxiety and direction of attention. *Psychological Bulletin*, *76*(2), 92.

Winer, B.J. (1971). *Statistical principles in experimental design* (2nd ed.). Mc Graw-Hill.

Zhang, S., Xia, X., Li, F., Chen, C., & Zhao, L. (2021). Study on visual and auditory perception characteristics of children with different type of mathematics learning disability. *International Journal of Disability, Development and Education*, *68*(1), 78-94. https://doi.org/10.1080/1034912X.2019.1634248

Zhu, Y., Liu, X., Xiao, Y., & Sindakis, S. (2024). Mathematics anxiety and problem-solving proficiency among high school students: Unraveling the complex interplay in the knowledge economy. *Journal of the Knowledge Economy*, 1-31.

APPENDICES

APPENDICES

Appendix I

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PROBLEM SOLVING ABILITY IN MATHEMATICS

(DRAFT-Malayalam Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

നിർദ്ദേശങ്ങൾ

ഈ പരീക്ഷയിൽ ആകെ 40 ചോദ്യങ്ങൾ തന്നിട്ടുണ്ട്. ഓരോ ചോദ്യത്തിനും a, b, c, d എന്നീ നാലുത്തരങ്ങൾ കൊടുത്തിട്ടുണ്ട്. ഓരോ ചോദ്യവും ശ്രദ്ധിച്ച് വായിച്ച ശേഷം ശരിയുത്തരം മനസ്സിലാക്കി നിങ്ങളുടെ ഉത്തരങ്ങൾ തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ അതാത് ചോദ്യനമ്പറുകൾക്ക് നേരെ കൊടുത്തിട്ടുള്ള കള്ളിയിൽ ഗുണന ചിഹ്നം × കൊണ്ട് രേഖപ്പെടുത്തുക.

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1. രാജൻ ഒരു കുല പഴം വാങ്ങി. കേടു വന്ന 7 എണ്ണം മാറ്റി കഴിഞ്ഞപ്പോൾ 46 എണ്ണമുണ്ട്. കുലയിൽ ആകെ എത്ര പഴം ഉണ്ടായിരുന്നു?

   a) 50 b) 51 c) 52 d) 53

2. എതിർവശങ്ങൾ സമാന്തരമായ ചതുർഭുജങ്ങൾ ഏത് പേരിൽ അറിയപ്പെടുന്നു?

   a) സാമാന്തരികം b) ത്രികോണം c) പഞ്ചഭുജം d) ഷഡ്ഭുജം

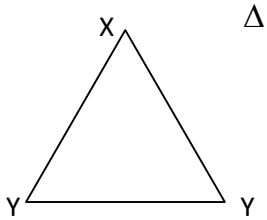
3. 'RANGE' എന്ന വാക്കിനെ '12345' എന്നെഴുതാമെങ്കിൽ 'ANGER' എന്ന വാക്കിനെ എങ്ങനെ എഴുതാം?

   a) 23451 b) 14352 c) 23154 d) 12453

4. 9,18,27,36, ---- ഈ സംഖ്യാശ്രേണിയിലെ അടുത്ത സംഖ്യ ഏത്?

   a) 45 b) 55 c) 65 d) 75

5. Δ XYZ ന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?



   a) 90^0 b) 180^0 c) 60^0 d) 360^0

6. $3^x = 9$ ആയാൽ 3^{x-1} കണ്ടുപിടിക്കുക.

   a) 3 b) 6 c) 9 d) 12

7. $\frac{7+7+7\div 7}{(5+5+5)\div 5} =$ .....

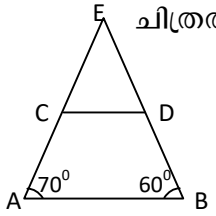
a) 4 b) 2 c) 6 d) 5

8. E, J, O, T, ... ഇവയിൽ അടുത്ത ആക്ഷരം ഏത്?

a) U b) X c) Y d) W

9. "അഞ്ച് മാർക്ക് കൂടി കിട്ടിയിരുന്നെങ്കിൽ കണക്കു പരീക്ഷയ്ക്ക് നൂറു മാർക്കും ആയേനെ", റീനയുടെ സങ്കടം. റീനക്ക് എത്ര മാർക്കാണ് കിട്ടിയത്?

a) 95 b) 96 c) 95 d) 98

10. 

ചിത്രത്തിൽ ABയും CDയും സമാന്തരമാണ് ∠Eയുടെ അളവ് എത്ര?

a) 50 b) 60 c) 70 d) 80

11. $\frac{10^6 \times 10^7}{10^4 \times 10^5} =$ .....?

a) 10^4 b) 10^5 c) 10^6 d) 10^7

12. രണ്ടു സംഖ്യകളിൽ ഓരോന്നിന്റേയും രണ്ട് മടങ്ങ് കണ്ടുപിടിച്ച് അവ കൂട്ടുക എന്ന ക്രിയയെ ബീജഗണിത രീതിയിൽ എങ്ങനെ എഴുതാം?

a) x + y b) 2x + 2 y c) 2 x+y d) x + 2y

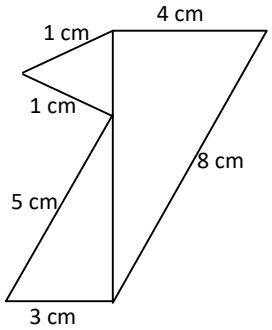
13. 2^{10} ന്റെ എത്ര മടങ്ങാണ് 2^{11}?

a) രണ്ട് മടങ്ങ് b) മൂന്ന് മടങ്ങ് c) നാലു മടങ്ങ് d) അഞ്ചു മടങ്ങ്

14. 5 പേർ 28 ദിവസം കൊണ്ട് ചെയ്ത് തീർക്കുന്ന ജോലി 20 പേർ എത്ര ദിവസം കൊണ്ട് ചെയ്ത് തീർക്കും.

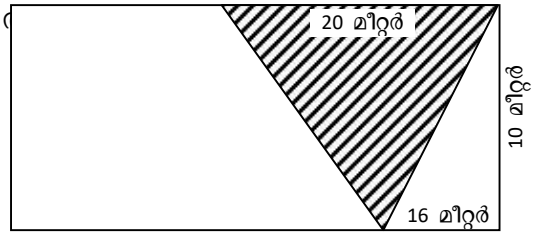
a) 7 b) 8 c) 9 d) 10

15. താഴെ തന്നിരിക്കുന്ന ബഹുഭുജത്തിന്റെ ചുറ്റളവ് എത്രയായിരിക്കും?



a) 22 cm b) 23 cm c) 24 cm d) 25 cm

16. ചതുരാകൃതിയായ ഒരു സ്ഥലത്തിന് 30 മീറ്റർ നീളവും 10 മീറ്റർ വീതിയും ഉണ്ട്. ഇതിനകത്ത് ചിത്രത്തിൽ കാണുന്നതുപോലെ ത്രികോണാകൃതിയായ ഒരു സ്ഥലം വാഴക്കൃഷി ചെയ്യുന്നതിനായി വേർതിരിച്ചിരിക്കുന്നു. ഈ ഭാഗത്തിന്റെ പരപ്പളവ് എത്ര ചതുരശ്രമീറ്റർ (



a) 100 b) 200 c) 300 d) 400

17. മൂന്ന് വശങ്ങളും തുല്യമായ ത്രികോണത്തെ ..... എന്ന് പറയുന്നു.

a) ത്രികോണം b) സമഭുജത്രികോണം c) സമാന്തരികം d) സമപാർശ്വത്രികോണം

18. $5^6 \times \frac{1}{5^x} = \frac{1}{5^{10}}$ എന്ന് കിട്ടുമെങ്കിൽ x = ...?

a) 16 b) 15 c) 6 d) 5

19. ഒരു സമ്മേളനത്തിൽ 120 സ്ത്രീകളും 140 പുരുഷൻമാരും പങ്കെടുത്തു. സ്ത്രീകളുടെ എണ്ണവും പുരുഷൻമാരുടെ എണ്ണവും തമ്മിലുള്ള അംശബന്ധം കണ്ടുപിടിക്കുക?

a) 11 : 12 b) 12 : 14 c) 13 : 15 d) 15 : 17

20. പച്ചക്കറി കച്ചവടത്തിലെ ലാഭം നാലുപേർ തുല്യമായി പങ്കുവച്ചപ്പോൾ ജോസിന് 1500 രൂപ കിട്ടി. ആകെ ലാഭം എത്ര രൂപയാണ്?

a) 6000 b) 7000 c) 8000 d) 9000

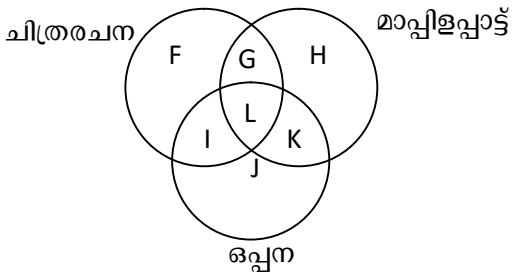
21. '+' ഹരണത്തേയും, '-' ഗുണനത്തേയും, 'x' സങ്കലനത്തേയും, ÷ വ്യവകലനത്തേയും സൂചിപ്പിച്ചാൽ $30 \div 20 + 2 \times 5 - 7$ എത്ര?

a) 40 b) 70 c) 55 d) 53

22. 5623 എന്ന സംഖ്യയിൽ 5 ന്റെ സ്ഥാനവിലയും മുഖവിലയും തമ്മിലുള്ള വ്യത്യാസം കാണുക?

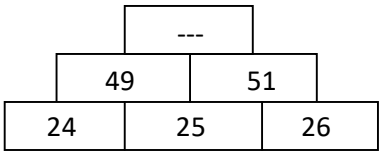
a) 4995 b) 4599 c) 5499 d) 9459

23. ചിത്രത്തിൽ, സ്കൂൾ യുവജനോത്സവത്തിൽ മാപ്പിളപ്പാട്ട്, ചിത്രരചന, ഒപ്പന എന്നീ മൂന്ന് വിഭാഗത്തിലും മത്സരിച്ച വിദ്യാർത്ഥികളെ സൂചിപ്പിക്കുന്ന ഭാഗമേത്?

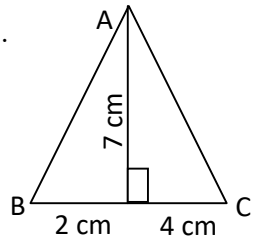


a) F b) H c) J d) L

24. താഴെ തന്നിരിക്കുന്ന സംഖ്യാഗോപുരത്തിന്റെ ഏറ്റവും മുകളിൽ വരുന്ന സംഖ്യ ഏത്?



a) 100 b) 49 c) 51 d) 25

25. 

Δ ABC യുടെ പരപ്പളവ് എത്ര?

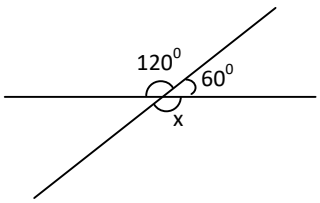
a) 21 cm^2 b) 31 cm^2 c) 41 cm^2 d) 51 cm^2

26. അച്ഛന് ഇപ്പോൾ 40 വയസ്സും മകന് 5 വയസ്സും പ്രായമുണ്ട്. മകന് 40 വയസ്സാകുമ്പോൾ അച്ഛന്റെ വയസ്സ് എത്ര?

a) 80 b) 75 c) 85 d) 70

27. 1^{10}ന്റെ വിലയെത്ര?

a) 1 b) 0 c) 10 d) 2

28. 

തന്നിരിക്കുന്ന ചിത്രത്തിൽ x ന്റെ വിലയെത്ര?

a) 60^0 b) 120^0 c) 80^0 d) 180^0

29. സീനയും സോനയും ഒരു തുക 3:2 എന്ന അംശബന്ധത്തിൽ വീതിച്ചപ്പോൾ സീനക്ക് 480 രൂപ കിട്ടി. ആകെ എത്ര രൂപയാണ് വീതിച്ചത്?

a) 800 b) 600 c) 500 d) 400

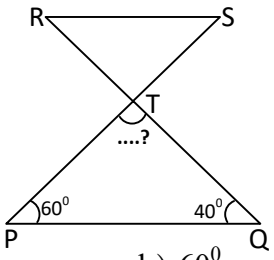
30. രവിയുടെ വീട് റെയിൽവേ സ്റ്റേഷനിൽനിന്ന് 90km അകലെയാണ്. 8 മണിക്ക് വീട്ടിൽനിന്ന് പുറപ്പെടുന്ന കാർ 9.30ന് റെയിൽവേ സ്റ്റേഷനിലെത്തിയാലേ വണ്ടി കിട്ടുകയുള്ളൂ. ചുരുങ്ങിയത് എത്ര km വേഗത്തിൽ കാർ സഞ്ചരിക്കണം?

a) 60 b) 50 c) 70 d) 80

31. നീതുവിന്റെ പണപ്പെട്ടിയിൽ 110 രൂപയുണ്ട് പേന വാങ്ങാൻ 15 രൂപയെടുത്തു. 10 രൂപയ്ക്ക് പേന കിട്ടി. മിച്ചം വന്ന 5 രൂപ വീണ്ടും പെട്ടിയിലിട്ടു. ഇപ്പോൾ പെട്ടിയിൽ എത്ര രൂപയുണ്ട്?

a) 100 b) 90 c) 75 d) 25

32. ചിത്രത്തിൽ PQവും RS ഉം സമാന്തരമാണ് ∠PTQ= ?



a) 80^0 b) 60^0 c) 40^0 d) 100^0

33. ഒരു കുളത്തിൽ താമരപ്പൂക്കൾ വിരിഞ്ഞു നിൽക്കുന്നു. പറന്നെത്തിയ കിളിക്കൂട്ടം ക്ഷീണമകറ്റാൻ പൂക്കളിലിരുന്നു. ഒരു താമരയിൽ ഒരു കിളി വീതം ഇരുന്നപ്പോൾ ഒരു കിളിക്ക് ഇടമില്ലാതായി. ഒരു താമരയിൽ ഇരുകിളികളായി ചേർന്നിരുന്നപ്പോൾ ഒരു താമര ബാക്കിയായി താമരയെത്ര? കിളിയെത്ര?

a) 3, 4 b) 3, 5 c) 5, 7 d) 7, 9

34. ക്ലാസ് തുടങ്ങിയപ്പോൾ 38 കുട്ടികൾ ഉണ്ടായിരുന്നു. അൽപം വൈകി 5 കുട്ടികൾ കൂടി എത്തി. കുറച്ചു കഴിഞ്ഞപ്പോൾ 3 കുട്ടികൾ ഗണിത ക്ലബ്ബിന്റെ യോഗത്തിനു പോയി. ഇപ്പോൾ ക്ലാസിൽ എത്ര പേരുണ്ട്?

a) 40 b) 30 c) 35 d) 45

35. റിയ ചരടുപയോഗിച്ച് ഒരു വൃത്തം കാർഡ്ബോർഡിൽ നിർമ്മിച്ചു. ഈ വൃത്തത്തിലെ ഒരു വ്യാസത്തിന്റെ രണ്ടറ്റങ്ങൾ വൃത്തത്തിലെ മറ്റൊരു ബിന്ദുവുമായി യോജിപ്പിച്ചപ്പോൾ റിയക്കു കിട്ടിയ കോൺ ഏതാണ്?

a) മട്ടകോൺ b) ന്യൂനകോൺ c) ബൃഹത്കോൺ d) ഇവയൊന്നുമല്ല

36. ഒരു കച്ചവടക്കാരൻ 2500 രൂപ കൊടുത്തു വാങ്ങിയ ഫാൻ 40% വില വർദ്ധിപ്പിച്ച് 15% കിഴിവ് കൊടുത്തു വിൽക്കുന്നു. അത് എത്ര രൂപക്കാണ് വിൽക്കുന്നത്?

a) 2975 b) 2900 c) 3500 d) 3000

37. ബാലു 25000 രൂപ ബാങ്കിൽ നിക്ഷേപിച്ചു. ബാങ്ക് 15% നിരക്കിലാണ് പലിശ കണക്കാക്കുന്നത്. 2 വർഷം കഴിഞ്ഞ് എത്ര രൂപ പലിശ ലഭിക്കും?

a) 7500 b) 7000 c) 5000 d) 6000

38. ഒരു വിനോദയാത്രക്കു പോയവർ ചെലവായ 5200 രൂപ തുല്യമായി വീതിച്ചു. ഓരോരുത്തർക്കും 1300 രൂപകൊടുത്തു. എത്ര പേരാണ് സംഘത്തിൽ ഉണ്ടായിരുന്നത്?

a) 4 b) 3 c) 2 d) 5

39. ദോശയുണ്ടാക്കാൻ, 6 കിണ്ണം അരിക്ക് 2 കിണ്ണം ഉഴുന്ന് എന്നാണ് കണക്ക്. 9 കിണ്ണം അരിയെടുത്താൻ എത്ര കിണ്ണം ഉഴുന്ന് എടുക്കണം.

a) 1 b) 2 c) 3 d) 4

40. ഒരു തീവണ്ടി 36 കി.മീ/മണിക്കൂർ വേഗത്തിൽ സഞ്ചരിക്കുന്നു. 3 മിനിറ്റുകൊണ്ട് ഈ തീവണ്ടി എത്ര ദൂരം സഞ്ചരിക്കും.

a) 1800 മീറ്റർ b) 1200 മീറ്റർ c) 1400 മീറ്റർ d) 1600 മീറ്റർ

Appendix II

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PROBLEM SOLVING ABILITY IN MATHEMATICS

(DRAFT-English Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

Instructions

This test consists of 40 questions. Each question contains answers in four options a, b , c , d. Read each question carefully find out the right answer and mark your answer in the response sheet given to you with an x mark. Your answers will be kept confidential and will be used only for research purposes.

1. Rajan bought a bunch of bananas after removing the 7 damaged bananas from the bunch there are 46 bananas left. Totally how many bananas were there in that bunch?

   a) 50 b) 51 c) 52 d) 53

2. A quadrilateral with opposite sides parallel is known as?

   a) Parallelogram b) triangle c) pentagon d) hexagon

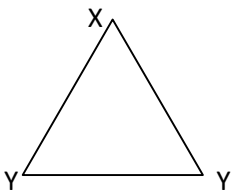
3. RANGE Can be written as '12345'. Then how to write the word 'ANGER'?

   a) 23451 b) 14352 c) 23154 d) 12453

4. 9, 18, 27, 36,…… Find out the next number in this number series?

   a) 45 b) 55 c) 65 d) 75

5. Find the sum of the interior angle of Δ XYZ?



   a) 90^0 b) 180^0 c) 60^0 d) 360^0

6. $3^x = 9$ then find out 3^{x-1}

   a) 3 b) 6 c) 9 d) 12

7. $\frac{7+7+7\div7}{(5+5+5)\div5}$ = -------.....

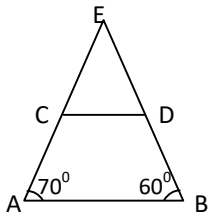
a) 4 b) 2 c) 6 d) 5

8. E, J, O, T, ……find the next letter in this series?

a) U b) X c) Y d) W

9. If Reena got five more marks in the exam her total score in mathematics will be 100. Find how much she scored in her mathematics exam?

a) 95 b) 96 c) 95 d) 98

10. 

In the given figure AB and CD are parallel then find out the measure of $\angle E$

a) 50 b) 60 c) 70 d) 80

11. $\frac{10^6 \times 10^7}{10^4 \times 10^5} =$.....?

a) 10^4 b) 10^5 c) 10^6 d) 10^7

12. Write the expression in an algebraic form of addition of double of two numbers?

a) x + y b) 2x + 2 y c) 2 x+y d) x + 2y

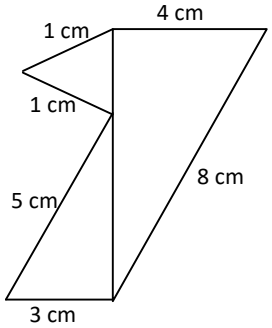
13. How many times of 2^{10} is 2^{11}?

a) 2-times b) 3-times c) 4-times d) 5-times

14. Five people take 28 days to complete a work how many days will take 20 people to complete the same work?

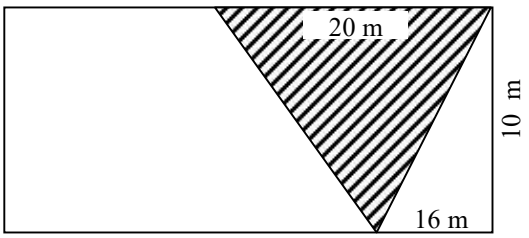
a) 7 b) 8 c) 9 d) 10

15. Find out the perimeter of a polygon whose sides are given?



a) 22 cm b) 23 cm c) 24 cm d) 25 cm

16. A rectangular field with a 30-meter length and 10-meter width. Inside the field, there is a triangle-shaped portion for a banana plantation. Find the perimeter of this triangle-shaped portion of the field?



a) 100 b) 200 c) 300 d) 400

17. A triangle with three sides are same is known as …….

a) Triangle b) equilateral triangle c) Isosceles triangle d) parallelogram

18. $5^6 \times \frac{1}{5^x} = \frac{1}{5^{10}}$ then x = ...?

a) 16 b) 15 c) 6 d) 5

19. If 120 women and 140 men have participated in a conference. find the ratio of the number of men and women?

a) 11 : 12 b) 12 : 14 c) 13 : 15 d) 15 : 17

20. By dividing the profit of selling the vegetables, Jose got 1500 rupees Find out the total profit of the vegetable selling?

a) 6000 b) 7000 c) 8000 d) 9000

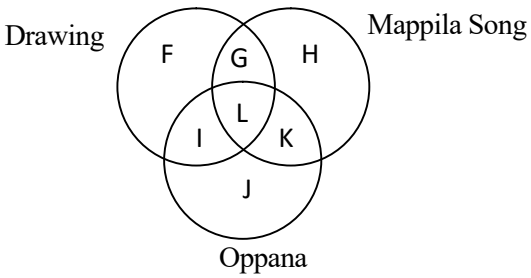
21. (+) indicates division, (-) indicates Multiplication, (x) indicate addition, (/) indicate subtraction. Then find out 30 ÷ 20 + 2 x 5–7 F{X?

a) 40 b) 70 c) 55 d) 53

22. Find out the difference in the place value and face value of five in 5623?

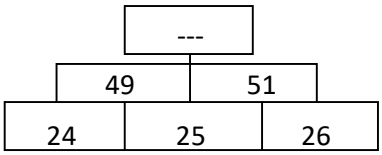
a) 4995 b) 4599 c) 5499 d) 9459

23. Which letter shows the children who participated in all the items in the school festival?



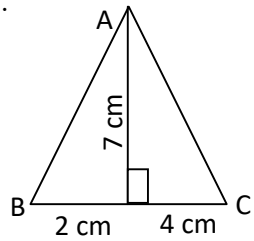
a) F b) H c) J d) L

24. Which number will come at the top of the given number pyramid?



a) 100 b) 49 c) 51 d) 25

25. Find the area of Δ ABC?



a) 21 cm^2 b) 31 cm^2 c) 41 cm^2 d) 51 cm^2

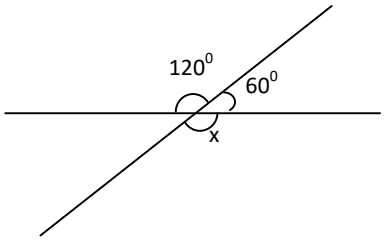
26. The present age of the father is 40 years old and the son is 5 years old. When the age of son becomes 40 years old then the age of the father will be?

a) 80 b) 75 c) 85 d) 70

27. Find the value of 1^{10}?

a) 1 b) 0 c) 10 d) 2

28. Find the value of X in the given figure?



a) 60^0 b) 120^0c) 80^0 d) 180^0

29. Seena and Sona divided their money in a ratio of 3: 2. By dividing the money Seena got 480 rupees. Find the total amount they divided?

a) 800 b) 600 c) 500 d) 400

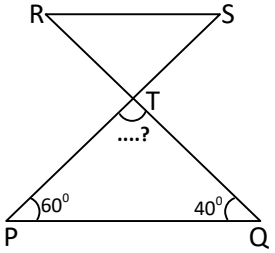
30. Ravi's House is 90 kilometers away from the railway station. To reach the railway station at 9:30 am Ravi wants to start his journey from his house at 8 am. Find the speed taken by his car to travel from home to the railway station?

a) 60 b) 50 c) 70 d) 80

31. Neethu has ₹110 in her purse to buy a pen she takes ₹15 and spends 10 rupees and keeps the balance of money in her purse. Now how much money is there in her purse?

a) 100 b) 90 c) 75 d) 25

32. PQ and RS are parallel in the given figure. Find the ∠PTQ= ?



a) 80^0 b) 60^0 c) 40^0 d) 100^0

33. A pond containing blossomed Lotus. The birds come and sit on the lotus if each bird is sitting on one lotus, then one bird will not get the place to sit. If two birds are sitting in one lotus then there will be one lotus excess. Find the number of Lotus and the number of birds?

a) 3, 4 b) 3,5 c) 5,7 d) 7,9

34. At the beginning of the class there were 38 students after sometimes five more students reached the class. Later three students went to the math club meeting. Now how many students are there in the class?

a) 40 b) 30 c) 35 d) 45

35. Riya made a circle with a thread in the cardboard. She joined the two ends of the diameter into another point in the circle. Which angle does she have now?

a) Right angled triangle b) Acute angle
c) Obtuse angle d) None of these

36. A seller bought a fan for 2500 rupees. He increased the 40 % price and gave a reduction of 15 % and sold the fan. Find the selling price of the fan?

a) 2975 b) 2900 c) 3500 d) 3000

37. Balu deposits ₹25,000 in a bank with a rate of 15 % interest. How much money will he get as interest after two years?

a) 7500 b) 7000 c) 5000 d) 6000

38. The amount spent for a tour is 5200 rupees and the money is divided equally and each gets 1300 rupees then how many people were there in the team?

a) 4 b) 3 c) 2 d) 5

39. To make dosa for 6 bowls of rice we need to take two bowls of urad dal. If we take nine bowls of rice how many bowls of urad dal do we need to take?

a) 1 b) 2 c) 3 d) 4

40. The train travels at a speed of 36 Km/hour. How much distance will the train cover in three minutes?

a) 1800 m b) 1200 m c) 1400 m d) 1600 m

Appendix III

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PROBLEM SOLVING ABILITY IN MATHEMATICS

(FINAL-Malayalam Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

നിർദ്ദേശങ്ങൾ

ഈ പരീക്ഷയിൽ ആകെ 37 ചോദ്യങ്ങൾ തന്നിട്ടുണ്ട്. ഓരോ ചോദ്യത്തിനും a, b, c, d എന്നീ നാലുത്തരങ്ങൾ കൊടുത്തിട്ടുണ്ട്. ഓരോ ചോദ്യവും ശ്രദ്ധിച്ച് വായിച്ച ശേഷം ശരിയുത്തരം മനസ്സിലാക്കി നിങ്ങളുടെ ഉത്തരങ്ങൾ തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ അതാത് ചോദ്യനമ്പറുകൾക്ക് നേരെ കൊടുത്തിട്ടുള്ള കള്ളിയിൽ ഗുണന ചിഹ്നം × കൊണ്ട് രേഖപ്പെടുത്തുക.

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1. രാജൻ ഒരു കുല പഴം വാങ്ങി. കേടു വന്ന 7 എണ്ണം മാറ്റി കഴിഞ്ഞപ്പോൾ 46 എണ്ണമുണ്ട്. കുലയിൽ ആകെ എത്ര പഴം ഉണ്ടായിരുന്നു?

   a) 50 b) 51 c) 52 d) 53

2. എതിർവശങ്ങൾ സമാന്തരമായ ചതുർഭുജങ്ങൾ ഏത് പേരിൽ അറിയപ്പെടുന്നു?

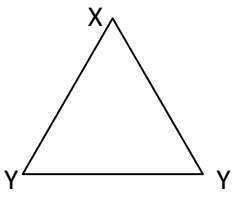
   a) സാമാന്തരികം b) ത്രികോണം c) പഞ്ചഭുജം d) ഷഡ്ഭുജം

3. 'RANGE' എന്ന വാക്കിനെ '12345' എന്നെഴുതാമെങ്കിൽ 'ANGER' എന്ന വാക്കിനെ എങ്ങനെ എഴുതാം?

   a) 23451 b) 14352 c) 23154 d) 12453

4. 9,18,27,36, ---- ഈ സംഖ്യാശ്രേണിയിലെ അടുത്ത സംഖ്യ ഏത്?

   a) 45 b) 55 c) 65 d) 75

5. 

   Δ XYZ ന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?

   a) 90^0 b) 180^0 c) 60^0 d) 360^0

6. $3^x = 9$ ആയാൽ 3^{x-1} കണ്ടുപിടിക്കുക.

   a) 3 b) 6 c) 9 d) 12

7. $\frac{7+7+7\div 7}{(5+5+5)\div 5} =$ .....

a) 4 b) 2 c) 6 d) 5

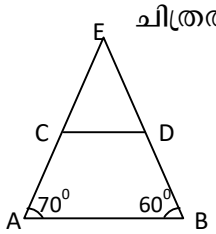
8. E, J, O, T, ... ഇവയിൽ അടുത്ത ആക്ഷരം ഏത്?

a) U b) X c) Y d) W

9. "അഞ്ച് മാർക്ക് കൂടി കിട്ടിയിരുന്നെങ്കിൽ കണക്കു പരീക്ഷയ്ക്ക് നൂറു മാർക്കും ആയേനെ", റീനയുടെ സങ്കടം. റീനക്ക് എത്ര മാർക്കാണ് കിട്ടിയത്?

a) 95 b) 96 c) 95 d) 98

10. ചിത്രത്തിൽ ABയും CDയും സമാന്തരമാണ് ∠Eയുടെ അളവ് എത്ര?



a) 50 b) 60 c) 70 d) 80

11. $\frac{10^6 \times 10^7}{10^4 \times 10^5} =$ .....?

a) 10^4 b) 10^5 c) 10^6 d) 10^7

12. രണ്ടു സംഖ്യകളിൽ ഓരോന്നിന്റേയും രണ്ട് മടങ്ങ് കണ്ടുപിടിച്ച് അവ കൂട്ടുക എന്ന ക്രിയയെ ബീജഗണിത രീതിയിൽ എങ്ങനെ എഴുതാം?

a) x + y b) 2x + 2 y c) 2 x+y d) x + 2y

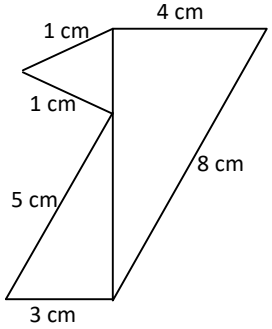
13. 2^{10} ന്റെ എത്ര മടങ്ങാണ് 2^{11}?

a) രണ്ട് മടങ്ങ് b) മൂന്ന് മടങ്ങ് c) നാലു മടങ്ങ് d) അഞ്ചു മടങ്ങ്

14. 5 പേർ 28 ദിവസം കൊണ്ട് ചെയ്ത് തീർക്കുന്ന ജോലി 20 പേർ എത്ര ദിവസം കൊണ്ട് ചെയ്ത് തീർക്കും.

a) 7 b) 8 c) 9 d) 10

15. താഴെ തന്നിരിക്കുന്ന ബഹുഭുജത്തിന്റെ ചുറ്റളവ് എത്രയായിരിക്കും?



a) 22 cm b) 23 cm c) 24 cm d) 25 cm

16. മൂന്ന് വശങ്ങളും തുല്യമായ ത്രികോണത്തെ ..... എന്ന് പറയുന്നു.

a) ത്രികോണം b) സമഭുജത്രികോണം

c) സമാന്തരികം d) സമപാർശ്വത്രികോണം

17. $5^6 \times \frac{1}{5^x} = \frac{1}{5^{10}}$ എന്ന് കിട്ടുമെങ്കിൽ x = ...?

a) 16 b) 15 c) 6 d) 5

18. ഒരു സമ്മേളനത്തിൽ 120 സ്ത്രീകളും 140 പുരുഷൻമാരും പങ്കെടുത്തു. സ്ത്രീകളുടെ എണ്ണവും പുരുഷൻമാരുടെ എണ്ണവും തമ്മിലുള്ള അംശബന്ധം കണ്ടുപിടിക്കുക?

a) 11 : 12 b) 12 : 14 c) 13 : 15 d) 15 : 17

19. പച്ചക്കറി കച്ചവടത്തിലെ ലാഭം നാലുപേർ തുല്യമായി പങ്കുവച്ചപ്പോൾ ജോസിന് 1500 രൂപ കിട്ടി. ആകെ ലാഭം എത്ര രൂപയാണ്?

a) 6000 b) 7000 c) 8000 d) 9000

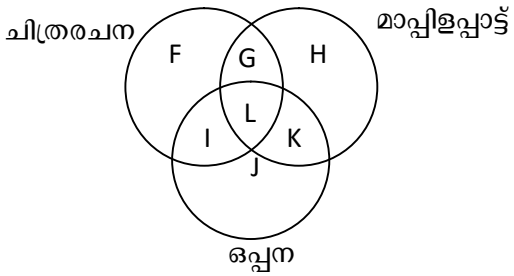
20. '+' ഹരണത്തേയും, '–' ഗുണനത്തേയും, 'x' സങ്കലനത്തേയും, ÷ വ്യവകലനത്തേയും സൂചിപ്പിച്ചാൽ 30 ÷ 20 + 2 x 5–7 എത്ര?

a) 40 b) 70 c) 55 d) 53

21. 5623 എന്ന സംഖ്യയിൽ 5 ന്റെ സ്ഥാനവിലയും മുഖവിലയും തമ്മിലുള്ള വ്യത്യാസം കാണുക?

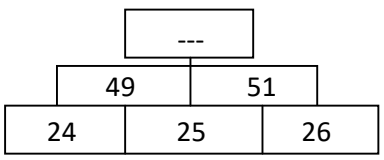
a) 4995 b) 4599 c) 5499 d) 9459

22. ചിത്രത്തിൽ, സ്കൂൾ യുവജനോത്സവത്തിൽ മാപ്പിളപ്പാട്ട്, ചിത്രരചന, ഒപ്പന എന്നീ മൂന്ന് വിഭാഗത്തിലും മത്സരിച്ച വിദ്യാർത്ഥികളെ സൂചിപ്പിക്കുന്ന ഭാഗമേത്?



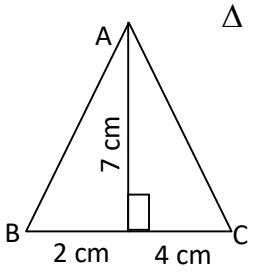
a) F b) H c) J d) L

23. താഴെ തന്നിരിക്കുന്ന സംഖ്യാഗോപുരത്തിന്റെ ഏറ്റവും മുകളിൽ വരുന്ന സംഖ്യ ഏത്?



a) 100 b) 49 c) 51 d) 25

24. Δ ABC യുടെ പരപ്പളവ് എത്ര?



a) 21 cm^2 b) 31 cm^2 c) 41 cm^2 d) 51 cm^2

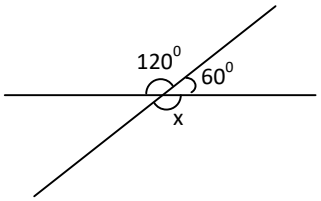
25. അച്ഛന് ഇപ്പോൾ 40 വയസ്സും മകന് 5 വയസ്സും പ്രായമുണ്ട്. മകന് 40 വയസ്സാകുമ്പോൾ അച്ഛന്റെ വയസ്സ് എത്ര?

a) 80 b) 75 c) 85 d) 70

26. 1^{10}ന്റെ വിലയെത്ര?

a) 1 b) 0 c) 10 d) 2

27. തന്നിരിക്കുന്ന ചിത്രത്തിൽ x ന്റെ വിലയെത്ര?



a) 60^0 b) 120^0 c) 80^0 d) 180^0

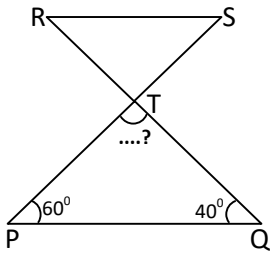
28. സീനയും സോനയും ഒരു തുക 3:2 എന്ന അംശബന്ധത്തിൽ വീതിച്ചപ്പോൾ സീനക്ക് 480 രൂപ കിട്ടി. ആകെ എത്ര രൂപയാണ് വീതിച്ചത്?

a) 800 b) 600 c) 500 d) 400

29. നീതുവിന്റെ പണപ്പെട്ടിയിൽ 110 രൂപയുണ്ട് പേന വാങ്ങാൻ 15 രൂപയെടുത്തു. 10 രൂപയ്ക്ക് പേന കിട്ടി. മിച്ചം വന്ന 5 രൂപ വീണ്ടും പെട്ടിയിലിട്ടു. ഇപ്പോൾ പെട്ടിയിൽ എത്ര രൂപയുണ്ട്?

a) 100 b) 90 c) 75 d) 25

30. ചിത്രത്തിൽ PQവും RS ഉം സമാന്തരമാണ് $\angle PTQ$= ?



a) 80^0 b) 60^0 c) 40^0 d) 100^0

31. ഒരു കുളത്തിൽ താമരപ്പൂക്കൾ വിരിഞ്ഞു നിൽക്കുന്നു. പറന്നെത്തിയ കിളിക്കൂട്ടം ക്ഷീണമകറ്റാൻ പൂക്കളിലിരുന്നു. ഒരു താമരയിൽ ഒരു കിളി വീതം ഇരുന്നപ്പോൾ ഒരു കിളിക്ക് ഇടമില്ലാതായി. ഒരു താമരയിൽ ഇരുകിളികളായി ചേർന്നിരുന്നപ്പോൾ ഒരു താമര ബാക്കിയായി താമരയെത്ര? കിളിയെത്ര?

a) 3, 4 b) 3, 5 c) 5, 7 d) 7, 9

32. ക്ലാസ് തുടങ്ങിയപ്പോൾ 38 കുട്ടികൾ ഉണ്ടായിരുന്നു. അൽപം വൈകി 5 കുട്ടികൾ കൂടി എത്തി. കുറച്ചു കഴിഞ്ഞപ്പോൾ 3 കുട്ടികൾ ഗണിത ക്ലബ്ബിന്റെ യോഗത്തിനു പോയി. ഇപ്പോൾ ക്ലാസിൽ എത്ര പേരുണ്ട്?

a) 40 b) 30 c) 35 d) 45

33. റിയ ചരടുപയോഗിച്ച് ഒരു വൃത്തം കാർഡ്ബോർഡിൽ നിർമ്മിച്ചു. ഈ വൃത്തത്തിലെ ഒരു വ്യാസത്തിന്റെ രണ്ടറ്റങ്ങൾ വൃത്തത്തിലെ മറ്റൊരു ബിന്ദുവുമായി യോജിപ്പിച്ചപ്പോൾ റിയക്കു കിട്ടിയ കോൺ ഏതാണ്?

a) മട്ടകോൺ b) ന്യൂനകോൺ c) ബ്യൂഹത്കോൺ d) ഇവയൊന്നുമല്ല

34. ഒരു കച്ചവടക്കാരൻ 2500 രൂപ കൊടുത്തു വാങ്ങിയ ഫാൻ 40% വില വർദ്ധിപ്പിച്ച് 15% കിഴിവ് കൊടുത്തു വിൽക്കുന്നു. അത് എത്ര രൂപക്കാണ് വിൽക്കുന്നത്?

a) 2975 b) 2900 c) 3500 d) 3000

35. ബാലു 25000 രൂപ ബാങ്കിൽ നിക്ഷേപിച്ചു. ബാങ്ക് 15% നിരക്കിലാണ് പലിശ കണക്കാക്കുന്നത്. 2 വർഷം കഴിഞ്ഞ് എത്ര രൂപ പലിശ ലഭിക്കും?

a) 7500 b) 7000 c) 5000 d) 6000

36. ഒരു വിനോദയാത്രക്കു പോയവർ ചെലവായ 5200 രൂപ തുല്യമായി വീതിച്ചു. ഓരോരുത്തർക്കും 1300 രൂപകൊടുത്തു. എത്ര പേരാണ് സംഘത്തിൽ ഉണ്ടായിരുന്നത്?

a) 4 b) 3 c) 2 d) 5

37. ദോശയുണ്ടാക്കാൻ, 6 കിണ്ണം അരിക്ക് 2 കിണ്ണം ഉഴുന്ന് എന്നാണ് കണക്ക്. 9 കിണ്ണം അരിയെടുത്താൻ എത്ര കിണ്ണം ഉഴുന്ന് എടുക്കണം.

a) 1 b) 2 c) 3 d) 4

Appendix IV

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PROBLEM SOLVING ABILITY IN MATHEMATICS

(Final-English Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha P.V. — Research Scholar

Instructions

This test consists of 37 questions. Each question contains answers in four options a, b , c , d. Read each question carefully find out the right answer and mark your answer in the response sheet given to you with an x mark. Your answers will be kept confidential and will be used only for research purposes.

1. Rajan bought a bunch of bananas after removing the 7 damaged bananas from the bunch there are 46 bananas left. Totally how many bananas were there in that bunch?

   a) 50 b) 51 c) 52 d) 53

2. A quadrilateral with opposite sides parallel is known as?

   a) Parallelogram b) triangle c) pentagon d) hexagon

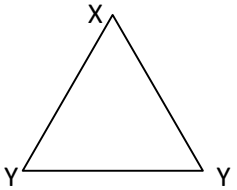
3. RANGE Can be written as '12345'. Then how to write the word 'ANGER'?

   a) 23451 b) 14352 c) 23154 d) 12453

4. 9, 18, 27, 36,…… Find out the next number in this number series?

   a) 45 b) 55 c) 65 d) 75

5. Find the sum of the interior angle of Δ XYZ?



   a) 90^0 b) 180^0 c) 60^0 d) 360^0

6. $3^x = 9$ then find out 3^{x-1}

   a) 3 b) 6 c) 9 d) 12

7. $\frac{7+7+7\div 7}{(5+5+5)\div 5}$ = -------.....

   a) 4 b) 2 c) 6 d) 5

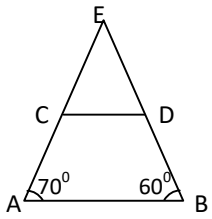
8. E, J, O, T, ……find the next letter in this series?

a) U b) X c) Y d) W

9. If Reena got five more marks in the exam her total score in mathematics will be 100. Find how much she scored in her mathematics exam?

a) 95 b) 96 c) 95 d) 98

10. In the given figure AB and CD are parallel then find out the measure of $\angle E$



a) 50 b) 60 c) 70 d) 80

11. $\frac{10^6 \times 10^7}{10^4 \times 10^5} = ...?$

a) 10^4 b) 10^5 c) 10^6 d) 10^7

12. Write the expression in an algebraic form of addition of double of two numbers?

a) x + y b) 2x + 2 y c) 2 x+y d) x + 2y

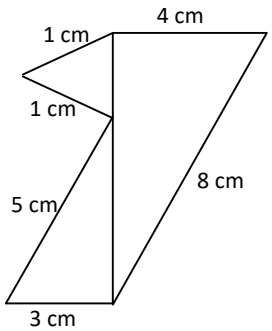
13. How many times of 2^{10} is 2^{11}?

a) 2-times b) 3-times c) 4-times d) 5-times

14. Five people take 28 days to complete a work how many days will take 20 people to complete the same work?

a) 7 b) 8 c) 9 d) 10

15. Find out the perimeter of a polygon whose sides are given?



a) 22 cm b) 23 cm c) 24 cm d) 25 cm

16. A triangle with three sides are same is known as …….

a) Triangle b) equilateral triangle c) Isosceles triangle d) parallelogram

17. $5^6 \times \frac{1}{5^x} = \frac{1}{5^{10}}$ then x = ...?

a) 16 b) 15 c) 6 d) 5

18. If 120 women and 140 men have participated in a conference. find the ratio of the number of men and women?

a) 11 : 12 b) 12 : 14 c) 13 : 15 d) 15 : 17

19. By dividing the profit of selling the vegetables, Jose got 1500 rupees Find out the total profit of the vegetable selling?

a) 6000 b) 7000 c) 8000 d) 9000

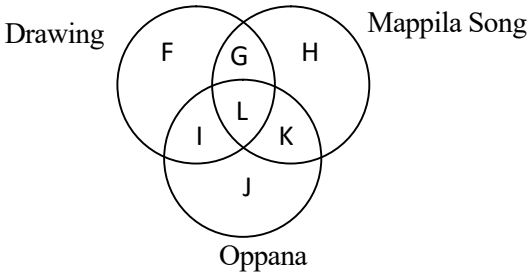
20. (+) indicates division, (-) indicates Multiplication, (x) indicate addition, (/) indicate subtraction. Then find out 30 ÷ 20 + 2 x 5–7 F{X?

a) 40 b) 70 c) 55 d) 53

21. Find out the difference in the place value and face value of five in 5623?

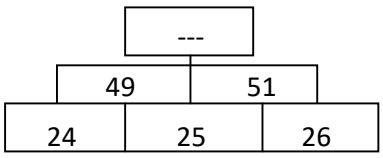
a) 4995 b) 4599 c) 5499 d) 9459

22. Which letter shows the children who participated in all the items in the school festival?



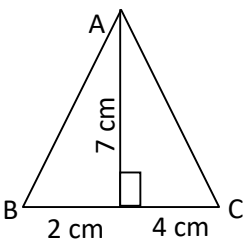
a) F b) H c) J d) L

23. Which number will come at the top of the given number pyramid?



a) 100 b) 49 c) 51 d) 25

24. Find the area of Δ ABC?



a) 21 cm^2 b) 31 cm^2 c) 41 cm^2 d) 51 cm^2

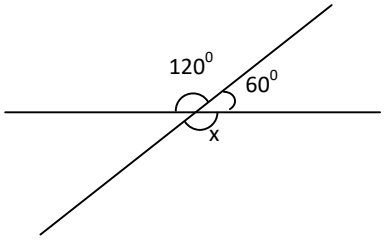
25. The present age of the father is 40 years old and the son is 5 years old. When the age of son becomes 40 years old then the age of the father will be?

a) 80 b) 75 c) 85 d) 70

26. Find the value of 1^{10}?

a) 1 b) 0 c) 10 d) 2

27. Find the value of X in the given figure?



a) 60^0 b) 120^0c) 80^0 d) 180^0

28. Seena and Sona divided their money in a ratio of 3: 2. By dividing the money Seena got 480 rupees. Find the total amount they divided?

a) 800 b) 600 c) 500 d) 400

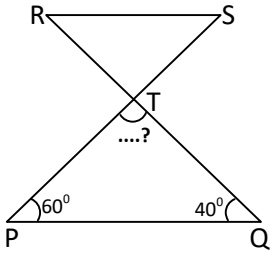
29. Ravi's House is 90 kilometers away from the railway station. To reach the railway station at 9:30 am Ravi wants to start his journey from his house at 8 am. Find the speed taken by his car to travel from home to the railway station?

a) 60 b) 50 c) 70 d) 80

30. Neethu has ₹110 in her purse to buy a pen she takes ₹15 and spends 10 rupees and keeps the balance of money in her purse. Now how much money is there in her purse?

a) 100 b) 90 c) 75 d) 25

31. PQ and RS are parallel in the given figure. Find the ∠PTQ= ?



a) 80^0 b) 60^0 c) 40^0 d) 100^0

32. A pond containing blossomed Lotus. The birds come and sit on the lotus if each bird is sitting on one lotus, then one bird will not get the place to sit. If two birds are sitting in one lotus then there will be one lotus excess. Find the number of Lotus and the number of birds?

    a) 3, 4 b) 3,5 c) 5,7 d) 7,9

33. At the beginning of the class there were 38 students after sometimes five more students reached the class. Later three students went to the math club meeting. Now how many students are there in the class?

    a) 40 b) 30 c) 35 d) 45

34. Riya made a circle with a thread in the cardboard. She joined the two ends of the diameter into another point in the circle. Which angle does she have now?

    a) Right angled triangle b) Acute angle
    c) Obtuse angle d) None of these

35. A seller bought a fan for 2500 rupees. He increased the 40 % price and gave a reduction of 15 % and sold the fan. Find the selling price of the fan?

    a) 2975 b) 2900 c) 3500 d) 3000

36. The amount spent for a tour is 5200 rupees and the money is divided equally and each gets 1300 rupees then how many people were there in the team?

    a) 4 b) 3 c) 2 d) 5

37. To make dosa for 6 bowls of rice we need to take two bowls of urad dal. If we take nine bowls of rice how many bowls of urad dal do we need to take?

    a) 1 b) 2 c) 3 d) 4

Appendix V

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PERCEPTUAL SPEED

(Draft-Malayalam Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

നിർദ്ദേശങ്ങൾ

ഈ പരീക്ഷയിൽ ആകെ 42 ചോദ്യങ്ങൾ തന്നിട്ടുണ്ട്. ഓരോ ചോദ്യത്തിനും a, b, c, d എന്നീ നാലുത്തരങ്ങൾ കൊടുത്തിട്ടുണ്ട്. ഓരോ ചോദ്യവും ശ്രദ്ധിച്ച് വായിച്ചശേഷം ശരിയുത്തരം മനസ്സിലാക്കി നിങ്ങളുടെ ഉത്തരങ്ങൾ തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ അതാത് ചോദ്യനമ്പറുകൾക്ക് നേരെ കൊടുത്തിട്ടുള്ള കള്ളിയിൽ ഗുണനചിഹ്നം × കൊണ്ട് രേഖപ്പെടുത്തുക.

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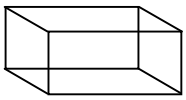
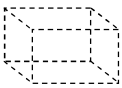
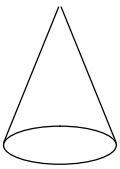
1. 
a)  b) c) d)

2. 
a) b) c) d)

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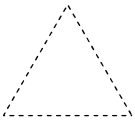
a) b) c)  d)

4. 0.12 — a) 1.20 b) 2.10 c) 0.12 d) 10.2

5. 43, 57, 921 — a) 57, 92, 134 b) 34, 57, 921 c) 43, 57, 921 d) 12, 97, 534

6. $\frac{75}{100}$ — a) 75% b) 100% c) 10% d) 7%

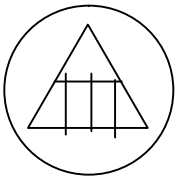
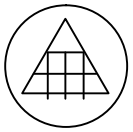
7. 0.9 — a) $\frac{9}{10}$ b) $\frac{9}{100}$ c) $\frac{9}{1000}$ d) $\frac{9}{10000}$

8. 96,351,827 — a) 93,651,827 b) 93,651,287 c) 96, 182, 735 d) 96, 351, 827

9. 729 — a) 927 b) 729 c) 972 d) 792

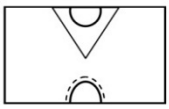
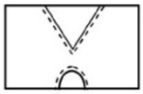
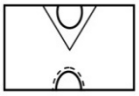
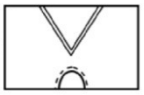
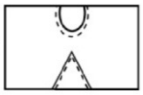
10. 1000 x 0 — a) 1000 b) 100 c) 10 d) 0

11. 9999 x 1 a) 999 b) 9999 c) 99 d) 9

12. 
a)  b) c) d)

13. 88888+0 a) 0 b) 88888 c) 8888 d) 888888

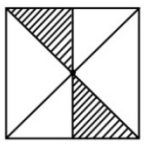
14. 78954-78954 a) 78954 b) 87954 c) 0 d) 45987

15. 
a)  b)  c)  d) 

16. 892.34 a) 8942.3 b) 892.34 c) 293.84 d) 43.298

17. 7,89,65,432 a) 9,87,65,432 b) 7,89,65,432 c) 2,34,56,987 d) 7,89,65,432

18.
a) b) c) d)

19. 
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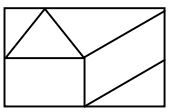
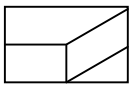
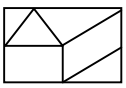
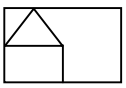
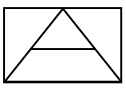
20. 
a)  b)  c)  d) 

21. $\frac{1}{2}$.....$\frac{1}{4}$ a) = b) > c) < d) %

22. $\frac{2}{100}$ a) 1% b) 2% c) 3% d) 4%

23. 19> ..... a) 27 b) 37 c) 17 d) 47

24. 100< .... a) 10 b) 50 c) 80 d) 200

25. 25 a) 2^2 b) 3^2 c) 4^2 d) 5^2

26. 75.... 100 a) < b) $\geq$ c) = d) %

27. 99.... 99 a) < b) > c) = d) $\neq$

28. 5678.3 a) 56.738 b) 5678.3 c) 67.853 d) 35.678

29. 100÷ 2 a) 25 b) 50 c) 75 d) 100

30. 0.19 a) $\frac{19}{10}$ b) $\frac{19}{100}$ c) $\frac{19}{1000}$ d) $\frac{19}{10000}$

31. 385431+ 584321

a) 38541+ 584231 = 443863

b) 385431+ 584321 = 448363

c) 385431+ 584321 = 443836

c) 385431+ 584321 = 969752

32. 989587 – 645672

a) 989587- 645672 = 343915

b) 989587- 645672 = 519343

c) 989587- 645672 = 343519

d) 989587- 645672 = 349315

33. 38.543 + 9.857

a) 38.543+ 9.857 = 48.400

b) 38.543+ 9.857 = 48.440

c) 38.543+ 9.857 = 48.444

d) 38.543+ 9.857 = 48.040

34. 8854.9 – 7521.8

a) 8854.9- 7521.8 = 1333.1

b) 8854.9- 7521.8 = 13.331

c) 8854.9- 7521.8 = 1.331

b) 8854.9- 7521.8 = 13331

35. 11011 x 1011x 0

a) 11011

b) 1011

c) 0

d) 1111

36. 9428 × 8201 = 77319028

a) 9428 × 8201 = 77319028

b) 9428 × 8201 = 77913028

c) 9428 × 8201 = 7728019

d) 9428 × 8201 = 77339028

37. 141.35 ÷5.5

a) 141.35 ÷5.5=25.7

b) 141.35 ÷5.5=25.07

c) 141.35 ÷5.5=25.77

d) 141.35 ÷5.5= 25.9

38. 21905 ÷ 65

a) 21905 ÷65= 337

b) 21905 ÷65= 373

c) 21905 ÷65= 733

d) 21905 ÷65= 777

39. 15.375÷2.5

a) 15.375 ÷2.5= 6.15

b) 15.375 ÷2.5= 61.5

c) 15.375 ÷2.5= 615

d) 15.375 ÷2.5=6150

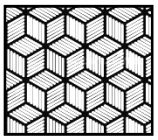
40. 26912 ÷ 32

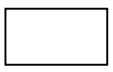
a) 26912 ÷32 =841

b) 26912 ÷32 148

c) 26912 ÷32 =481

d) 26912 ÷32 = 0

41. 

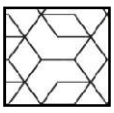
a) 

b)

c)

d)

42.

a) 

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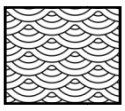
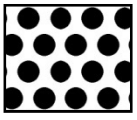
c) 

d) 

Appendix VI

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

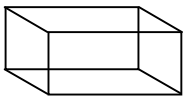
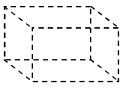
TEST OF PERCEPTUAL SPEED

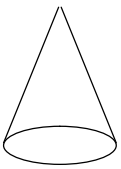
(Draft-English Version)

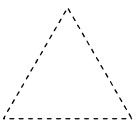
Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

Instructions

This test consists of 42 questions. Each question contains answers in four options a, b , c , d. Read each question carefully find out the right answer and mark your answer in the response sheet given to you with an x mark. Your answers will be kept confidential and will be used only for research purposes.

1. 
a)  b) c) d)

2. 
a) b) c) d)

3.
a) b) c)  d)

4. 0.12 — a) 1.20 b) 2.10 c) 0.12 d) 10.2

5. 43, 57, 921 — a) 57, 92, 134 b) 34, 57, 921 c) 43, 57, 921 d) 12, 97, 534

6. $\frac{75}{100}$ — a) 75% b) 100% c) 10% d) 7%

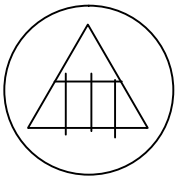
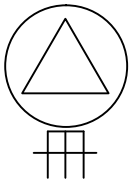
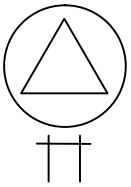
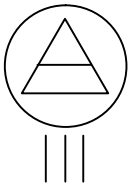
7. 0.9 — a) $\frac{9}{10}$ b) $\frac{9}{100}$ c) $\frac{9}{1000}$ d) $\frac{9}{10000}$

8. 96,351,827 — a) 93,651,827 b) 93,651,287 c) 96, 182, 735 d) 96, 351, 827

9. 729 — a) 927 b) 729 c) 972 d) 792

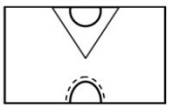
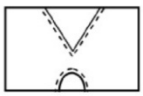
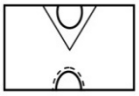
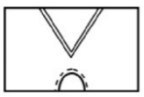
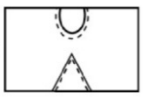
10. 1000 x 0 — a) 1000 b) 100 c) 10 d) 0

11. 9999 x 1 a) 999 b) 9999 c) 99 d) 9

12. 
a)  b)  c)  d)

13. 88888+0 a) 0 b) 88888 c) 8888 d) 888888

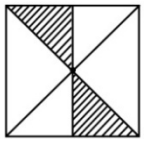
14. 78954-78954 a) 78954 b) 87954 c) 0 d) 45987

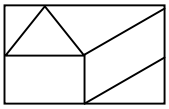
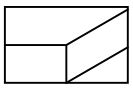
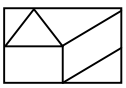
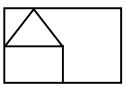
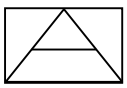
15. 
a)  b)  c)  d) 

16. 892.34 a) 8942.3 b) 892.34 c) 293.84 d) 43.298

17. 7,89,65,432 a) 9,87,65,432 b) 7,89,65,432
c) 2,34,56,987 d) 7,89,65,432

18
a) b) c) d)

19 
a) b) c) d)

20. 
a)  b)  c)  d) 

21. $\frac{1}{2}$.....$\frac{1}{4}$ a) = b) > c) < d) %

22. $\frac{2}{100}$ a) 1% b) 2% c) 3% d) 4%

23. 19> ..... a) 27 b) 37 c) 17 d) 47

24. 100< .... a) 10 b) 50 c) 80 d) 200

25. 25 a) 2^2 b) 3^2 c) 4^2 d) 5^2

26. 75.... 100 a) < b) $\geq$ c) = d) %

27. 99.... 99 a) < b) > c) = d) $\neq$

28. 5678.3 a) 56.738 b) 5678.3 c) 67.853 d) 35.678

29. 100÷ 2 a) 25 b) 50 c) 75 d) 100

30. 0.19 a) $\frac{19}{10}$ b) $\frac{19}{100}$ c) $\frac{19}{1000}$ d) $\frac{19}{10000}$

31. 385431+ 584321

a) 38541+ 584231 = 443863
b) 385431+ 584321 = 448363
c) 385431+ 584321 = 443836
c) 385431+ 584321 = 969752

32. 989587 – 645672

a) 989587- 645672 = 343915
b) 989587- 645672 = 519343
c) 989587- 645672 = 343519
d) 989587- 645672 = 349315

33. 38.543 + 9.857

a) 38.543+ 9.857 = 48.400
b) 38.543+ 9.857 = 48.440
c) 38.543+ 9.857 = 48.444
d) 38.543+ 9.857 = 48.040

34. 8854.9 – 7521.8

a) 8854.9- 7521.8 = 1333.1
b) 8854.9- 7521.8 = 13.331
c) 8854.9- 7521.8 = 1.331
b) 8854.9- 7521.8 = 13331

35. 11011 x 1011x 0

a) 11011
b) 1011
c) 0
d) 1111

36. 9428 × 8201 = 77319028

a) 9428 × 8201 = 77319028
b) 9428 × 8201 = 77913028
c) 9428 × 8201 = 7728019
d) 9428 × 8201 = 77339028

37. 141.35 ÷5.5

a) 141.35 ÷5.5=25.7
b) 141.35 ÷5.5=25.07
c) 141.35 ÷5.5=25.77
d) 141.35 ÷5.5= 25.9

38. 21905 ÷ 65

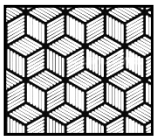
a) 21905 ÷65= 337
b) 21905 ÷65= 373
c) 21905 ÷65= 733
d) 21905 ÷65= 777

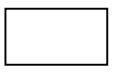
39. 15.375÷2.5

a) 15.375 ÷2.5= 6.15
b) 15.375 ÷2.5= 61.5
c) 15.375 ÷2.5= 615
d) 15.375 ÷2.5=6150

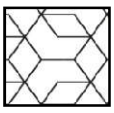
40. 26912 ÷ 32

a) 26912 ÷32 =841
b) 26912 ÷32 148
c) 26912 ÷32 =481
d) 26912 ÷32 = 0

41. 

a) 
b)
c)
d)

42.

a) 
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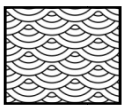
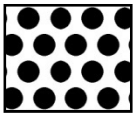
c) 
d) 

Appendix VII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

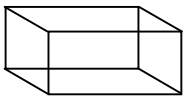
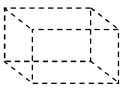
TEST OF PERCEPTUAL SPEED

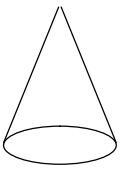
(Final-Malayalam Version)

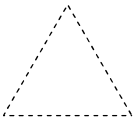
Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

നിർദ്ദേശങ്ങൾ

ഈ പരീക്ഷയിൽ ആകെ 40 ചോദ്യങ്ങൾ തന്നിട്ടുണ്ട്. ഓരോ ചോദ്യത്തിനും a, b, c, d എന്നീ നാലുത്തരങ്ങൾ കൊടുത്തിട്ടുണ്ട്. ഓരോ ചോദ്യവും ശ്രദ്ധിച്ച് വായിച്ചശേഷം ശരിയുത്തരം മനസ്സിലാക്കി നിങ്ങളുടെ ഉത്തരങ്ങൾ തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ അതാത് ചോദ്യനമ്പറുകൾക്ക് നേരെ കൊടുത്തിട്ടുള്ള കള്ളിയിൽ ഗുണനചിഹ്നം × കൊണ്ട് രേഖപ്പെടുത്തുക.

1. 
a)  b) c) d)

2. 
a) b) c) d)

3.
a) b) c)  d)

4. 0.12 a) 1.20 b) 2.10 c) 0.12 d) 10.2

5. 43, 57, 921 a) 57, 92, 134 b) 34, 57, 921 c) 43, 57, 921 d) 12, 97, 534

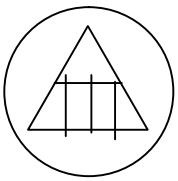
6. $\frac{75}{100}$ a) 75% b) 100% c) 10% d) 7%

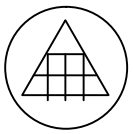
7. 0.9 a) $\frac{9}{10}$ b) $\frac{9}{100}$ c) $\frac{9}{1000}$ d) $\frac{9}{10000}$

8. 96,351,827 a) 93,651,827 b) 93,651,287 c) 96, 182, 735 d) 96, 351, 827

9. 729 a) 927 b) 729 c) 972 d) 792

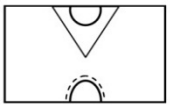
10. 9999 x 1 a) 999 b) 9999 c) 99 d) 9

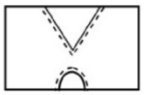
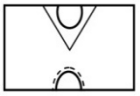
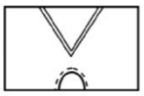
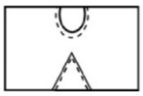
11. 

a)  b) c) d)

12. 88888+0 a) 0 b) 88888 c) 8888 d) 888888

13. 78954-78954 a) 78954 b) 87954 c) 0 d) 45987

14. 

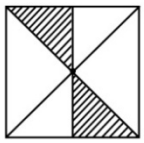
a)  b)  c)  d) 

15. 892.34 a) 8942.3 b) 892.34 c) 293.84 d) 43.298

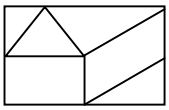
16. 7,89,65,432 a) 9,87,65,432 b) 7,89,65,432 c) 2,34,56,987 d) 7,89,65,432

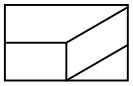
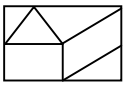
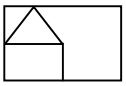
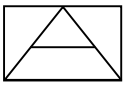
17.

a) b) c) d)

18. 

a) b) c) d)

19. 

a)  b)  c)  d) 

20. $\frac{1}{2}$.....$\frac{1}{4}$ a) = b) > c) < d) %

21. $\frac{2}{100}$ a) 1% b) 2% c) 3% d) 4%

22. 19> ..... a) 27 b) 37 c) 17 d) 47

23. 100< .... a) 10 b) 50 c) 80 d) 200

24. 25 a) 2^2 b) 3^2 c) 4^2 d) 5^2

25. 75.... 100 a) < b) $\geq$ c) = d) %

26. 99.... 99 a) < b) > c) = d) $\neq$

27. 5678.3 a) 56.738 b) 5678.3 c) 67.853 d) 35.678

28. 100÷ 2 a) 25 b) 50 c) 75 d) 100

29. 0.19 a) $\frac{19}{10}$ b) $\frac{19}{100}$ c) $\frac{19}{1000}$ d) $\frac{19}{10000}$

30. 385431+ 584321

a) 38541+ 584231 443863 b) 385431+ 584321 448363 c) 385431+ 584321 443836 c) 385431+ 584321 969752

31. 989587 – 645672

a) 989587 - 645672 = 343915

b) 989587 - 645672 = 519343

c) 989587 - 645672 = 343519

d) 989587 - 645672 = 349315

32. 38.543 + 9.857

a) 38.543 + 9.857 = 48.400

b) 38.543 + 9.857 = 48.440

c) 38.543 + 9.857 = 48.444

d) 38.543 + 9.857 = 48.040

33. 8854.9 – 7521.8

a) 8854.9 - 7521.8 = 1333.1

b) 8854.9 - 7521.8 = 13.331

c) 8854.9 - 7521.8 = 1.331

b) 8854.9 - 7521.8 = 13331

34. 11011 x 1011x 0

a) 11011

b) 1011

c) 0

d) 1111

35. 9428 × 8201 = 77319028

a) 9428 × 8201 = 77319028

b) 9428 × 8201 = 77913028

c) 9428 × 8201 = 7728019

d) 9428 × 8201 = 77339028

36. 141.35 ÷5.5

a) 141.35 ÷5.5=25.7

b) 141.35 ÷5.5=25.07

c) 141.35 ÷5.5=25.77

d) 141.35 ÷5.5= 25.9

37. 21905 ÷ 65

a) 21905 ÷65= 337

b) 21905 ÷65= 373

c) 21905 ÷65= 733

d) 21905 ÷65= 777

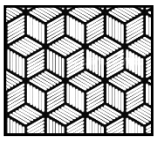
38. 26912 ÷ 32

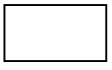
a) 26912 ÷32 =841

b) 26912 ÷32 148

c) 26912 ÷32 =481

d) 26912 ÷32 = 0

39. 

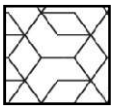
a) 

b)

c)

d)

40.

a) 

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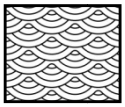
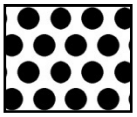
c) 

d) 

Appendix VIII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PERCEPTUAL SPEED

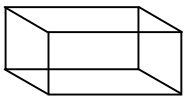
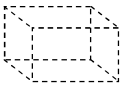
(Final-English Version)

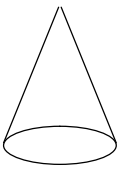
Dr. (Prof.) P.K. Aruna
Supervising Teacher

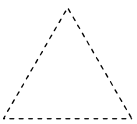
Lisheetha. P.V.
Research Scholar

Instructions

This test consists of 40 questions. Each question contains answers in four options a, b , c , d. Read each question carefully find out the right answer and mark your answer in the response sheet given to you with an x mark. Your answers will be kept confidential and will be used only for research purposes.

1. 
a)  b) c) d)

2. 
a) b) c) d)

3.
a) b) c)  d)

4. 0.12 a) 1.20 b) 2.10 c) 0.12 d) 10.2

5. 43, 57, 921 a) 57, 92, 134 b) 34, 57, 921
c) 43, 57, 921 d) 12, 97, 534

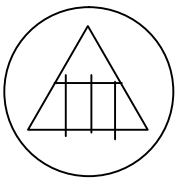
6. $\frac{75}{100}$ a) 75% b) 100% c) 10% d) 7%

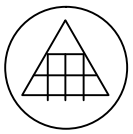
7. 0.9 a) $\frac{9}{10}$ b) $\frac{9}{100}$ c) $\frac{9}{1000}$ d) $\frac{9}{10000}$

8. 96,351,827 a) 93,651,827 b) 93,651,287
c) 96, 182, 735 d) 96, 351, 827

9. 729 a) 927 b) 729 c) 972 d) 792

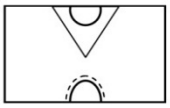
10. 9999 x 1 a) 999 b) 9999 c) 99 d) 9

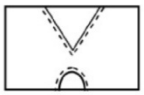
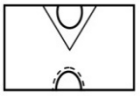
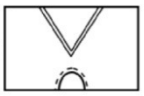
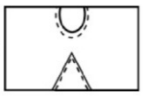
11. 

a)  b) c) d)

12. 88888+0 a) 0 b) 88888 c) 8888 d) 888888

13. 78954-78954 a) 78954 b) 87954 c) 0 d) 45987

14. 

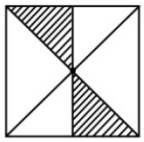
a)  b)  c)  d) 

15. 892.34 a) 8942.3 b) 892.34 c) 293.84 d) 43.298

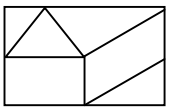
16. 7,89,65,432 a) 9,87,65,432 b) 7,89,65,432 c) 2,34,56,987 d) 7,89,65,432

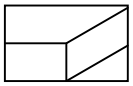
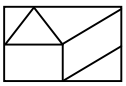
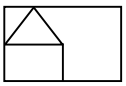
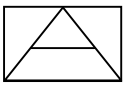
17.

a) b) c) d)

18. 

a) b) c) d)

19. 

a)  b)  c)  d) 

20. $\frac{1}{2}$.....$\frac{1}{4}$ a) = b) > c) < d) %

21. $\frac{2}{100}$ a) 1% b) 2% c) 3% d) 4%

22. 19> ..... a) 27 b) 37 c) 17 d) 47

23. 100< .... a) 10 b) 50 c) 80 d) 200

24. 25 a) 2^2 b) 3^2 c) 4^2 d) 5^2

25. 75.... 100 a) < b) ≥ c) = d) %

26. 99.... 99 a) < b) > c) = d) ≠

27. 5678.3 a) 56.738 b) 5678.3 c) 67.853 d) 35.678

28. 100÷ 2 a) 25 b) 50 c) 75 d) 100

29. 0.19 a) $\frac{19}{10}$ b) $\frac{19}{100}$ c) $\frac{19}{1000}$ d) $\frac{19}{10000}$

30. 385431+ 584321 a) 38541+ 584231 b) 385431+ 584321 448363 c) 385431+ 584321 443836 c) 385431+ 584321 969752

443863

31. 989587 – 645672

a) 989587- 645672 = 343915
b) 989587- 645672 = 519343
c) 989587- 645672 = 343519
d) 989587- 645672 = 349315

32. 38.543 + 9.857

a) 38.543+ 9.857 = 48.400
b) 38.543+ 9.857 = 48.440
c) 38.543+ 9.857 = 48.444
d) 38.543+ 9.857 = 48.040

33. 8854.9 – 7521.8

a) 8854.9- 7521.8 = 1333.1
b) 8854.9- 7521.8 = 13.331
c) 8854.9- 7521.8 = 1.331
b) 8854.9- 7521.8 = 13331

34. 11011 x 1011x 0

a) 11011
b) 1011
c) 0
d) 1111

35. 9428 × 8201 = 77319028

a) 9428 × 8201 = 77319028
b) 9428 × 8201 = 77913028
c) 9428 × 8201 = 7728019
d) 9428 × 8201 = 77339028

36. 141.35 ÷5.5

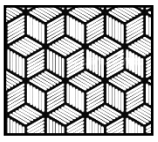
a) 141.35 ÷5.5=25.7
b) 141.35 ÷5.5=25.07
c) 141.35 ÷5.5=25.77
d) 141.35 ÷5.5= 25.9

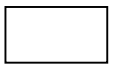
37. 21905 ÷ 65

a) 21905 ÷65= 337
b) 21905 ÷65= 373
c) 21905 ÷65= 733
d) 21905 ÷65= 777

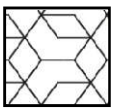
38. 26912 ÷ 32

a) 26912 ÷32 =841
b) 26912 ÷32 148
c) 26912 ÷32 =481
d) 26912 ÷32 = 0

39. 

a) 
b)
c)
d)

40.

a) 
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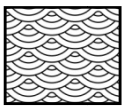
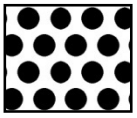
c) 
d) 

Appendix IX

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

MATHEMATICS ANXIETY SCALE

(Draft-Malayalam Version)

Dr. (Prof.) P.K. Aruna
Supervising Teacher

Lisheetha. P.V.
Research Scholar

നിർദ്ദേശങ്ങൾ

താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകൾ ഗണിതവുമായി ബന്ധപ്പെട്ട വിവിധ സാഹചര്യങ്ങളിൽ നിങ്ങൾക്ക് അനുഭവപ്പെടുന്ന/തോന്നുന്ന പ്രയാസങ്ങളുമായി ബന്ധപ്പെട്ടതാണ്. ഇവയുമായി നിങ്ങൾ എത്രമാത്രം യോജിക്കുന്നു അഥവാ വിയോജിക്കുന്നു എന്ന് ഇനി പറയും പ്രകാരം രേഖപ്പെടുത്തുക. ഓരോ പ്രസ്താവനയ്ക്കും അഞ്ചു രീതിയിലുള്ള ഉത്തരങ്ങൾ കൊടുത്തിരിക്കുന്നു (i) എല്ലായ്പ്പോഴും (ii) മിക്കപ്പോഴും (iii) ചിലപ്പോൾ (iv) വല്ലപ്പോഴും (v) ഒരിക്കലുമില്ല എന്നിങ്ങനെ സൂചിപ്പിക്കുന്നു. ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിച്ചതിനുശേഷം, നിങ്ങളുടെ ഉത്തരത്തിന് നേരെ ശരി (✓) അടയാളമിടുക. ഒരു പ്രസ്താവനയും വിട്ടുകളയരുത്. നിങ്ങളുടെ ഉത്തരങ്ങൾ രഹസ്യമായി സൂക്ഷിക്കുന്നതും ഗവേഷണാവശ്യത്തിനുമാത്രം ഉപയോഗപ്പെടുത്തുന്നതുമാണ്.

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1. ടീച്ചർക്ക് സൂത്രവാക്യങ്ങൾ പറഞ്ഞുകൊടുക്കുമ്പോൾ നാവു വരണ്ടുപോവുന്നതായി തോന്നാറുണ്ട്.
2. മനക്കണക്കുകൾ വളരെ വേഗത്തിൽ ചെയ്യാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
3. ഗണിത പരീക്ഷയുടെ സമയത്ത് എനിക്ക് അത്യധികമായി ഉത്കണ്ഠ തോന്നാറുണ്ട്.
4. ജ്യാമിതീയ രൂപങ്ങൾ ഉപയോഗിച്ച് വളരെ മനോഹരമായ കെട്ടിട മാതൃക നിർമ്മിക്കാനെനിക്ക് സാധിക്കാറുണ്ട്.
5. ഗണിത പ്രശ്നങ്ങൾ ടീച്ചർ നോട്ടുബുക്കിൽ ചെയ്യിക്കുമ്പോൾ എന്റെ കൈകൾ തണുത്തു വിയർക്കാറുണ്ട്.
6. വഴിക്കണക്കുമായി ബന്ധപ്പെട്ട പുതിയ ഒരു ചോദ്യം തന്നാൽ അത് നിർദ്ധാരണം ചെയ്യാൻ എനിക്ക് സാധിക്കാറില്ല.
7. ഗണിത പരീക്ഷയിൽ തോറ്റുപോയതായി സ്വപ്നം കണ്ട് ഞെട്ടി ഉണരാറുണ്ട്.
8. ഗണിത മേളകൾക്ക് വേണ്ടി ദ്വിമാന, ത്രിമാന രൂപങ്ങൾ നിർമ്മിക്കാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
9. ഗണിതം സ്കൂളിൽ നിന്നും ഒഴിവാക്കിയാൽ നന്നായിരുന്നുവെന്ന് ആഗ്രഹിക്കാറുണ്ട്.
10. ഗണിതപ്രശ്നങ്ങൾ നിർദ്ധാരണം ചെയ്ത് പഠിക്കുമ്പോൾ എനിക്ക് പല വിധ ശരീരാസ്വസ്ഥ്യങ്ങൾ അനുഭവപ്പെടാറുണ്ട്.
11. റൂബിക്സ് ക്യൂബുപോലുള്ള പസ്സിലുകൾ വളരെ വേഗത്തിൽ നിർദ്ധാരണം ചെയ്യാനെനിക്ക് സാധിക്കാറുണ്ട്.

12. ഗണിത ക്ലാസിൽ, ഗ്രൂപ്പ് ആക്ടിവിറ്റി നന്നായി ചെയ്യാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
13. ഗണിത പരീക്ഷ നന്നായി എഴുതാൻ കഴിയില്ലെന്ന് പരീക്ഷയുടെ മുൻപു തന്നെ എനിക്ക് തോന്നാറുണ്ട്.
14. പാഠപുസ്തകത്തിലെ പ്രവർത്തനങ്ങൾ ചെയ്യുവരാൻ ആവശ്യപ്പെട്ടാൽ എനിക്ക് വല്ലാത്ത മാനസിക പിരിമുറുക്കം അനുഭവപ്പെടാറുണ്ട്.
15. ഗണിത പരീക്ഷയിൽ ഒരു തവണയെങ്കിലും A+ ഗ്രേഡ് കിട്ടാൻ ഞാൻ എപ്പോഴും ആഗ്രഹിക്കാറുണ്ട്.
16. സ്ഥൂപികകളെക്കുറിച്ച് പഠിച്ചതിനാൽ പിരമിഡുകളെക്കുറിച്ച് പഠിക്കുമ്പോൾ എനിക്ക് വളരെ താൽപര്യം തോന്നാറുണ്ട്.
17. ബോർഡിൽ ഗണിതപ്രശ്നം നിർധാരണം ചെയ്യാൻ ടീച്ചർ ആവശ്യപ്പെട്ടാൽ എനിക്ക് വിറയൽ അനുഭവപ്പെടാറുണ്ട്.
18. സ്ഥിതിവിവരക്കണക്ക് പഠിക്കുന്നതിലൂടെ ചിത്രങ്ങൾ മുഖേന തിരിക്കുന്ന വിവരങ്ങളെ വായിച്ചെടുക്കാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
19. പരീക്ഷസമയത്ത് ഞാൻ പഠിച്ച ഗണിതപാഠങ്ങൾ വ്യക്തമായി ഓർത്തെടുക്കാൻ എനിക്ക് കഴിയാറില്ല.
20. ഗണിത പ്രശ്നങ്ങൾ നിർധാരണം ചെയ്ത് ഉത്തരത്തിലെത്തുമ്പോൾ എനിക്ക് വിലയ സന്തോഷം തോന്നാറുണ്ട്.
21. സ്കൂളിൽ ഗണിതവുമായി ബന്ധപ്പെട്ട് നടക്കുന്ന എല്ലാ പ്രോഗ്രാമുകളിലും ഞാൻ പങ്കെടുക്കാറുണ്ട്.
22. ഗണിത പ്രോജക്ടുകൾ ചെയ്യാൻ എനിക്ക് വളരെ ഇഷ്ടമാണ്.
23. ഗണിത പരീക്ഷയിൽ മുഴുവൻ ചോദ്യങ്ങൾക്കും ഉത്തരമെഴുതാനുള്ള സമയം എനിക്ക് ലഭിക്കാറില്ല.
24. ത്രിമാനരൂപങ്ങൾ മനസ്സിൽ സങ്കല്പിച്ച് പ്രശ്നനിർധാരണം ചെയ്യാൻ എനിക്ക് സാധിക്കാറില്ല.
25. ഗണിതം വായിച്ചു പഠിക്കരുതെന്ന് ടീച്ചർ പറയുമ്പോൾ എനിക്ക് ഭീതിയും അസ്വസ്ഥതയും തോന്നാറുണ്ട്.
26. ഗണിതത്തിൽ ഉയർന്ന ഗ്രേഡ് കിട്ടുതിനാൽ ഞാൻ നല്ല ബുദ്ധിയുള്ള കുട്ടിയാണെന്ന് സഹപാഠികൾ പറയാറുണ്ട്.
27. ഗണിത പരീക്ഷയുടെ ഉത്തരക്കടലാസ് ടീച്ചറുടെ കൈയിൽ കാണുമ്പോൾ തന്നെ എന്റെ ഹൃദയമിടിപ്പ് കൂടാറുണ്ട്.
28. ഗണിതക്രിയ ശരിയായി ചെയ്തില്ലെങ്കിൽ ടീച്ചർ എന്നെ പരിഹസിക്കുമോ എന്ന ചിന്ത എന്നെ അലട്ടാറുണ്ട്.
29. പണമിടപാടുകൾ, പലിശ, കൂട്ടുപലിശ ഇവയെല്ലാം പഠിപ്പിക്കുമ്പോൾ എനിക്ക് വല്ലാത്ത ശൂന്യത അനുഭവപ്പെടാറുണ്ട്.
30. എന്റെ കൂട്ടുകാരെ അപേക്ഷിച്ച് ഗണിതത്തിൽ ഞാനൊരു പരാജയമാണെന്ന തോന്നൽ എന്നെ അസ്വസ്ഥനാക്കാറുണ്ട്.

Appendix X

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

MATHEMATICS ANXIETY SCALE

(Draft-English Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

Instructions

The following statements are about the difficulties you experience/feel in various situations related to mathematics. Please indicate how much you agree or disagree with them as follows. Five response options are given for each statement, indicating (i) always (ii) most of the time (iii) sometimes (iv) occasionally (v) never. After reading each statement carefully, tick (✓) your answer. Do not leave out any statement. Your answers will be kept confidential and will be used only for research purposes.

1. My tongue sometimes feels dry when I am saying formulas in front of the teacher.
2. I can do mental calculations very quickly.
3. I often feel extremely anxious during math exams.
4. I can make gorgeous building models using geometric shapes.
5. My hands often get cold and sweaty when the teacher gives me math problems in my notebook.
6. If I get a new model question related to word problems, I can't solve it.
7. I often wake up shocked after dreaming that I failed in mathematics test.
8. I can make two-dimensional and three-dimensional shapes for math fairs.
9. I often wish math had been eliminated from school.
10. I experience various physical ailments while studying and solving math problems.
11. I can solve puzzles like the Rubik's Cube very quickly.
12. In math class, I can do group activities well.
13. I often feel like I won't be able to do well on the math test before the exam.
14. I feel very stressed when I am asked to do activities in the textbook.

15. I always want to get an A+ grade on a math test at least once.
16. I am very interested in learning about pyramids because I have studied about prism.
17. I feel nervous when the teacher asks me to solve a math problem on the board.
18. By studying statistics, I can read information presented in pictures.
19. I can't remember clearly the math lessons during the exams which I have studied already.
20. I feel great joy when I solve math problems and arrive at the correct answer.
21. I participate in all math-related programs at school.
22. I like doing math projects.
23. I don't get enough time to answer all the questions on the math test.
24. I am not able to solve problems by visualizing three-dimensional shapes in my mind.
25. I feel scared and uncomfortable when my teacher tells me not to study math by reading.
26. My classmates often say that I am a smart student because I get high grades in mathematics.
27. My heart beats faster when I see the answer sheet of the math test in the teacher's hand.
28. I often worry that the teacher will make fun of me if I don't do the math correctly.
29. I feel a great emptiness when the teacher teaches us about money transactions, interest, and compound interest.
30. I often feel uncomfortable feeling like I'm a failure at math compared to my friends.

Appendix XI

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

MATHEMATICS ANXIETY SCALE

(Final-Malayalam Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher

Lisheetha. P.V. — Research Scholar

നിർദ്ദേശങ്ങൾ

താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകൾ ഗണിതവുമായി ബന്ധപ്പെട്ട വിവിധ സാഹചര്യങ്ങളിൽ നിങ്ങൾക്ക് അനുഭവപ്പെടുന്ന/തോന്നുന്ന പ്രയാസങ്ങളുമായി ബന്ധപ്പെട്ടതാണ്. ഇവയുമായി നിങ്ങൾ എത്രമാത്രം യോജിക്കുന്നു അഥവാ വിയോജിക്കുന്നു എന്ന് ഇനി പറയും പ്രകാരം രേഖപ്പെടുത്തുക. ഓരോ പ്രസ്താവനയ്ക്കും അഞ്ചു രീതിയിലുള്ള ഉത്തരങ്ങൾ കൊടുത്തിരിക്കുന്നു (i) എല്ലായ്പ്പോഴും (ii) മിക്കപ്പോഴും (iii) ചിലപ്പോൾ (iv) വല്ലപ്പോഴും (v) ഒരിക്കലുമില്ല എന്നിങ്ങനെ സൂചിപ്പിക്കുന്നു. ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിച്ചതിനുശേഷം, നിങ്ങളുടെ ഉത്തരത്തിന് നേരെ ശരി (✓) അടയാളമിടുക. ഒരു പ്രസ്താവനയും വിട്ടുകളയരുത്. നിങ്ങളുടെ ഉത്തരങ്ങൾ രഹസ്യമായി സൂക്ഷിക്കുന്നതും ഗവേഷണാവശ്യത്തിനുമാത്രം ഉപയോഗപ്പെടുത്തുന്നതുമാണ്.

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1. മനക്കണക്കുകൾ വളരെ വേഗത്തിൽ ചെയ്യാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
2. ഗണിത പരീക്ഷയുടെ സമയത്ത് എനിക്ക് അത്യധികമായി ഉത്കണ്ഠ തോന്നാറുണ്ട്.
3. ജ്യാമിതീയ രൂപങ്ങൾ ഉപയോഗിച്ച് വളരെ മനോഹരമായ കെട്ടിട മാതൃക നിർമ്മിക്കാനെനിക്ക് സാധിക്കാറുണ്ട്.
4. ഗണിത പ്രശ്നങ്ങൾ ടീച്ചർ നോട്ടുബുക്കിൽ ചെയ്യിക്കുമ്പോൾ എന്റെ കൈകൾ തണുത്തു വിയർക്കാറുണ്ട്.
5. വഴിക്കണക്കുമായി ബന്ധപ്പെട്ട പുതിയ ഒരു ചോദ്യം തന്നാൽ അത് നിർദ്ധാരണം ചെയ്യാൻ എനിക്ക് സാധിക്കാറില്ല.
6. ഗണിത പരീക്ഷയിൽ തോറ്റുപോയതായി സ്വപ്നം കണ്ട് ഞെട്ടി ഉണരാറുണ്ട്.
7. ഗണിത മേളകൾക്ക് വേണ്ടി ദ്വിമാന, ത്രിമാന രൂപങ്ങൾ നിർമ്മിക്കാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
8. ഗണിതം സ്കൂളിൽ നിന്നും ഒഴിവാക്കിയാൽ നന്നായിരുന്നുവെന്ന് ആഗ്രഹിക്കാറുണ്ട്.
9. ഗണിതപ്രശ്നങ്ങൾ നിർദ്ധാരണം ചെയ്ത് പഠിക്കുമ്പോൾ എനിക്ക് പല വിധ ശരീരാസ്വസ്ഥ്യങ്ങൾ അനുഭവപ്പെടാറുണ്ട്.
10. റൂബിക്സ് ക്യൂബുപോലുള്ള പസ്സിലുകൾ വളരെ വേഗത്തിൽ നിർദ്ധാരണം ചെയ്യാനെനിക്ക് സാധിക്കാറുണ്ട്.
11. ഗണിത ക്ലാസിൽ, ഗ്രൂപ്പ് ആക്ടിവിറ്റി നന്നായി ചെയ്യാൻ എനിക്ക് സാധിക്കാറുണ്ട്.

12. ഗണിത പരീക്ഷ നന്നായി എഴുതാൻ കഴിയില്ലെന്ന് പരീക്ഷയുടെ മുൻപു തന്നെ എനിക്ക് തോന്നാറുണ്ട്.
13. പാഠപുസ്തകത്തിലെ പ്രവർത്തനങ്ങൾ ചെയ്യുവരാൻ ആവശ്യപ്പെട്ടാൽ എനിക്ക് വല്ലാത്ത മാനസിക പിരിമുറുക്കം അനുഭവപ്പെടാറുണ്ട്.
14. ഗണിത പരീക്ഷയിൽ ഒരു തവണയെങ്കിലും A+ ഗ്രേഡ് കിട്ടാൻ ഞാൻ എപ്പോഴും ആഗ്രഹിക്കാറുണ്ട്.
15. സൂപികകളെക്കുറിച്ച് പഠിച്ചതിനാൽ പിരമിഡുകളെക്കുറിച്ച് പഠിക്കുമ്പോൾ എനിക്ക് വളരെ താൽപര്യം തോന്നാറുണ്ട്.
16. ബോർഡിൽ ഗണിതപ്രശ്നം നിർധാരണം ചെയ്യാൻ ടീച്ചർ ആവശ്യപ്പെട്ടാൽ എനിക്ക് വിറയൽ അനുഭവപ്പെടാറുണ്ട്.
17. സ്ഥിതിവിവരക്കണക്ക് പഠിക്കുന്നതിലൂടെ ചിത്രങ്ങൾ മുഖേന തിരിക്കുന്ന വിവരങ്ങളെ വായിച്ചെടുക്കാൻ എനിക്ക് സാധിക്കാറുണ്ട്.
18. പരീക്ഷസമയത്ത് ഞാൻ പഠിച്ച ഗണിതപാഠങ്ങൾ വ്യക്തമായി ഓർത്തെടുക്കാൻ എനിക്ക് കഴിയാറില്ല.
19. ഗണിത പ്രശ്നങ്ങൾ നിർധാരണം ചെയ്ത് ഉത്തരത്തിലെത്തുമ്പോൾ എനിക്ക് വിലയ സന്തോഷം തോന്നാറുണ്ട്.
20. സ്കൂളിൽ ഗണിതവുമായി ബന്ധപ്പെട്ട് നടക്കുന്ന എല്ലാ പ്രോഗ്രാമുകളിലും ഞാൻ പങ്കെടുക്കാറുണ്ട്.
21. ഗണിത പ്രോജക്ടുകൾ ചെയ്യാൻ എനിക്ക് വളരെ ഇഷ്ടമാണ്.
22. ഗണിത പരീക്ഷയിൽ മുഴുവൻ ചോദ്യങ്ങൾക്കും ഉത്തരമെഴുതാനുള്ള സമയം എനിക്ക് ലഭിക്കാറില്ല.
23. ഗണിതം വായിച്ചു പഠിക്കരുതെന്ന് ടീച്ചർ പറയുമ്പോൾ എനിക്ക് ഭീതിയും അസ്വസ്ഥതയും തോന്നാറുണ്ട്.
24. ഗണിതത്തിൽ ഉയർന്ന ഗ്രേഡ് കിട്ടുതിനാൽ ഞാൻ നല്ല ബുദ്ധിയുള്ള കുട്ടിയാണെന്ന് സഹപാഠികൾ പറയാറുണ്ട്.
25. ഗണിത പരീക്ഷയുടെ ഉത്തരക്കടലാസ് ടീച്ചറുടെ കൈയിൽ കാണുമ്പോൾ തന്നെ എന്റെ ഹൃദയമിടിപ്പ് കൂടാറുണ്ട്.
26. ഗണിതക്രിയ ശരിയായി ചെയ്തില്ലെങ്കിൽ ടീച്ചർ എന്നെ പരിഹസിക്കുമോ എന്ന ചിന്ത എന്നെ അലട്ടാറുണ്ട്.
27. പണമിടപാടുകൾ, പലിശ, കൂട്ടുപലിശ ഇവയെല്ലാം പഠിപ്പിക്കുമ്പോൾ എനിക്ക് വല്ലാത്ത ശൂന്യത അനുഭവപ്പെടാറുണ്ട്.
28. എന്റെ കൂട്ടുകാരെ അപേക്ഷിച്ച് ഗണിതത്തിൽ ഞാനൊരു പരാജയമാണെന്ന തോന്നൽ എന്നെ അസ്വസ്ഥനാക്കാറുണ്ട്.

Appendix XII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

MATHEMATICS ANXIETY SCALE

(Final-English Version)

Dr. (Prof.) P.K. Aruna — Supervising Teacher
Lisheetha. P.V. — Research Scholar

Instructions

The following statements are about the difficulties you experience/feel in various situations related to mathematics. Please indicate how much you agree or disagree with them as follows. Five response options are given for each statement, indicating (i) always (ii) most of the time (iii) sometimes (iv) occasionally (v) never. After reading each statement carefully, tick (✓) your answer. Do not leave out any statement. Your answers will be kept confidential and will be used only for research purposes.

1. I can do mental calculations very quickly.
2. I often feel extremely anxious during math exams.
3. I can make gorgeous building models using geometric shapes.
4. My hands often get cold and sweaty when the teacher gives me math problems in my notebook.
5. If I get a new model question related to word problems, I can't solve it.
6. I often wake up shocked after dreaming that I failed in mathematics test.
7. I can make two-dimensional and three-dimensional shapes for math fairs.
8. I often wish math had been eliminated from school.
9. I experience various physical ailments while studying and solving math problems.
10. I can solve puzzles like the Rubik's Cube very quickly.
11. In math class, I can do group activities well.
12. I often feel like I won't be able to do well on the math test before the exam.
13. I feel very stressed when I am asked to do activities in the textbook.
14. I always want to get an A+ grade on a math test at least once.
15. I am very interested in learning about pyramids because I have studied about prism.

16. I feel nervous when the teacher asks me to solve a math problem on the board.
17. By studying statistics, I can read information presented in pictures.
18. I can't remember clearly the math lessons during the exams which I have studied already.
19. I feel great joy when I solve math problems and arrive at the correct answer.
20. I participate in all math-related programs at school.
21. I like doing math projects.
22. I don't get enough time to answer all the questions on the math test.
23. I feel scared and uncomfortable when my teacher tells me not to study math by reading.
24. My classmates often say that I am a smart student because I get high grades in mathematics.
25. My heart beats faster when I see the answer sheet of the math test in the teacher's hand.
26. I often worry that the teacher will make fun of me if I don't do the math correctly.
27. I feel a great emptiness when the teacher teaches us about money transactions, interest, and compound interest.
28. I often feel uncomfortable feeling like I'm a failure at math compared to my friends.

Appendix - XIII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

QUESTIONNAIRE ON TEACHER'S PERCEPTION TOWARDS PREVAILING STRATEGIES, CONSTRAINTS AND SUGGESTIONS IN TEACHING MATHEMATICS

Dr. (Prof.) P.K. Aruna
Supervising Teacher

Lisheetha. P.V.
Research Scholar

1. The prevailing strategies and methods in this school

		Yes	No	Expected Outcomes
a)	Problem Based Learning			
b)	Brain Compatible Learning			
c)	Blended Learning			
d)	Computer Assisted Instruction			
e)	Assignments, Projects			
f)	Co-operative Learning			
g)	Collaborative Learning			
h)	Activity Oriented			
i)	Seminars			
j)	Mentoring			
k)	Team Teaching			
l)	Group Instruction			
m)	Individualised Instruction			
n)	Inclusive Instruction			
o)	Mind maps			
p)	Graphic Organizes			
q)	Explicit Instruction			
r)	Integrated Instruction			
s)	Inductive-Deductive			
t)	Heuristic			
u)	Discovery			
v)	Analytic-Synthetic			
w)	Problem Solving			
x)	Laboratory			
y)	Project			

2. Constraints in Teaching Mathematics

	Yes	No	Expected Outcomes
a) Lack of Pre-requisite skills of Students			
b) Time of reflection			
c) Lack of effort/interest by students			
d) Learning experience and resources			
e) Self motivation			
f) Expert teachers			
g) Lack of training			
h) Any other reasons			

3. Suggestions for the Betterment

Appendix XIV

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PROBLEM SOLVING ABILITY IN MATHEMATICS

RESPONSE SHEET

Name of the Student:..... Gender:.....

Name of the School:.....

Sl. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d
11	a	b	c	d
12	a	b	c	d
13	a	b	c	d
14	a	b	c	d
15	a	b	c	d
16	a	b	c	d
17	a	b	c	d
18	a	b	c	d
19	a	b	c	d

Sl. No.	Options			
20	a	b	c	d
21	a	b	c	d
22	a	b	c	d
23	a	b	c	d
24	a	b	c	d
25	a	b	c	d
26	a	b	c	d
27	a	b	c	d
28	a	b	c	d
29	a	b	c	d
30	a	b	c	d
31	a	b	c	d
32	a	b	c	d
33	a	b	c	d
34	a	b	c	d
35	a	b	c	d
36	a	b	c	d
37	a	b	c	d

Appendix XV

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

TEST OF PERCEPTUAL SPEED

RESPONSE SHEET

Name of the Student:..... Gender:.....

Name of the School:.....

Gender:.....

Time Taken	

Sl. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d
11	a	b	c	d
12	a	b	c	d
13	a	b	c	d
14	a	b	c	d
15	a	b	c	d
16	a	b	c	d
17	a	b	c	d
18	a	b	c	d
19	a	b	c	d
20	a	b	c	d

Sl. No.	Options			
21	a	b	c	d
22	a	b	c	d
23	a	b	c	d
24	a	b	c	d
25	a	b	c	d
26	a	b	c	d
27	a	b	c	d
28	a	b	c	d
29	a	b	c	d
30	a	b	c	d
31	a	b	c	d
32	a	b	c	d
33	a	b	c	d
34	a	b	c	d
35	a	b	c	d
36	a	b	c	d
37	a	b	c	d
38	a	b	c	d
39	a	b	c	d
40	a	b	c	d

Appendix XVI

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

MATHEMATICS ANXIETY SCALE

RESPONSE SHEET

Name of the Student:..... Gender:.....

Name of the School:.....

Sl. No	Always	Most of the Time	Sometimes	Occasionally	Never
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Sl. No	Always	Most of the Time	Sometimes	Occasionally	Never
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					

Appendix XVII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LESSON TRANSCRIPT BASED ON BRAIN COMPATIBLE LEARNING

Dr. P.K. Aruna
Rtd. Professor

Lisheetha P.V.
Research Scholar

LESSON TRANSCRIPT NO. I

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	ബഹുഭുജങ്ങൾ			
Topic	:	ബഹുഭുജങ്ങളുടെ ആന്തരകോണുകളുടെ തുക	Date	:	

PHASE I

Stage 1- Pre- Exposure

[അധ്യാപിക ക്ലാസ്സിലേക്ക് പ്രവേശിക്കുമ്പോൾ കുട്ടികൾ അധ്യാപികയെ അഭിവാദ്യം ചെയ്യുന്നു. അധ്യാപിക തിരിച്ചും കുട്ടികളെ അഭിവാദ്യം ചെയ്യുന്നു.]

- അധ്യാപിക ബഹുഭുജങ്ങളുടെ ആന്തരകോണുകളുടെ അളവുകളുടെ തുക എന്ന പാഠഭാഗത്തിലേക്ക് എത്തുന്നതിനാവശ്യമായ ചില സാഹചര്യങ്ങൾ സൃഷ്ടിക്കുന്നു.

Situation-1

അധ്യാപിക	:	നിങ്ങൾക്കറിയാവുന്ന ബഹുഭുജങ്ങളുടെ പേരുകൾ പറയാമോ?
കുട്ടികൾ	:	ത്രികോണം, ചതുരം, സാമാന്തരികം, പഞ്ചഭുജം, ഷഡ്ഭുജം.
അധ്യാപിക	:	very good…നിങ്ങൾ പറഞ്ഞ ബഹുഭുജങ്ങളോട് സാമ്യമുള്ള രൂപങ്ങൾ ക്ലാസിലോ, ക്ലാസിനു പുറത്തോ, എവിടെയെങ്കിലും കണ്ടിട്ടുണ്ടോ?
കുട്ടികൾ	:	സമൂസ, പട്ടം, ഇഷ്ടിക, ബോർഡ്…..
അധ്യാപിക	:	എങ്കിൽ എന്താണ് ബഹുഭുജങ്ങൾ.
	:	മൂന്നോ, അതിലധികമോ വശങ്ങളുള്ള രൂപത്തിന്റെ പൊതുവായ പേരാണ് ബഹുഭുജം.

[അധ്യാപിക ബോർഡിൽ ഒരു മെടിക്സ് ഡയഗ്രം വരച്ച് ആശയങ്ങൾ ക്രോഡീകരിച്ച് ആശയം കാണിക്കുന്നു.]

ബഹുഭുജം

↓

മൂന്നോ അതിലധികമോ വശങ്ങളുള്ള രൂപത്തിന്റെ പൊതുവായ പേര്

↓

ഉദാ:-ചതുരം, ത്രികോണം, പഞ്ചഭുജം, സാമാന്തരികം, ഷഡ്ഭുജം

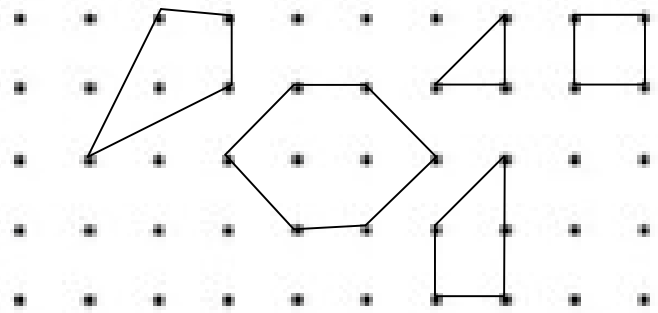
Stage 2- Preparation

അധ്യാപിക : കുട്ടികളെ ചെറിയ ഗ്രൂപ്പുകളാക്കുന്നു. ഓരോ ഗ്രൂപ്പിനും ഓരോ ഡോട്ട്ഗ്രിഡ് പേജ് വീതം നൽകുന്നു.

Situation-2

അധ്യാപിക : നിങ്ങൾക്ക് തന്നിരിക്കുന്ന ഡോട്ട് ഗ്രിഡ് പേജിൽ മൂന്ന് കൂത്തുകൾ യോജിപ്പിച്ച് ത്രികോണം, നാലു കൂത്തുകൾ യോജിപ്പിച്ച് ഒരു ചതുർഭുജം, അഞ്ച് കൂത്തുകൾ യോജിപ്പിച്ച് ഒരു പഞ്ചഭുജം, ആറ് കൂത്തുകൾ യോജിപ്പിച്ച് ഒരു ഷഡ്ഭുജം എന്നിവ നിർമ്മിക്കാമോ?

(കുട്ടികൾ നിർമ്മിക്കുന്നു)



Situation-3

അധ്യാപിക : അധ്യാപിക ചാർട്ടിൽ കാണിച്ചിരിക്കുന്നതുപോലുള്ള പട്ടിക നോട്ട്ബുക്കിൽ വരച്ച് അതിലെ വിട്ട ഭാഗങ്ങൾ പൂരിപ്പിച്ച് അധ്യാപിക പറയുന്ന ഗ്രൂപ്പുകൾ വന്ന് ചാർട്ടിൽ ഉത്തരം എഴുതാൻ ആവശ്യപ്പെടുന്നു.

ബഹുഭുജം	വശങ്ങൾ	മൂലകൾ
ചതുരം	4	2
പഞ്ചഭുജം	5	3
ഷഡ്ഭുജം	6	4

[പട്ടികിലെ വിട്ട ഭാഗങ്ങൾ അധ്യാപിക വിളിക്കുന്ന കുട്ടികൾ വന്ന് പൂരിപ്പിക്കുന്നു.]

Stage 3- Initiation and Acquisition

Situation-4

അധ്യാപിക : അധ്യാപിക വ്യത്യസ്ത നിറത്തിലുള്ള ചതുർഭുജം, പഞ്ചഭുജം, ഷഡ്ഭുജം എന്നിവ ഓരോ ഗ്രൂപ്പുകൾക്കും നൽകുന്നു. അതിൽ ആവശ്യമായ വികർണ്ണങ്ങൾ വരച്ച് ഓരോ ബഹുഭുജത്തിലും എത്ര ത്രികോണങ്ങൾ ഉണ്ടെന്ന് കണ്ടെത്താൻ ആവശ്യപ്പെടുന്നു.

കുട്ടികൾ : ബോർഡിൽ വരച്ചിരിക്കുന്ന പട്ടിക നോട്ട് ബുക്കിൽ വരച്ച് പൂർത്തീകരിക്കുന്നു.

ബഹുഭുജങ്ങൾ	**വശങ്ങളുടെ എണ്ണം**	**ത്രികോണങ്ങളുടെ എണ്ണം**
ചതുരം	4	2
പഞ്ചഭുജം	5	3
ഷഡ്ഭുജം	6	4

Situation-5

അധ്യാപിക : ബോർഡിൽ വരച്ച പട്ടികയിൽ ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണവും അതിൽ ഉൾക്കൊള്ളുന്ന ത്രികോണത്തിന്റെ എണ്ണവും തമ്മിൽ എന്തെങ്കിലും പ്രത്യേകതകൾ കണ്ടെത്താമോ?

കുട്ടികൾ : വശങ്ങളുടെ എണ്ണത്തിൽ നിന്നും രണ്ട് കുറവാണ്. അതിലെ ത്രികോണത്തിന്റെ എണ്ണം

അധ്യാപിക : അങ്ങനെയെങ്കിൽ വശങ്ങളുടെ എണ്ണം 'n' ആയ ഒരു ബഹുഭുജത്തിൽ ഉൾക്കൊള്ളുന്ന ത്രികോണത്തിന്റെ എണ്ണം (n-2) എന്ന് എഴുതാമല്ലോ.

കുട്ടികൾ : അതെ

[അധ്യാപിക ആശയം ക്രോഡീകരിച്ച് ബോർഡിൽ എഴുതുന്നു.]

'n' **വശങ്ങളുള്ള ഏതൊരു ബഹുഭുജത്തിലും**
(n-2) **ത്രികോണങ്ങൾ കണ്ടെത്താം.**

PHASE II

Stage 4- Elaboration

അധ്യാപിക : അധ്യാപിക ഇതുവരെ ചെയ്ത എല്ലാ ആക്ടിവിറ്റികളും ക്രോഡീകരിച്ച് ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക എന്ന ആശയം ചോദ്യോത്തരങ്ങളിലൂടെ കുട്ടികൾക്ക് പൊതുവൽക്കരിച്ച് കൊടുക്കുന്നു.

[അധ്യാപിക ഓരോ ഗ്രൂപ്പുകളോടായി ചോദ്യങ്ങൾ ചോദിക്കുന്നു]

അധ്യാപിക : ഒരു ത്രികോണത്തിലെ മൂന്നു കോണുകളുടെ തുക എത്രയായിരിക്കും?

ഗ്രൂപ്പ് : 180^0

അധ്യാപിക : ഒരു ബഹുഭുജത്തിൽ രണ്ട് ത്രികോണങ്ങൾ ഉണ്ടെങ്കിൽ ആ ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?

ഗ്രൂപ്പ് : $2x180^0 = 360^0$

അധ്യാപിക : രണ്ട് ത്രികോണങ്ങൾ ഉൾക്കൊള്ളുന്ന ഒരു ബഹുഭുജം ഏതാണ്?

ഗ്രൂപ്പ് : ചതുരം

അധ്യാപിക : ചതുരത്തിന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?

ഗ്രൂപ്പ് : 360^0

അധ്യാപിക : മൂന്ന് ത്രികോണങ്ങൾ ഉൾക്കൊള്ളുന്ന ഒരു ബഹുഭുജം ഏതാണ്?

ഗ്രൂപ്പ് : പഞ്ചഭുജം

അധ്യാപിക : പഞ്ചഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?

ഗ്രൂപ്പ് : $3x180^0$

അധ്യാപിക : 'n' വശങ്ങളുള്ള ഒരു ബഹുഭുജത്തിൽ എത്ര ത്രികോണങ്ങൾ ഉണ്ടായിരിക്കും.

ഗ്രൂപ്പ് : n-2

അധ്യാപിക : (n-2) ത്രികോണങ്ങളുള്ള ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക എത്രയായിരിക്കും?

ഗ്രൂപ്പ് : $(n-2)\ x180^0$

Situation-6

അധ്യാപിക ചാർട്ടിൽ കാണിച്ചിരിക്കുന്ന പട്ടിക നോട്ടുബുക്കിൽ വരച്ച് വിട്ട ഭാഗം പൂരിപ്പിച്ച് ഓരോ ഗ്രൂപ്പിനോടായി വായിക്കാൻ ആവശ്യപ്പെടുന്നു.

	ബഹുഭുജം	വശങ്ങളുടെ എണ്ണം	ത്രികോണങ്ങളുടെ എണ്ണം	ആന്തരകോണുകളുടെ തുക
1	ത്രികോണം Δ	3	1	$1 \times 180^0 = 180^0$
2	ചതുരം □	4	2	$2 \times 180^0 = 360^0$
3	പഞ്ചഭുജം	5	3	3×180^0
4	ഷഡ്ഭുജം	6	4	4×180^0
5	'n' വശങ്ങളുള്ള ബഹുഭുജം	n	(n-2)	$(n-2) \times 180^0$

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-7

അധ്യാപിക കുട്ടികൾക്ക് സ്വെച്ചിങ്ങ് ആന്റ് റിലാക്സേഷൻ എക്സൈസ് നൽകികൊണ്ട് കുട്ടികൾക്ക് ആന്തരികകോണുകളുടെ അളവുകളുടെ തുക എന്ന ആശയം ചർച്ച ചെയ്യാനുള്ള അവസരം നൽകുന്നു.

Stage 6- Verification and Confidence Check

Situation-8

അധ്യാപിക : ഓരോ ഗ്രൂപ്പിനോടും ചർച്ച ചെയ്ത് മൂന്ന് ചോദ്യങ്ങളും ഉത്തരങ്ങളും ഉണ്ടാക്കാനാവശ്യപ്പെടുന്നു.

: നിലവിലുള്ള ഗ്രൂപ്പുകളെ മാറ്റി രണ്ട് ഗ്രൂപ്പുകളാക്കുന്നു. പിന്നീട് ക്വിസ് മത്സരം നടത്തുന്നു. ഒരു ഗ്രൂപ്പ് ചോദ്യം ചോദിക്കുന്നു. അടുത്ത ഗ്രൂപ്പ്

ഉത്തരം പറഞ്ഞാൽ ഒരു പോയിന്റ് തെറ്റിച്ചാൽ ചോദിച്ച ഗ്രൂപ്പിന് പോയിന്റ്

രണ്ടു ഗ്രൂപ്പുകളേയും നന്നായി ചെയ്തതിന് അധ്യാപിക അഭിനന്ദിക്കുന്നു. മാത്രമല്ല വിജയിച്ച ഗ്രൂപ്പിനെ അഭിനന്ദിക്കാനായി എല്ലാവരോടും ക്ലാപ്പ് ചെയ്യാൻ ആവശ്യപ്പെടുന്നു.

Stage 7- Celebration and Integration

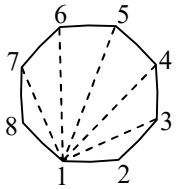
അധ്യാപിക : ഓരോ ഗ്രൂപ്പിൽനിന്നും ഓരോ വിദ്യാർത്ഥിയോട് വന്ന് അവരുടെ പഠനാനുഭവം പങ്കുവക്കാൻ ആവശ്യപ്പെടുന്നു.

[അതിനുശേഷം ക്ലാസിൽ ഉള്ള രണ്ട് കുട്ടികൾ വന്ന് മനോഹരമായ ഒരു പാട്ടുപാടുന്നു.]

അധ്യാപിക വിദ്യാർത്ഥികൾക്ക് ഫോളോ അപ്പ് ആക്ടിവിറ്റിയായി ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക എന്ന ആശയവുമായി ബന്ധപ്പെട്ട ഹോംവർക്ക് നൽകുന്നു.

Follow up Activity

1. ഒരു അഷ്ടഭുജം വരച്ച് അതിന്റെ ആന്തരകോണുകളുടെ തുക കണ്ടു പിടിക്കുക.



2. ഒരു ബഹുഭുജത്തിന്റെ കോണുകളുടെ തുക 8100^0 ആയാൽ ആ ബഹുഭുജത്തിന് എത്ര വശങ്ങൾ ഉണ്ടായിരിക്കും.

LESSON TRANSCRIPT NO. II

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	ചതുർഭുജപരപ്പ്			
Topic	:	സാമാന്തരികത്തിന്റെ പരപ്പളവ്	Date	:	

PHASE I

Stage 1- Pre- Exposure

[അധ്യാപിക ക്ലാസ്സിലേക്ക് പ്രവേശിക്കുമ്പോൾ കുട്ടികൾ അധ്യാപികയെ അഭിവാദ്യം ചെയ്യുന്നു. അധ്യാപിക തിരിച്ചും കുട്ടികളെ അഭിവാദ്യം ചെയ്യുന്നു.]

അധ്യാപിക : ഇന്നലെ ബുള്ളറ്റിൻ ബോർഡിൽ "സമഭുജസാമാന്തരികം"എന്ന ആശയം പ്രദർശിപ്പിച്ചപ്പോൾ അതുമായി ബന്ധപ്പെട്ട വിവരങ്ങൾ ഇന്ന് ശേഖരിച്ചു വരാൻ ആവശ്യപ്പെട്ടിരുന്നു എന്ന് ഓർമ്മിപ്പിക്കുന്നു.

Situation-1

അധ്യാപിക : നിങ്ങൾ ശേഖരിച്ച സമഭുജസാമാന്തരികവുമായി ബന്ധപ്പെട്ട ആശയങ്ങളും, ഈ ഗണിത രൂപവുമായി സാമ്യമുള്ള നിങ്ങൾക്കറിയാവുന്ന ഉദാഹരണങ്ങളും നമ്മുടെ ക്ലാസിലെ എല്ലാവർക്കും വേണ്ടി പങ്കിടാമോ?

കുട്ടികൾ : ഓരോ ബെഞ്ചിൽനിന്നും ഓരോരുത്തരായി വന്ന് അവർ മുൻ ക്ലാസുകളിൽ പഠിച്ചിരുന്ന സമഭുജസാമാന്തരികവുമായി ബന്ധപ്പെട്ട ആശയങ്ങളും അവർക്കറിയാവുന്ന ഉദാഹരണങ്ങളും മറ്റുള്ളവർക്കായി പങ്കുവക്കുന്നു.

[അധ്യാപിക സമഭുജ സാമാന്തരികവുമായി ബന്ധപ്പെട്ട് ഗണിതശാസ്ത്ര വസ്തുതകൾ അടങ്ങുന്ന ചാർട്ട് കുട്ടികൾക്കായി പ്രദർശിപ്പിക്കുന്നു.]

Stage 2- Preparation

അധ്യാപിക : കുട്ടികൾക്ക് വിവിധ നിറത്തിലുള്ള ഓരോ A-ഫോർ ഷീറ്റ് വീതം നൽകുന്നു.

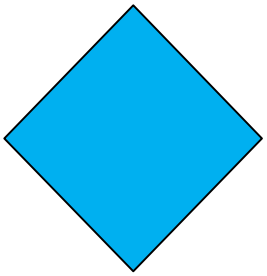
Situation-2

അധ്യാപിക : നിങ്ങൾക്ക് എല്ലാവർക്കും സമചതുരം വരക്കാനറിയാമല്ലോ?

കുട്ടികൾ : അറിയാം

അധ്യാപിക : എങ്കിൽ നിങ്ങൾ നൽകിയ നിറമുള്ള A ഫോർ ഷീറ്റിൽ വികർണങ്ങൾ 6 സെന്റീമീറ്ററായ സമചതുരം വരയ്ക്കാമോ?

കുട്ടികൾ : അവർക്ക് കിട്ടിയ നിറമുള്ള A-ഫോർ ഷീറ്റിൽ വികർണ്ണങ്ങൾ 6 സെന്റീമീറ്ററായ സമചതുരമായ സമഭുജസാമാന്തരികം വരയ്ക്കുന്നു.



അധ്യാപിക : Very good, എല്ലാവരും നന്നായി വരച്ചല്ലോ.

Stage 3- Initiation and Acquisition

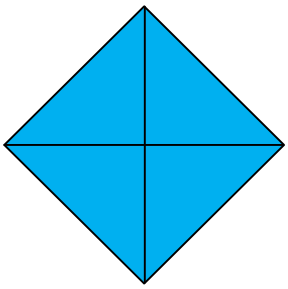
Situation-3

അധ്യാപിക : നിങ്ങൾ വരച്ചിരിക്കുന്ന ഈ സമചതുരമായ സമഭുജസാമാന്തരികത്തെ നാലു തുല്യ ത്രികോണങ്ങളാക്കി മാറ്റാൻ കഴിയുമോ?

കുട്ടികൾ : നാല് തുല്യ സമപാർശ്വത്രികോണങ്ങളാക്കി മാറ്റാൻ കഴിയും.

അധ്യാപിക : എങ്കിൽ എല്ലാവരും സമഭുജസാമാന്തരികത്തെ നാല് തുല്യ സമപാർശ്വ ത്രികോണങ്ങളാക്കുമോ?

കുട്ടികൾ : നാലുസമപാർശ്വത്രികോണങ്ങളാക്കുന്നു



അധ്യാപിക : ഈ സമചതുരമായ സമഭുജ സാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ടുപിടിക്കാമോ?

കുട്ടികൾ : സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ട്പിടിക്കുന്നു.

PHASE II

Stage 4- Elaboration

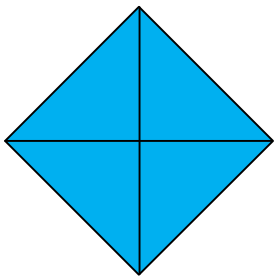
[അധ്യാപിക കുട്ടികൾക്ക് ഒരു വാം അപ്പ് വ്യായാമം നൽകുന്നു.]

Situation-4

അധ്യാപിക : വികർണ്ണങ്ങൾ 6 സെന്റിമീറ്ററും 4 സെന്റീമീറ്ററും ആയ വിവിധ നിറത്തിലുള്ള സമഭുജസാമാന്തരികത്തിന്റെ മാതൃക ഓരോ ഗ്രൂപ്പുകൾക്കായി നൽകുന്നു.

അധ്യാപിക : നിങ്ങൾക്ക് നൽകിയിരിക്കുന്ന സമഭുജസാമാന്തരികത്തിന്റെ വികർണ്ണങ്ങൾ യോജിപ്പിച്ച് നാല് മട്ടത്രികോണങ്ങൾ നിർമ്മിക്കാമോ.

കുട്ടികൾ : സമഭുജസാമാന്തരികത്തിൽ നാല മട്ടത്രികോണങ്ങൾ നിർമ്മിക്കുന്നു.



അധ്യാപിക : Very good, കുട്ടികളെ അഭിന്ദിക്കുന്നു.

അധ്യാപിക : ഈ സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് നേരത്തെ കണ്ടുപിടിച്ച അതേ രീതിയിൽ കണ്ടുപിടിക്കാമോ?

കുട്ടികൾ : ഓരോ ഗ്രൂപ്പും ചർച്ച ചെയ്ത് സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ടുപിടിച്ച് ഉത്തരം പറയുന്നു.

[അധ്യാപിക സമഭുജ സാമാന്തരികത്തിന്റെ പരപ്പളവ് വികർണ്ണങ്ങളുടെ ഗുണഫലത്തിന്റെ പകുതിയാണ് എന്ന ആശയം ഉൾക്കൊള്ളുന്ന ചാർട്ട് ചുമരിൽ ഒട്ടിക്കുന്നു.]

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-5

അധ്യാപിക കുട്ടികൾക്ക് മെമ്മറിയും കോൺസൻട്രേഷനും കൂട്ടുന്നതിനുള്ള ബ്രയിൻ എക്സൈസുകൾ നൽകികൊണ്ട് സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് എന്ന വസ്തുതകൾ ചർച്ച ചെയ്യാനുള്ള അവസരം നൽകുന്നു.

Stage 6- Verification and Confidence Check

Situation-6

അധ്യാപിക : ഓരോ ഗ്രൂപ്പിനോടും ഇന്ന് ക്ലാസിൽ ചർച്ച ചെയ്ത കാര്യങ്ങൾ ക്രോഡീകരിച്ച് അവരുടേതായ രീതിയിൽ എഴുതാൻ ആവശ്യപ്പെടുന്നു.

കുട്ടികൾ : ഓരോ ഗ്രൂപ്പുകളും ചർച്ച ചെയ്ത് അവരുടെ ആശയങ്ങൾ നോട്ടുബുക്കിൽ എഴുതുന്നു.

അധ്യാപിക : പേര് വിളിക്കുന്ന കുട്ടികളോട് അവരെഴുതിയത് വായിക്കാൻ പറയുന്നു.

കുട്ടികൾ : അവരുടെ ആശയം ഉച്ചത്തിൽ വായിക്കുന്നു.

അധ്യാപിക ക്ലാപ്പ് ചെയ്യിപ്പിച്ചുകൊണ്ട് കുട്ടികളെ അഭന്ദിക്കുന്നു.

Stage 7- Celebration and Integration

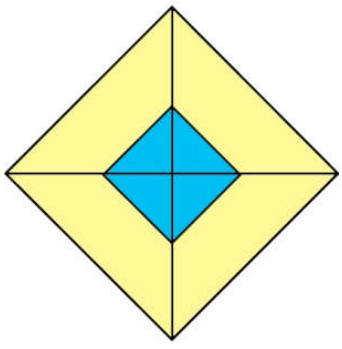
Situation-7

[അധ്യാപിക കുട്ടികൾക്കായി ലളിത സംഗീതം വച്ച് കൊടുക്കുന്നു]

അധ്യാപിക കുട്ടികൾക്ക് സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവുമായി ബന്ധപ്പെട്ട ഹോംവർക്ക് നൽകുന്നു.

Follow up Activity (തുടർപ്രവർത്തനം)

3. ചിത്രത്തിൽ ഒരു സമഭുജസാമാന്തരികത്തിന്റെ വികർണ്ണങ്ങളുടെ പകുതിയുടെ മധ്യബിന്ദുക്കൾ യോജിപ്പിച്ച് ചെറിയൊരു ചതുർഭുജം വരച്ചിരിക്കുന്നു.



(i) ഈ ചതുർഭുജം സാമാന്തരികമാണെന്ന് തെളിയിക്കുക.

(ii) ചെറിയ സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് 3 ചതുരശ്ര സെന്റീമീറ്ററാണ്. വലിയ സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് എന്തായിരിക്കും?

LESSON TRANSCRIPT NO. III

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	അംശബന്ധം			
Topic	:	ഭാഗങ്ങളുടെ ബന്ധം	Date	:	

PHASE I

Stage 1- Pre- Exposure

[അധ്യാപിക ക്ലാസ്സിലേക്ക് പ്രവേശിക്കുമ്പോൾ കുട്ടികൾ അധ്യാപികയെ ആശംസിക്കുന്നു. ചെയ്യുന്നു. അധ്യാപിക തിരിച്ചും കുട്ടികളെ ആശംസിക്കുന്നു.]

അധ്യാപിക : ഇന്നലെ ക്ലാസിൽ പ്രദർശിപ്പിച്ച അംശബന്ധം എന്ന ഗണിത ആശയം നിത്യജീവിതവുമായി എങ്ങനെ ബന്ധപ്പെട്ടിരിക്കുന്നു എന്ന വസ്തുതകൾ ശേഖരിച്ചു വരാൻ പറഞ്ഞിരുന്നില്ലേ?

കുട്ടികൾ : പറഞ്ഞിരുന്നു

Situation-1

അധ്യാപിക : നിങ്ങൾ ശേഖരിച്ച അംശബന്ധം എന്ന ഗണിത ആശയത്തിന്റെ നിത്യജീവിതവുമായി ബന്ധപ്പെട്ട വിവിധതരം ഉദാഹരണങ്ങൾ ക്ലാസിലെ എല്ലാവരുമായി ചർച്ച ചെയ്താലോ?

കുട്ടികൾ : ഓരോരുത്തരായി വന്ന് അംശബന്ധം എന്ന ആശയവുമായി ബന്ധപ്പെട്ട നിത്യജീവിതത്തിൽ ഉപയോഗിച്ചുവരുന്ന ഉദാഹരണങ്ങൾ പങ്കുവയ്ക്കുന്നു.

[കുട്ടികൾ അധികപേരും വിവിധതരം ഭക്ഷണസാധനങ്ങൾ ഉണ്ടാക്കുമ്പോൾ സാധനങ്ങൾ എടുക്കുന്ന അളവുകളുടെ അംശബന്ധത്തെ കുറിച്ചാണ് പറഞ്ഞിരുന്നത്.]

[അധ്യാപിക കുട്ടികളുടെ ആശയങ്ങളും ഉദാഹരണങ്ങളും ക്രോഡീകരിച്ച് ആംശബന്ധം എന്ന് ആശയത്തിന്റെ ഗണിതസാസ്തുവസ്തുതകൾ ഉൾക്കൊള്ളുന്ന ഒരു പിങ്ക് കളർ ചാർട്ട് കുട്ടികൾക്കായി പ്രദർശിപ്പിക്കുന്നു.]

Stage 2- Preparation

[അധ്യാപിക കുട്ടികൾക്ക് മഞ്ഞ നിറത്തിലുള്ള ചാർട്ടിൽ വെട്ടിയെടുത്ത സമചതുരങ്ങൾ ഓരോ ഗ്രൂപ്പിനും നൽകുന്നു]

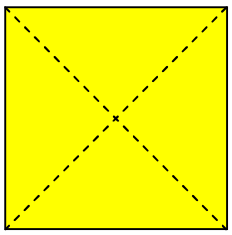
Situation-2

അധ്യാപിക : നിങ്ങൾക്ക് നൽകിയിരിക്കുന്ന മഞ്ഞനിറത്തിലുള്ള സമചതുരത്തിൽ വികർണ്ണങ്ങൾ വരച്ച് അതിലെ തുല്യ ത്രികോണങ്ങളെ കണ്ടുപിടിക്കാൻ നിങ്ങൾക്കറിയാമല്ലോ?

കുട്ടികൾ : അറിയാം

അധ്യാപിക : എങ്കിൽ നിങ്ങൾക്ക് നൽകിയ മഞ്ഞ നിറമുള്ള സമചതുരത്തിൽ വികർണ്ണങ്ങൾ വരച്ച് തുല്യ ത്രികോണങ്ങൾ നിർമ്മിക്കാമോ?

കുട്ടികൾ : അവർക്ക് നൽകിയ മഞ്ഞ നിറമുള്ള സമചതുരത്തിൽ വികർണ്ണങ്ങൾ വരച്ച് തുല്യ തിക്രോണങ്ങളാക്കുന്നു.



അധ്യാപിക : എല്ലാവരും നന്നായി ചെയ്തതിന് അധ്യാപിക കുട്ടികളെ അഭിനന്ദിക്കുന്നു.

Stage 3- Initiation and Acquisition

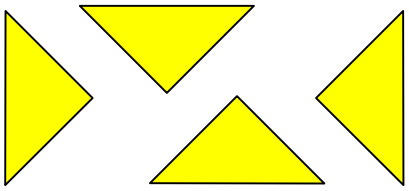
Situation-3

അധ്യാപിക : നിങ്ങൾക്ക് മഞ്ഞ നിറമുള്ള സമചതുരത്തിനുള്ളിൽ എത്ര മഞ്ഞ ത്രികോണങ്ങളാണ് കിട്ടിയത്?

കുട്ടികൾ : നാല് തുല്യ ത്രികോണങ്ങൾ

അധ്യാപിക : നിങ്ങൾക്ക് ആ മഞ്ഞ സമചതുരത്തെ നാലു മഞ്ഞ തുല്യത്രികോണങ്ങളാക്കി മാറ്റാമോ?

കുട്ടികൾ : ആ മഞ്ഞ സമചതുരത്തെ നാലു മഞ്ഞ തുല്യ ത്രികോണങ്ങളാക്കി മാറ്റുന്നു.



അധ്യാപിക : എല്ലാവരോടും ക്ലാപ്പ് ചെയ്യാൻ ആവശ്യപ്പെടുന്നു.

കുട്ടികൾ : എല്ലാവരും ക്ലാപ്പ് ചെയ്യുന്നു.

PHASE II

Stage 4- Elaboration

[അധ്യാപിക കുട്ടികൾക്ക് ഒരു വാം അപ്പ് വ്യായാമം നൽകുന്നു.]

Situation-4

അധ്യാപിക : ആദ്യ ഗ്രൂപ്പിലെ മുഹമ്മദിനോട് ഒരു മഞ്ഞ ത്രികോണം കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കാൻ ആവശ്യപ്പെടുന്നു.

കുട്ടികൾ : ആദ്യഗ്രൂപ്പിലെ മുഹമ്മദ് ഒരു മഞ്ഞത്രികോണമെടുത്ത് എണീറ്റ് നിൽക്കുന്നു.

അധ്യാപിക : ഈ ഗ്രൂപ്പിൽ മുഹമ്മദിന് തുല്യത്രികോണങ്ങളുടെ എത്ര ഭാഗമാണ് കിട്ടിയത്?

കുട്ടികൾ : നാലിൽ ഒരു ഭാഗം (1/4)

അധ്യാപിക : പെൺകുട്ടികളുടെ ഗ്രൂപ്പിൽനിന്നും റിഹാനയോട് രണ്ട് ത്രികോണങ്ങൾ എടുത്ത് എണീറ്റ് നിൽക്കാൻ ആവശ്യപ്പെടുന്നു.

അധ്യാപിക : റിഹാനയ്ക്ക് ഗ്രൂപ്പിൽ നിന്നും എത്ര ത്രികോണങ്ങളാണ് കിട്ടിയത്.

കുട്ടികൾ : നാലിൽ രണ്ട് ഭാഗം (2/4 ഭാഗം)

അധ്യാപിക : സാഹിലിനോട് മൂന്ന് ത്രികോണങ്ങൾ എടുത്ത് എണീറ്റ് നിൽക്കാൻ പറയുന്നു.

അധ്യാപിക : സാഹിലിന് ഗ്രൂപ്പിൽനിന്നും എത്ര ത്രികോണങ്ങളാണ് കിട്ടിയത്.

കുട്ടികൾ : നാലിൽ മൂന്ന് ഭാഗം (3/4 ഭാഗം)

അധ്യാപിക : "രണ്ടളവുകൾ തമ്മിലുള്ള അംശബന്ധം a:b ആണെങ്കിൽ ആദ്യത്തെ അളവ് axഉം രണ്ടാമത്തെ അളവ് bxഉം ആകുന്നു. x എന്ന ഒരു അളവുണ്ട്" എന്ന ഉള്ളടക്കം അടങ്ങുന്ന ചാർട്ട് കുട്ടികൾക്ക് വേണ്ടി പ്രദർശിപ്പിക്കുന്നു.

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-5

[അധ്യാപിക കുട്ടികൾക്ക് ബ്രയിൻ എക്സൈസുകൾ നൽകികൊണ്ട് അനുപാതത്തിന്റെ സവിശേഷതകൾ ചർച്ച ചെയ്യാനുള്ള അവസരം നൽകുന്നു].

Stage 6- Verification and Confidence Check

Situation-6

അധ്യാപിക : അധ്യാപിക ഗ്രൂപ്പുകൾ മാറ്റി പുതിയ ഗ്രൂപ്പുകൾ ഉണ്ടാക്കി ഇന്ന് ക്ലാസിൽ ചർച്ച ചെയ്ത കാര്യങ്ങൾ ക്രോഡീകരിച്ച് അവരുടേതായ രീതിയിൽ എഴുതാൻ ആവശ്യപ്പെടുന്നു.

കുട്ടികൾ : പുതിയ ഗ്രൂപ്പുകൾ ചർച്ച ചെയ്ത് അവരുടെ ആശയങ്ങൾ നോട്ടുബുക്കിൽ എഴുതുന്നു.

അധ്യാപിക : അധ്യാപിക ഓരോ ഗ്രൂപ്പിൽ നിന്നും അവരെഴുതിയത് വായിക്കാൻ പറയുന്നു.

അധ്യാപിക : കുട്ടികളെ അഭിനന്ദിക്കുന്നു. അവർ പറയുന്നതിൽ വന്ന തെറ്റുകൾ തിരുത്തി ശരിയാക്കിക്കൊടുക്കുന്നു.

അധ്യാപിക ക്ലാപ്പ് ചെയ്യിപ്പിച്ചുകൊണ്ട് കുട്ടികളെ അഭന്ദിക്കുന്നു.

Stage 7- Celebration and Integration

Situation-7

അധ്യാപിക : അവസാന ബഞ്ചിൽ ഇരിക്കുന്ന ഓരോരുത്തരോടായി വന്ന് അവരുടെ പഠനാനുഭവം പങ്കുവയ്ക്കാൻ ആവശ്യപ്പെടുന്നു

[അതിനു ശേഷം മുഹമ്മദ് വന്ന് മനോഹരമായ ഒരു മാപ്പിളപ്പാട്ട് പാടുന്നു. മുഹമ്മദിനെ അഭിനന്ദിച്ചുകൊണ്ട് എല്ലാവരും ക്ലാപ്പ് ചെയ്യുന്നു].

അധ്യാപിക കുട്ടികൾക്ക് അംശബന്ധത്തിലെ ഭാഗങ്ങളുടെ ബന്ധം എന്ന ആശയവുമായി ബന്ധപ്പെട്ട ഹോംവർക്ക് നൽകുന്നു.

Follow up Activity (തുടർപ്രവർത്തനം)

1. 100 രൂപയെ 5 തുല്യ ഭാഗങ്ങളാക്കി ഭാഗിച്ചശേഷം ഓരോ ഭാഗവും ഓരോ സഞ്ചിയിൽ കെട്ടി വച്ചിട്ടുണ്ട്. ഇവയിൽ നിന്ന് 3 സഞ്ചി അനിലിനും 2 സഞ്ചി ബിനിലിനും കൊടുത്തു.
   (i) ആകെ തുകയുടെ എത്ര ഭാഗമാണ് അനിലിന് കിട്ടിയത്?
   (ii) ആകെ തുകയുടെ എത്ര ഭാഗമാണ് ബിനിലിന് കിട്ടിയത്?
   (iii) അനിലിന് കിട്ടിയതിന്റെ എത്ര ഭാഗമാണ് ബിനിലിന് കിട്ടിയത്?
   (iv) ബിനിലിന് കിട്ടിയതിന്റെ എത്ര മടങ്ങാണ് അനിലിന് കിട്ടിയത്?

Appendix XVIII

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LESSON TRANSCRIPT BASED ON BRAIN COMPATIBLE LEARNING

Dr. P.K. Aruna
Rtd. Professor

Lisheetha P.V.
Research Scholar

LESSON TRANSCRIPT NO. I

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Polygons			
Topic	:	The sum of the interior angles of the polygons	Date	:	

PHASE I

Stage 1- Pre- Exposure

[The children greet the teacher when she enters the classroom. The teacher greets the children in return.]

- The teacher creates some situations necessary to reach the lesson on the sum of the measures of the interior angles of polygons

Situation-1

Teacher	:	Can you name the polygons you know?
Students	:	Triangle, square, parallelogram, pentagon, hexagon
Teacher	:	Excellent ….Have you seen any shapes similar to the polygons you mentioned, in class or outside the class, anywhere?
Students	:	Samosa, kite, brick, board…..
Teacher	:	So what are polygons?
	:	A polygon is the general name for a closed shape with three or more sides.

[The teacher draws a matrix diagram on the board to organize and visualize the ideas.]

Polygon

↓

A polygon is the general name for a closed shape with three or more sides

↓

Examples: Triangle, square, pentagon, parallelogram

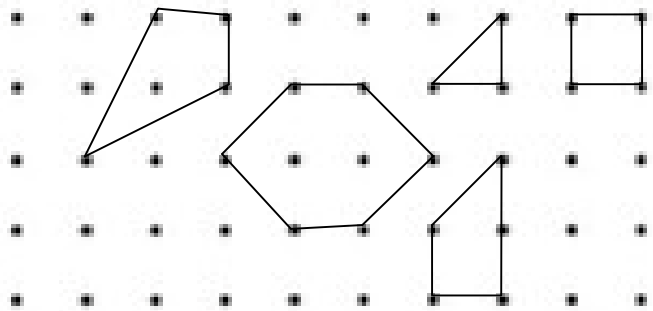
Stage 2- Preparation

Teacher : Divide the children into small groups. Each group is given a dot grid page.

Situation-2

Teacher : On the dot grid page given to you, can you connect three dots to make a triangle, four dots to make a quadrilateral, five dots to make a pentagon and six dots to make a hexagon.

(Students are constructing)



Situation-3

Teacher : The teacher told the students to draw a table like the one shown in the chart in their notebook, fill in the blanks and ask the groups to come and write the answers on the chart.

Polygons	Sides	Corners
Square	4	2
Pentagon	5	3
Hexagon	6	4

[The Students called by the teacher, come and fill in the blanks on the list.]

Stage 3- Initiation and Acquisition

Situation-4

Teacher : The teacher gives each group a quadrilateral, pentagon and hexagon in a different color. She asks them to draw the required diagonals and find out how many triangles there are in each polygon.

Students : Complete the list drawn on the board by drawing it in their notebooks.

Polygons	Number of Sides	Number of Triangles
Square	4	2
Pentagon	5	3
Hexagon	6	4

Situation-5

Teacher : Can you find any similarities between the number of sides of a polygon and the number of triangles contained in the table drawn on the board?

Students : The number of triangles in the polygon is two less than the number of sides.

Teacher : In that case, the number of triangles contained in a polygon with 'n' sides can be written as (n-2).

Students : Yes

[The teacher summarizes the idea and writes it on the board.]

In any polygon with 'n' sides can find (n-2) triangles in it.

PHASE II

Stage 4- Elaboration

Teacher **:** The teacher summarizes all the activities done so far and generalizes the concept of the sum of the interior angles of a polygon to the students through questions and answers.

[The teacher asks questions to each group]

Teacher **:** What is the sum of the three angles of a triangle?

Group **:** 180^0

Teacher : If a polygon contains two triangles in it, then what will be the sum of the interior angles of that polygon?

Group : **2**x180^0 = 360^0

Teacher : Which is a polygon that contains two triangles?

Group : Square

Teacher : What is the sum of the interior angles of a square?

Group : 360^0

Teacher : Which is a polygon that contains three triangles?

Group : Pentagon

Teacher : What is the sum of the interior angles of a pentagon?

Group : 3x180^0

Teacher : How many triangles are there in a polygon with 'n' sides?

Group : n-2

Teacher : What is the sum of the interior angles of a polygon with (n-2) triangles?

Group : (n-2) x180^0

Situation-6

The teacher said to draw the table shown on the chart in a notebook, fill in the blanks and ask each group to read it out.

	Polygons	Number of Sides	Number of Triangles	Sum of Interior Angles
1	Triangle Δ	3	1	1 X 180^0 = 180^0
2	Square □	4	2	2 x 180^0 = 360^0
3	Pentagon	5	3	3 x 180^0
4	Hexagon	6	4	4 x 180^0
5	'n' sided polygon	n	(n-2)	(n-2) x 180^0

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-7

The teacher gives the children a stretching and relaxation exercise by showing the videos and gives them a chance to discuss the concept of the sum of the measures of interior angles.

Stage 6- Verification and Confidence Check

Situation-8

Teacher **:** Each group is asked to discuss and come up with three questions and answers.

: The existing groups are divided into two groups. Then a quiz competition is held. One group asks questions to the next group

If the answer is right the group will get one point if the answer is wrong the point will get to the other group.

The teacher congratulates both groups for doing well. She also asks everyone to clap to congratulate the winning group.

Stage 7- Celebration and Integration

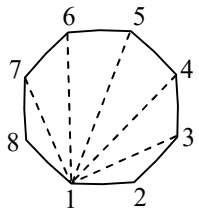
Teacher **:** Asks a student from each group to come and share their learning experience.

[After that, two children in the class come and sing a beautiful song.]

The teacher gives a follow-up activity and gives the students homework related to the concept of the sum of the interior angles of a polygon.

Follow up Activity

1. Draw an octagon and find the sum of its interior angles



2. The sum of the interior angles of a polygon is 8100^0. Then find out the number of sides of that polygon

LESSON TRANSCRIPT NO. II

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Area of Quadrilateral			
Topic	:	Area of equilateral Parallelogram	Date	:	

PHASE I

Stage 1- Pre- Exposure

[The students greet the teacher as she enters the classroom. The teacher greets the children in return]

Teacher : I would like to remind you that when the concept of "equilateral parallelogram" that is Rhombus was displayed on the bulletin board yesterday, you were asked to collect information related to it today.

Situation-1

Teacher : Can you share with everyone in our class the ideas you have collected related to the equilateral parallelogram (Rhombus) and any examples you know that are similar to this mathematical figure?

Students : Come one by one from each bench and share with others the ideas and examples they know related to the equilateral parallelogram (rhombus) that they studied in previous classes

[The teacher displays a chart containing mathematical facts related to the equilateral parallelogram (rhombus) for the children.]

Stage 2- Preparation

Teacher : The teacher gave different colored A-four sheets to students.

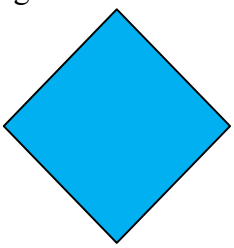
Situation-2

Teacher : Do you know how to draw a square?

Students : Yes

Teacher : Then can you draw a square with diagonals of 6 centimeters on the colored A-four sheet that you got?

Students : They draw a square with diagonals of 6 centimeters on the colored A-four sheet they got.



Teacher : Very good, everyone drew well

Stage 3- Initiation and Acquisition

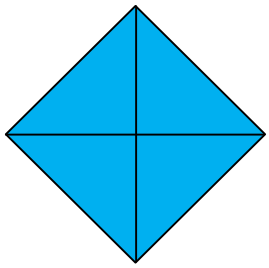
Situation-3

Teacher : Can you change the rhombus or equilateral parallelogram you have drawn into four equal triangles?

Students : Yes, It can be changed into four equal isosceles triangles

Teacher : Everyone tries to change the equilateral parallelogram or rhombus into four equal isosceles triangles.

Students : Changing the rhombus into four isosceles triangles



Teacher : Can you find the area of this equilateral parallelogram(rhombus)?

Students : Finding the area of the equilateral parallelogram(rhombus).

PHASE II

Stage 4- Elaboration

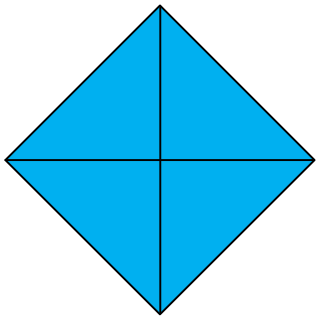
[The teacher gives the children a warm-up exercise.]

Situation-4

Teacher : Give each group a model of an equilateral parallelogram in different colors with diagonals of 6 centimeters and 4 centimeters

Teacher : Can you construct four right-angled triangles by joining the diagonals of the given equilateral parallelogram?

Students : Constructing four right-angled triangles in an equilateral triangle.



Teacher : Very good, congratulations dear students.

Teacher : Can you find the area of this equilateral parallelogram in the same way as you found it earlier?

Students : Each group discusses and finds the area of the equilateral parallelogram and gives the answer.

[The teacher sticks a chart on the wall that contains the idea that the area of an equilateral parallelogram is half the product of the diagonals.]

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-5

The teacher provides the children with brain exercises to improve memory and concentration and provides an opportunity to discuss facts such as the area of an equilateral parallelogram.

Stage 6- Verification and Confidence Check

Situation-6

Teacher : Each group is asked to discuss and summarize what was discussed in class today and write it down in their way.

Students : Each group discusses and writes their ideas in their notebooks.

Teacher : Asks the students to read what they have written while calling their names

Students : Read their ideas aloud.

The teacher encourages the students by clapping.

Stage 7- Celebration and Integration

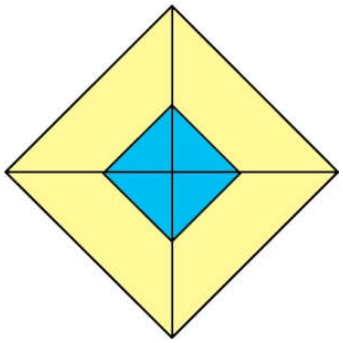
Situation-7

[The teacher plays light music for the children]

The teacher gives the children homework related to the area of an equilateral parallelogram

Follow up Activity

1. In the figure, a small quadrilateral is drawn by joining the midpoints of the half-diagonals of an equilateral parallelogram.



(i) Prove that this quadrilateral is a parallelogram.

(ii) The area of the smaller equilateral parallelogram is 3 square centimeters. What will be the area of the larger equilateral parallelogram?

LESSON TRANSCRIPT NO. III

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	U.H.H.S.S. Chaliyam	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Ratios			
Topic	:	Relation of parts	Date	:	

PHASE I

Stage 1- Pre- Exposure

[The students greet the teacher when she enters the class. The teacher greets the students in return.]

Teacher : Didn't I tell you to collect facts related to how the mathematical concept ratios connected to our daily life yesterday?

Students : Yes, Teacher

Situation-1

Teacher : Shall we discuss with everyone in the class the various examples of the mathematical concept of ratios that you have collected that are related to daily life?

Students : Come one by one and share examples related to the concept of ratios that are used in everyday life.

[Most of the children talked about the ratio of the quantities used to make various foods]

[The teacher summarizes the children's ideas and examples and displays a pink colored chart for the children that contains the mathematical facts of the concept of ratio.]

Stage 2- Preparation

[The teacher gives the yellow squares to each group.]

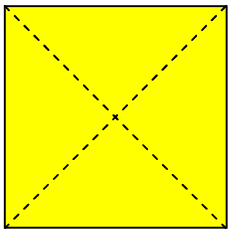
Situation-2

Teacher : Do you know how to draw diagonals on the yellow square given to you and find the congruent triangles in it?

Students : Yes

Teacher : Then can you draw diagonals on the yellow square given to you and make congruent triangles?

Students : They draw diagonals on the yellow square given to them and make congruent triangles.



Teacher : The teacher congratulates the students for all the good work they have done.

Stage 3- Initiation and Acquisition

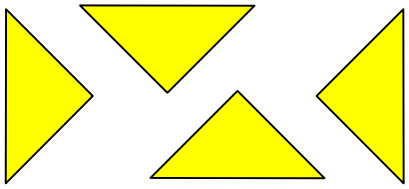
Situation-3

Teacher : How many yellow triangles did you get inside the yellow square?

Students : Four equal triangles

Teacher : Can you change that yellow square into four equal yellow triangles?

Students : Changing that yellow square into four equal yellow triangles.



Teacher : Ask everyone to clap.

Students : Everyone claps.

PHASE II

Stage 4- Elaboration

[The teacher gives the children a warm-up exercise.]

Situation-4

Teacher : Muhammad from the first group is asked to stand up with a yellow triangle in his hand.

Students : Muhammad from the first group stands up with a yellow triangle.

Teacher : How many parts of equal triangles did Muhammed get from his group

Students : One out of four (1/4)

Teacher : Rihanna from the girls' group takes two triangles and stands up.

Teacher : How many triangles did Rihanna get from the group?

Students : Two-fourths (2/4)

Teacher : Sahil take three triangles and stand up.

Teacher : How many triangles did Sahil get from the group?

Students : Three-fourths (3/4)

Teacher : "If the ratio between two quantities is a: b, then there will be a quantity x which makes the first quantity is ax and the second quantity is bx." A chart is displayed for the students by using this content.

PHASE III

Stage 5- Incubation and Memory Encoding

Situation-5

[The teacher allows the students to discuss the properties of ratios by giving them brain exercises].

Stage 6- Verification and Confidence Check

Situation-6

Teacher : The teacher changes the groups and forms new groups and asks them to compile the things discussed in class today and write them in their own way.

Students : The new groups discuss and write their ideas in their notebooks.

Teacher : The teacher asks each group to read what they have written.

Teacher : She praises the students. She corrects the mistakes they made in what they said.

The teacher appreciates the students by making them clap.

Stage 7- Celebration and Integration

Teacher : Ask each student sitting on the last bench to come and share their learning experience

[After that, Muhammad comes and sings a beautiful song. Everyone claps by praising Muhammad].

The teacher gives the homework to the students related to the concept of the relation of parts.

Follow up Activity

1. After dividing Rs. 100 into 5 equal parts, each part is tied in a separate bag. Out of these, 3 bags are given to Anil and 2 bags to Binil.
   (i) How much part of the total amount did Anil get?
   (ii) How much part of the total amount did Binil get?
   (iii) How much portion of Anil's part will get to Binil?
   (iv) How much portion of Binil's part will get to Anil?

Appendix XIX

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LESSON PLAN BASED ON EXISTING METHOD OF LEARNING

Dr. P.K. Aruna
Rtd. Professor

Lisheetha P.V.
Research Scholar

LESSON TRANSCRIPT NO. I

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	C & D
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	ബഹുഭുജങ്ങൾ			
Topic	:	ബഹുഭുജങ്ങളുടെ ആന്തരകോണുകളുടെ തുക	Date	:	

Learning Objectives (പഠനോദ്ദേശ്യങ്ങൾ)

- ബഹുഭുജത്തിന്റെ നിർവചനവും പ്രത്യേകതകളും മനസ്സിലാക്കുന്നതിന്.
- വിവിധ തരം ബഹുഭുജങ്ങൾ ഏതെല്ലാമെന്ന് ഉദാഹരണസഹിതം കണ്ടെത്തുന്നതിന്.
- വിവിധ തരം ബഹുഭുജങ്ങൾ നിർമ്മിക്കാൻ സാധിക്കുന്നതിന്.
- വിവിധതരം ബഹുഭുജങ്ങളെ ത്രികോണങ്ങളായി വിഭജിക്കുന്നതെങ്ങനെയെന്ന് മനസ്സിലാക്കുന്നതിന്.
- വിവിധതരം ബഹുഭുജങ്ങളുടെ ആന്തരകോണുകളുടെ തുക കാണാനുള്ള സൂത്രവാക്യം കൂട്ടി മനസ്സിലാക്കുന്നതിന്.

Content Analysis (ഉള്ളടക്ക വിശകലനം)

Facts

- മൂന്നോ അതിലധികമോ വശങ്ങളുള്ള രൂപത്തിന്റെ പൊതുവായ പേരാണ് ബഹുഭുജം.
- ഏതൊരു ബഹുഭുജത്തിലും വികർണ്ണങ്ങൾ വരച്ച് എത്ര ത്രികോണങ്ങൾ അടങ്ങിയിരിക്കുന്നു എന്ന് മനസ്സിലാക്കാൻ സാധിക്കുന്നു.
- ബഹുഭുജത്തിൽ ഉൾക്കൊള്ളുന്ന ത്രികോണങ്ങളുടെ എണ്ണത്തോട് 180^0 ഗുണിച്ചാൽ ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക ലഭിക്കും.
- ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്നും രണ്ട് കുറച്ചാൽ അതിൽ ഉൾക്കൊള്ളുന്ന ത്രികോണങ്ങളുടെ എണ്ണം ലഭിക്കും.

- ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്ന് രണ്ട് കുറച്ച് അതിനോട് 180^0 ഗുണിച്ചാൽ ആ ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക ലഭിക്കും.

Concept (ആശയങ്ങൾ)

- ബഹുഭുജത്തിൽ വികർണ്ണങ്ങൾ വരച്ച് അതിലടങ്ങിയിരിക്കുന്ന ത്രികോണങ്ങളെ കണ്ടെത്താം എന്ന ആശയം.
- ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്ന് രണ്ട് കുറച്ചാൽ അതിലടങ്ങിയിരിക്കുന്ന ത്രികോണങ്ങളുടെ എണ്ണം കണ്ടെത്താം എന്ന ആശയം.
- ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്നും രണ്ട് കുറച്ച് അതിനോട് 180^0 ഗുണിച്ചാൽ ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക ലഭിക്കും എന്ന ആശയം.

Pre-requisites (മുന്നറിവ്)

- മൂന്നോ അതിലധികമോ വശങ്ങളുടെ രൂപത്തിന്റെ പൊതുവായ പേരാണ് ബഹുഭുജം എന്ന മുന്നറിവ്.
- ത്രികോണം, ചതുരം, പഞ്ചഭുജം, ഷഡ്ഭുജം, എന്നീ ബഹുഭുജങ്ങളുടെ വശങ്ങളുടെ എണ്ണം, മൂലകളുടെ എണ്ണം എന്ന മുന്നറിവ്.
- വികർണ്ണങ്ങൾ എങ്ങനെയാണ് വരക്കുന്നത് എന്നതിനെ കുറിച്ചുള്ള മുന്നറിവ്.
- ത്രികോണത്തിന്റെ മൂന്ന് കോണുകളുടേയും തുക 180^0 ആണെന്ന മുന്നറിവ്.

Resources (പഠനസാമഗ്രികൾ)

- ടെക്സ്റ്റ് ബുക്ക്
- ഡോട്ട് ഗ്രിഡ് പേജ്
- വ്യത്യസ്ത നിറത്തിലുള്ള ചാർട്ട് കൊണ്ട് നിർമ്മിച്ച ബഹുഭുജങ്ങൾ
  - ത്രികോണം
  - ചതുരം
  - പഞ്ചഭുജം
  - ഷഡ്ഭുജം
- ആശയങ്ങൾ ക്രോഡീകരിച്ചുകൊണ്ടുള്ള ചാർട്ട്.

Product/Value (മൂല്യങ്ങൾ)

- വ്യത്യസ്തങ്ങളായ ബഹുഭുജങ്ങൾ വരച്ച് വശങ്ങളുടെ എണ്ണം, ത്രികോണങ്ങളുടെ എണ്ണം, ആന്തരകോണുകളുടെ തുക. എന്നിവ അടങ്ങുന്ന ഒരു പട്ടിക കുട്ടികൾ തയ്യാറാകുന്നു.

Learning Activity(പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
Introductory Activity അധ്യാപിക ക്ലാസിലേക്ക് പ്രവേശിക്കുമ്പോൾ കുട്ടികൾ ഗുഡ്മോർണിംഗ് പറയുന്നു. അധ്യാപിക തിരിച്ചും അവരോട് ഗുഡ്മോർണിംഗ് പറയുന്നു.	
അധ്യാപിക കുട്ടികളോടായി പറയുന്നു. ഇന്ന് നമ്മൾ പഠിക്കാൻ പോകുന്ന പാഠഭാഗവുമായി ബന്ധപ്പെട്ട് മുൻ ക്ലാസ്സിൽ നിങ്ങൾ പഠിച്ച നിങ്ങൾക്കറിയാവുന്ന കുറച്ച് കാര്യങ്ങൾ ആണ് ഞാൻ നിങ്ങളോട് ചോദിക്കാൻ പോവുന്നത്. ഉത്തരങ്ങൾ പറയാൻ നിങ്ങൾ തയ്യാറാണോ.	ഉത്തരം പറയാൻ തയ്യാറാണെന്ന് കുട്ടികൾ പറയുന്നു
അധ്യാപിക: നിങ്ങൾക്കറിയാവുന്ന ബഹുഭുജങ്ങൾ ഏതെല്ലാമാണ്?	ത്രികോണം, ചതുരം, പഞ്ചഭുജം, ഷഡ്ഭുജം, എന്നിങ്ങനെ കുട്ടികൾ പറയുന്നു
അധ്യാപിക: നിങ്ങൾ പറയുന്ന ബഹുഭുജങ്ങളോട് സാമ്യമുള്ള രൂപങ്ങൾ പുറത്തെവിടെയെങ്കിലും കണ്ടിട്ടുണ്ടോ? അവ ഏതെല്ലാമെന്ന് പറയാമോ?	ഹൽവ, ഇഷ്ടിക, ബുക്ക്....
ഉത്തരം പറഞ്ഞതിന് അധ്യാപിക കുട്ടികളെ അഭിനന്ദിക്കുന്നു.	
അധ്യാപിക: നിങ്ങൾക്ക് വിവിധതരം ബഹുഭുജങ്ങൾ ഏതെല്ലാമെന്നറിയാം. എങ്കിൽ എന്താണ് ബഹുഭുജങ്ങൾ.	കുട്ടികൾ ഉത്തരം പറയുന്നു
Developmental Activity വിവിധതരം ബഹുഭുജങ്ങളുടെ വശങ്ങളുടെ എണ്ണവും, മൂലകളുടെ എണ്ണവും തമ്മിൽ ബന്ധം ഉണ്ട് എന്ന് കണ്ടുപിടിക്കുന്ന പ്രവർത്തനം.	
പ്രവർത്തനം-1	
അധ്യാപിക ഓരോ ഗ്രൂപ്പിനും ഒരു ഡോട്ട് ഗ്രിഡ് പേജ് നൽകി അതിൽ മൂന്ന് കുത്തുകൾ യോജിപ്പിച്ച് ഒരു ത്രികോണം, നാലു കുത്തുകൾ യോജിപ്പിച്ച് ഒരു ചതുരം, അഞ്ച് കുത്തുകൾ യോജിപ്പിച്ച് ഒരു പഞ്ചഭുജം. ആറ് കുത്തുകൾ യോജിപ്പിച്ച് ഒരു ഷഡ്ഭുജം എന്നിവ വരച്ച്, ബഹുഭുജം, വശങ്ങളുടെ എണ്ണം, മൂലകളുടെ എണ്ണം, എന്നിവ ഒരു പട്ടിക രൂപത്തിൽ എഴുതി തയ്യാറാക്കാൻ ആവശ്യപ്പെടുന്നു.	ഓരോ ഗ്രൂപ്പും അവർ തയ്യാറാക്കിയ പട്ടിക ഉച്ചത്തിൽ വായിക്കുന്നു. ഓരോ ഗ്രൂപ്പും ബഹുഭുജം വരച്ച് പട്ടിക തയ്യാറാക്കുന്നു.

Learning Activity(പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
അധ്യാപിക ഓരോ ഗ്രൂപ്പിനോടും അവർ തയ്യാറാക്കിയ പട്ടിക ഉച്ചത്തിൽ വായിക്കാൻ പറയുന്നു. ശരിയുത്തരം പറഞ്ഞതിന് ഓരോ ഗ്രൂപ്പുകളെയും അഭിനന്ദിക്കുന്നു.	ഓരോ ഗ്രൂപ്പും ബഹുഭുജം വരച്ച് പട്ടിക തയ്യാറാക്കുന്നു
പ്രവർത്തനം-2 ഒരു ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണവും അതിൽ ഉൾക്കൊള്ളുന്ന ത്രികോണങ്ങളുടെ എണ്ണവും തമ്മിലുള്ള ബന്ധം കണ്ടെത്തുന്നതിനുള്ള പ്രവർത്തനം. അധ്യാപിക വ്യത്യസ്ത നിറത്തിലുള്ള ചതുർഭുജം, പഞ്ചഭുജം, ഷഡ്ഭുജം എന്നിവ ഓരോ ഗ്രൂപ്പിനും നൽകി. അതിൽ വികർണ്ണം വരച്ച് ഓരോന്നിലും എത്ര തികോണങ്ങൾ ഉണ്ടെന്ന് കണ്ടെത്തി, ബഹുഭുജം, ത്രികോണങ്ങളുടെ എണ്ണം എന്നിവ അടങ്ങിയ ഒരു പട്ടിക നോട്ടുബുക്കിൽ തയ്യാറാക്കാൻ പറയുന്നു.	
(അധ്യാപിക ബോർഡിൽ ബഹുഭുജം, വശങ്ങളുടെ എണ്ണം, ത്രികോണങ്ങളുടെ എണ്ണം. എന്നിവ അടങ്ങിയ ഒരു പട്ടിക വരക്കുന്നു. ഓരോ ഗ്രൂപ്പിലേയും അധ്യാപിക വിളിക്കുന്ന കുട്ടികളോട് ബോർഡിൽ വരച്ച പട്ടിക പൂർത്തീകരിക്കാനാവശ്യപ്പെടുന്നു. ശരിയുത്തരം എഴുതിയതിന് അധ്യാപിക കുട്ടികളെ പ്രോത്സാഹിപ്പിക്കുന്നു.)	ഓരോ ഗ്രൂപ്പിലേയും അധ്യാപിക വിളിക്കുന്ന കുട്ടികൾ വന്ന് ബോർഡിൽ വരച്ച പട്ടിക പൂർത്തിയാക്കുന്നു.
അധ്യാപിക: ഇവിടെ ഓരോ ഗ്രൂപ്പിനും കിട്ടിയിരിക്കുന്ന ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണവും, ത്രികോണങ്ങളുടെ എണ്ണവും, തമ്മിൽ എന്തെങ്കിലും ബന്ധം കാണാൻ കഴിയുന്നുണ്ടോ? അധ്യാപിക വിദ്യാർത്ഥികളെ അഭിനന്ദിക്കുന്നു.	ഉണ്ട്, ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്നും രണ്ട് കുറച്ചാൽ ത്രികോണങ്ങളുടെ എണ്ണം ലഭിക്കും
അധ്യാപിക: 'n' വശങ്ങളുള്ള ഒരു ബഹുഭുജത്തിൽ എത്ര ത്രികോണങ്ങൾ ഉണ്ടായിരിക്കും. (n-2) ഉണ്ടായിരിക്കും. Very good, അധ്യാപിക വിദ്യാർത്ഥികളെ അഭിനന്ദിക്കുന്നു.	
പ്രവർത്തനം-3 ബഹുഭുജത്തിന്റെ വശങ്ങളുടെ എണ്ണത്തോട് 180^0 ഗുണിച്ചാൽ ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക കണ്ടെത്താം എന്ന പ്രവർത്തനം.	

Learning Activity(പഠനപ്രവർത്തനങ്ങൾ)	**Assessment** (പ്രതികരണം)
അധ്യാപിക ഓരോ ഗ്രൂപ്പിനോടും അവർക്ക് നൽകിയിട്ടുള്ള വിവിധ നിറത്തിലുള്ള ചതുർഭുജം, പഞ്ചഭുജം, ഷഡ്ഭുജം എന്നിവയുടെ ആന്തരകോണുകളുടെ തുക കണ്ടെത്തി അവതരിപ്പിക്കാൻ പറയുന്നു. ശരിയുത്തരം പറഞ്ഞതിന് അധ്യാപിക ഓരോ ഗ്രൂപ്പിനേയും അഭിനന്ദിക്കുന്നു.	ഓരോ ഗ്രൂപ്പും വന്ന് അവർക്ക് കിട്ടിയ ഉത്തരങ്ങൾ വായിക്കുന്നു

Consolidation

അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്നു.

'n' വശങ്ങളുള്ള ഒരു ബഹുഭുജത്തിൽ അടങ്ങിയിരിക്കുന്ന ത്രികോണങ്ങളുടെ എണ്ണം അറിയാൻ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്നും രണ്ട് കുറച്ചാൽ മതി.

'n' വശങ്ങളുള്ള ഒരു ബഹുഭുജത്തിലെ ത്രികോണങ്ങളുടെ എണ്ണം (n-2) ആയിരിക്കും.

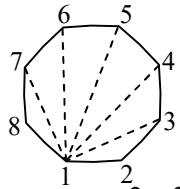
ഒരു ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക കാണാൻ വശങ്ങളുടെ എണ്ണത്തിൽ നിന്ന് രണ്ട് കുറച്ച് കിട്ടുന്ന ഉത്തരത്തോട് 180^0 ഗുണിക്കണം.

'n' വശങ്ങളുള്ള ഒരു ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക $(n-2)x\ 180^0$ ആയിരിക്കും.

(അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്ന ഒരു ചാർട്ട് പ്രദർശിപ്പിക്കുന്നു.)

Follow-up Activity (തുടർപ്രവർത്തനങ്ങൾ)

1) ഒരു അഷ്ടഭുജം വരച്ച് അതിന്റെ ആന്തര കോണുകളുടെ തുക കണ്ടെത്തുക.



2) ഒരു ബഹുഭുജത്തിന്റെ ആന്തരകോണുകളുടെ തുക 8100^0 ആയാൽ അതിൽ എത്ര വശങ്ങളുണ്ടായിരിക്കും.

LESSON TRANSCRIPT NO. II

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	ചതുർഭുജപരപ്പ്			
Topic	:	സാമാന്തരികത്തിന്റെ പരപ്പളവ്	Date	:	

Learning Objectives (പഠനോദ്ദേശ്യങ്ങൾ)

- സമഭുജസാമാന്തരികത്തിന്റെ നിർവ്വചനവും പ്രത്യേകതകളും കൂട്ടി മനസ്സിലാക്കുന്നതിന്.
- വിവിധ തരം സമഭുജസാമാന്തരികങ്ങൾ ഏതെല്ലാമെന്ന് ഉദാഹരണസഹിതം വിശദീകരിക്കുന്നതിന്.
- വികർണ്ണങ്ങളുടെ നീളം ഉപയോഗിച്ച് സമഭുജ സാമാന്തരികം നിർമ്മിക്കാൻ സാധിക്കുന്നതിന്.
- സമഭുജസാമാന്തരികത്തിന്റെ വികർണ്ണങ്ങൾ യോജിപ്പിച്ച് മട്ടത്രികോണങ്ങൾ നിർമ്മിക്കുന്നത് എങ്ങനെയെന്ന് മനസ്സിലാക്കുന്നതിന്
- സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് കാണാനുള്ള സൂത്രവാക്യം മനസ്സിലാക്കുന്നതിന്

Content Analysis (ഉള്ളടക്ക വിശകലനം)

Facts

- എതിർവശങ്ങൾ സാമാന്തരവും തുല്യവും എതിർത്രികോണകൾ തുല്യവും ആയ ചതുർഭുജം ആണ് സാമാന്തരികം.
- നാല് വശങ്ങളും തുല്യമായ സാമാന്തരികമാണ് സമഭുജസാമാന്തരികം.
- സമചതുരത്തെ നാല് തുല്യ സമപാർശ്വത്രികോണങ്ങളാക്കി മാറ്റാൻ കഴിയും എന്ന് മനസ്സിലാക്കാൻ സാധിക്കുന്നു.
- സമഭുജസാമാന്തരികത്തെ നാല് മട്ടത്രികോണങ്ങളാക്കി മാറ്റാൻ കഴിയും എന്ന് മനസ്സിലാക്കാൻ സാധിക്കുന്നു.
- സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് വികർണ്ണങ്ങളുടെ ഗുണനഫലത്തിന്റെ പകുതിയാണെന്ന് മനസ്സിലാക്കുന്നു.

Concept

- വികർണ്ണത്തിന്റെ നീളം ഉപയോഗിച്ച് സമചതുരം നിർമ്മിച്ച് സമചതുര മായ സമഭുജസാമാന്തരികത്തെ നാലു സമപാർശ്വത്രികോണങ്ങളാക്കാം എന്ന ആശയം

- സമചതുരമല്ലാത്ത സമഭുജസാമാന്തരികത്തേയും വികർണ്ണങ്ങൾ ഉപയോ ഗിച്ച് നാല് മട്ടത്രികോണങ്ങളാക്കാം എന്ന ആശയം.

- സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ്, വികർണങ്ങളുടെ ഗുണന ഫലത്തിന്റെ പകുതിയാണ് എന്ന ആശയം.

Pre-requisites

- നാല് വശങ്ങളും തുല്യമായ സാമാന്തരികമാണ് സമഭുജസാമാന്തരികം എന്ന മുന്നറിവ്.

- സമചതുരത്തിന്റെ പരപ്പളവ് വികർണ്ണത്തിന്റെ വർഗത്തിന്റെ പകുതിയാണ് എന്ന് മുന്നറിവ്.

- വികിർണ്ണങ്ങൾ വരച്ച് സമചതുരത്തെ ത്രികോണങ്ങളാക്കി മാറ്റുന്നതിനുള്ള മുന്നറിവ്.

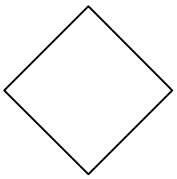
Resources

- ടെക്സ്റ്റ് ബുക്ക്
- നിറമുള്ള എ-ഫോർ ഷീറ്റുകൾ
- വ്യത്യസ്ത നിറത്തിലുള്ള ചാർട്ട് കൊണ്ട് നിർമ്മിച്ച സമഭുജസാമാന്തരിക ങ്ങൾ
- ആശയങ്ങൾ ക്രോഡീകരിച്ചുകൊണ്ടുള്ള ചാർട്ട്.

Product/Value

- വികർണ്ണത്തിന്റെ അളവ് ഉപയോഗിച്ച് സമഭുജസാമാന്തരികം നിർമ്മിച്ച് അവയെ മട്ടത്രികോണങ്ങളാക്കി മാറ്റി പരപ്പളവ് കണ്ടുപിടിക്കുന്നു.

Learning Activity (പഠനപ്രവർത്തനങ്ങൾ)	**Assessment** (പ്രതികരണം)
അധ്യാപിക ക്ലാസിലേക്ക് പ്രവേശിക്കു മ്പോൾ കുട്ടികൾ ആശംസിക്കുന്നു. അധ്യാപിക തിരിച്ചും ആശംസിക്കുന്നു.	

Learning Activity (പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
Introductory Activity അധ്യാപിക കുട്ടികളോടായി പറയുന്നു. ഇന്നലെ സമഭുജ സാമാന്തരികവുമായി ബന്ധപ്പെട്ട് മുൻ ക്ലാസിൽ പഠിച്ച കാര്യങ്ങൾ ഇന്നേക്ക് ശേഖരിച്ചുവരാൻ പറഞ്ഞിരുന്നില്ലേ? എല്ലാവരും ശേഖരിച്ചുവന്നോ?	അതെ, എന്ന് കുട്ടികൾ പറയുന്നു
അധ്യാപിക: ശേഖരിച്ച വിവരങ്ങൾ എല്ലാവർക്കുമായി ഉച്ചത്തിൽ വായിച്ചു കേൾപ്പിക്കാമോ?	ഓരോ ബഞ്ചിൽനിന്നും ഓരോരുത്തരായി വന്ന് മുൻ ക്ലാസിൽ പഠിച്ച സമഭുജസാമാന്തരികവുമായി ബന്ധപ്പെട്ട ആശയങ്ങളും അവർക്കറിയാവുന്ന ഉദാഹരണങ്ങളും മറ്റുള്ളവർക്കായി പങ്കുവയ്ക്കുന്നു.
അധ്യാപിക: സമഭുജസാമാന്തരികവുമായി ബന്ധപ്പെട്ട ഗണിതശാസ്ത്രവസ്തുതകൾ അടങ്ങുന്ന ചാർട്ട് കുട്ടികൾക്കായി പ്രദർശിപ്പിക്കുന്നു.	
Developmental Activity അധ്യാപിക കുട്ടികൾക്കായി വിവിധ നിറത്തിലുള്ള എ-ഫോർ ഷീറ്റുകൾ നൽകുന്നു.	
പ്രവർത്തനം-1	
നിങ്ങൾക്ക് നൽകിയിരിക്കുന്ന നിറമുള്ള എ-ഫോർ ഷീറ്റിൽ വികർണ്ണങ്ങൾ 6 സെന്റീമീറ്ററായ ഒരു സമചതുരം നിർമ്മിക്കാമോ?	കുട്ടികൾ വികർണ്ണം 6 സെന്റീമീറ്ററായ സമചതുരം നിർമ്മിക്കുന്നു. 
പ്രവർത്തനം-2	
നിങ്ങൾ വരച്ചിരിക്കുന്ന സമചതുരമായ സമഭുജ സാമാന്തരികത്തെ നാല് തുല്യ സമപാർശ്വ ത്രികോണങ്ങളാക്കി മാറ്റാൻ സാധിക്കുമോ?	കുട്ടികൾ അവർ വരച്ച സമചതുരമായ സമഭുജസാമാന്തരികത്തെ നാല് തുല്യസമപാർശ്വത്രികോണങ്ങളാക്കി മാറ്റുന്നു.
അധ്യാപിക: ഇപ്പോൾ നിങ്ങൾക്ക് കിട്ടിയ സമപാർശ്വത്രികോണത്തിന്റെ	കുട്ടികൾ അവരുടെ ഗ്രൂപ്പിൽ ചർച്ച ചെയ്ത് സമഭുജ സാമാന്തരികത്തിന്റെ

Learning Activity (പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
അളവുകളുപയോഗിച്ച് സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ടു പിടിക്കാമോ? അധ്യാപിക: Very good, എല്ലാവരും നന്നായി ചെയ്തല്ലോ, എന്ന് പറഞ്ഞ് അഭിനന്ദിക്കുന്നു. **പ്രവർത്തനം**-3 അധ്യാപിക ഓരോ ഗ്രൂപ്പുകൾക്കായി. വികർണ്ണങ്ങൾ 6 സെന്റിമീറ്ററും 4 സെന്റീമീറ്ററും ആയ വിവിധ നിറത്തിലുള്ള സമഭുജസാമാന്തരികത്തിന്റെ മാതൃക വിദ്യാർത്ഥികൾക്ക് നൽകുന്നു. 	വിസ്തീർണ്ണം കണ്ടുപിടിക്കുന്നു.
അധ്യാപിക: നിങ്ങൾക്ക് നൽകിയിരിക്കുന്ന സമഭുജ സാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ടുപിടിക്കാമോ?	കുട്ടികൾ ഗ്രൂപ്പിൽ ചർച്ച ചെയ്ത് അവർക്ക് കിട്ടിയ സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് കണ്ടുപിടിക്കുന്നു.
അധ്യാപിക: ഓരോ ഗ്രൂപ്പും പരപ്പളവ് കണ്ടുപിടിച്ച മാർഗ്ഗം വിശദീകരിച്ച് അവർക്ക് കിട്ടിയ ഉത്തരം വായിക്കാൻ ആവശ്യപ്പെടുന്നു.	ഓരോ ഗ്രൂപ്പിൽനിന്നും ഒരാൾ വന്ന് അവരുടെ ഗ്രൂപ്പ് പരപ്പളവ് കണ്ടുപിടിച്ച മാർഗ്ഗം വിശദീകരിച്ച് അവർക്ക് കിട്ടിയ ഉത്തരം പറയുന്നു.
അധ്യാപിക: ഓരോ ഗ്രൂപ്പും പറഞ്ഞു കഴിയുമ്പോൾ എല്ലാവരോടും ക്ലാപ്പ് ചെയ്യാനാവശ്യപ്പെടുന്നു.	കുട്ടികൾ ഗ്രൂപ്പുകളെ ക്ലാപ്പ് ചെയ്ത് അഭിനന്ദിക്കുന്നു.

Consolidation

അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്നു.

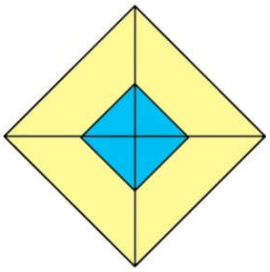
''സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് വികർണ്ണങ്ങളുടെ ഗുണനഫലത്തിന്റെ പകുതിയായിരിക്കും.''

[അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്ന ചാർട്ട് പ്രദർശിപ്പിക്കുന്നു.]

Follow up Activities

ചിത്രത്തിൽ ഒരോ സമഭുജ സാമാന്തരികത്തിന്റെ വികിർണ്ണങ്ങളുടെ പകുതിയുടെ മധ്യബിന്ദുക്കൾ യോജിപ്പിച്ച് ചെറിയൊരു ചതുർഭുജം വരച്ചിരിക്കുന്നു.

Learning Activity (പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)



(i) ഈ ചതുർഭുജം സമഭുജസാമാന്തരികമാണെന്ന് തെളിയിക്കുക.

(ii) ചെറിയ സാമാന്തരികത്തിന്റെ പരപ്പളവ് 3 ചതുരശ്ര സെന്റീമീറ്ററാണ്. വലിയ സമഭുജസാമാന്തരികത്തിന്റെ പരപ്പളവ് എന്തായിരിക്കും.

LESSON TRANSCRIPT NO. III

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	അംശബന്ധം			
Topic	:	ഭാഗങ്ങളുടെ ബന്ധം	Date	:	

Learning Objectives

- അംശബന്ധത്തിന്റെ നിർവചനവും, ഗണിതശാസ്ത്രവസ്തുക്കളും മനസ്സിലാക്കുന്നതിന്.
- അംശബന്ധം എന്ന ഗണിത ആശയം നിത്യജീവിതത്തിൽ ഉപയോഗിച്ചു വരുന്ന ഉദാഹരണങ്ങൾ കൂട്ടി വിശദീകരിക്കുന്നതിന്.
- സമചതുരത്തെ തുല്യത്രികോണങ്ങളാക്കി ഓരോ ത്രികോണത്തിന്റേയും അംശബന്ധം കണ്ടുപിടിക്കുന്നത് എങ്ങനെയെന്ന് മനസ്സിലാക്കുന്നതിന്.
- ഭാഗങ്ങളുടെ അംശബന്ധം എങ്ങനെയാണ് കണ്ടെത്തേണ്ടത് എന്ന് മനസ്സിലാക്കുന്നതിന്.

Content Analysis

Facts

- ഗണിതശാസ്ത്രത്തിൽ രണ്ടുസംഖ്യകളെ താരതമ്യപ്പെടുത്താൻ ആ സംഖ്യകളുടെ ഭിന്നിതം ഉപയോഗപ്പെടുത്തുന്നു. ഈ ഭിന്നിതമാണ് അവയുടെ അംശബന്ധം.
- ഒരു സമചതുരത്തെ നാല് തുല്യ ത്രികോണങ്ങളാക്കി മാറ്റി ഓരോ ഭാഗങ്ങളുടെ ബന്ധം മനസ്സിലാക്കാൻ സാധിക്കും.
- രണ്ടളവുകൾ തമ്മിലുള്ള അംശബന്ധം a:b ആണെങ്കിൽ ആദ്യത്തെ അളവ് ax ഉം രണ്ടാമത്തെ bx**ഉം** ആകുന്ന x **എന്നൊരു അളവുണ്ട്.**

Concept

- അംശബന്ധം എന്ന ഗണിത ആശയം നിത്യജീവിതത്തിൽ നാം എത്രമാത്രം ഉപയോഗിക്കുന്നു എന്ന് മനസ്സിലാക്കാൻ സാധിക്കുന്നു.
- ഒരു ഗണിത രൂപത്തെ തുല്യഭാഗങ്ങളാക്കി വിഭജിച്ച് ഭാഗങ്ങളുടെ ബന്ധം എങ്ങനെ കണ്ടെത്താം എന്ന ആശയം.
- രണ്ട് അളവുകൾ തമ്മിലുള്ള ബന്ധം എങ്ങനെ കണ്ടെത്താം എന്ന ആശയം.

Pre-requisites

- ഗണിത ശാസ്ത്രത്തിൽ രണ്ട് സംഖ്യകളെ താരതമ്യപ്പെടുത്താൻ ആ സംഖ്യകളുടെ ഭിന്നിതം ഉപയോഗപ്പെടുത്തുന്നു. ഈ ഭിന്നിതമാണ് അവയുടെ അംശബന്ധം എന്ന മുന്നറിവ്.
- സമചതുരത്തിന്റെ പരപ്പളവ് വികർണ്ണത്തിന്റെ വർഗത്തിന്റെ പകുതിയാണ് എന്ന മുന്നറിവ്.
- സമപാർശ്വത്രികോണങ്ങളെ കുറിച്ചുള്ള മുന്നറിവ്.
- മട്ടത്രികോണങ്ങളെ കുറിച്ചുള്ള മുന്നറിവ്.
- വികർണ്ണങ്ങൾ യോജിപ്പിച്ച് സമചതുരത്തെ ത്രികോണങ്ങളാക്കി മാറ്റുന്നതിനുള്ള മുന്നറിവ്.

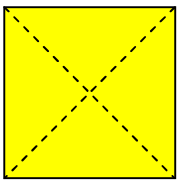
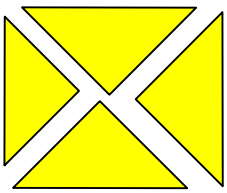
Resources

- ടെക്സ്റ്റ് ബുക്ക്
- മഞ്ഞ നിറത്തിലുള്ള ചാർട്ട് കൊണ്ട് നിർമ്മിച്ച സമചതുരങ്ങൾ, ത്രികോണങ്ങൾ.
- ആശയങ്ങൾ ക്രോഡീകരിച്ചുകൊണ്ടുള്ള ചാർട്ട്.

Product/Value

- വിവിധ ഗണിതരൂപങ്ങളെ തുല്യ ഭാഗങ്ങളായി വിഭജിച്ച് ഭാഗങ്ങളുടെ ബന്ധം എങ്ങനെ കണ്ടെത്താം എന്ന് കുട്ടികൾ കണ്ടെത്തുന്നു.

Learning Activity (പഠനപ്രവർത്തനങ്ങൾ)	**Assessment** (പ്രതികരണം)
അധ്യാപിക ക്ലാസിലേക്ക് പ്രവേശിക്കുമ്പോൾ കുട്ടികൾ അധ്യാപികയെ ആശംസിക്കുന്നു. അധ്യാപിക തിരിച്ചും കുട്ടികളെ ആശംസിക്കുന്നു.	
Introductory Activity അധ്യാപിക കുട്ടികളോടായി പറയുന്നു. അംശബന്ധം എന്ന ഗണിത ആശയം നിത്യജീവിതവുമായി എങ്ങനെ ബന്ധപ്പെട്ടിരിക്കുന്നു. എന്ന വസ്തുതകൾ ഇന്നു ശേഖരിച്ചു വന്നിട്ടില്ലേ?	കുട്ടികൾ അതെ എന്നു പറയുന്നു

Learning Activity (പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
അധ്യാപിക കുട്ടികളോട് അവർ ശേഖരിച്ച വിവരങ്ങൾ ഓരോരുത്തരായി എല്ലാവർക്കും വേണ്ടി വായിച്ചു കേൾപ്പിക്കാൻ ആവശ്യപ്പെടുന്നു.	കുട്ടികൾ ഓരോരുത്തരായി അവരെഴുതിയത് വായിക്കുന്നു.
	കുട്ടികളിൽ അധികപേരും വിവിധ തരം ഭക്ഷണസാധനങ്ങൾ ഉണ്ടാക്കുമ്പോൾ സാധനങ്ങൾ എടുക്കുന്ന അളവുകളുടെ അംശബന്ധത്തെ കുറിച്ചാണ് പറയുന്നത്.
അധ്യാപിക കുട്ടികളുടെ ആശയങ്ങളും ഉദാഹരണങ്ങളും ക്രോഡീകരിച്ച് അംശബന്ധം എന്ന ആശയത്തിന്റെ ഗണിതശാസ്ത്ര വസ്തുതകൾ ഉൾകൊള്ളുന്ന ഒരു കളർചാർട്ട് കുട്ടികൾക്കായി പ്രദർശിപ്പിക്കുന്നു.	
Developmental Activity അധ്യാപിക മഞ്ഞ നിറത്തിലുള്ള സമചതുര മാതൃകകൾ ഓരോ ഗ്രൂപ്പിനും നൽകുന്നു.	
പ്രവർത്തനം-1	
അധ്യാപിക: നിങ്ങൾക്ക് നൽകിയിരിക്കുന്ന മഞ്ഞനിറത്തിലുള്ള സമചതുരത്തിൽ വികർണ്ണങ്ങൾ വരച്ച് അതിലെ തുല്യത്രികോണങ്ങൾ കണ്ടുപിടിക്കാൻ ആവശ്യപ്പെടുന്നു.	കുട്ടികൾ മഞ്ഞ നിറമുള്ള സമചതുരത്തിൽ വികിർണ്ണങ്ങൾ വരച്ച് അവയെ നാല് തുല്യ ത്രികോണങ്ങൾ ആക്കുന്നു. 
പ്രവർത്തനം-2	
അധ്യാപിക : നിങ്ങൾ വികർണ്ണങ്ങൾ ഉപയോഗിച്ച് ചതുരത്തെ നാല് ത്രികോണങ്ങളാക്കിയില്ലേ? ആ ചതുരത്തിൽ നിന്ന് നാല് ത്രികോണങ്ങളെ വെട്ടിയെടുക്കാമോ?	കുട്ടികൾ സമചതുരത്തിലെ 4 തുല്യത്രികോണങ്ങളേയും മുറിച്ചെടുക്കുന്നു. 
അധ്യാപിക കുട്ടികളെ ക്ലാപ്പ് ചെയ്ത് അഭിനന്ദിക്കുന്നു.	

Learning Activity (പഠനപ്രവർത്തങ്ങൾ)	**Assessment** (പ്രതികരണം)
പ്രവർത്തനം-3	
അധ്യാപിക: ആദ്യത്തെ ഗ്രൂപ്പിലെ ഒരാളോട് ഒരു മഞ്ഞത്രികോണം കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കാൻ ആവശ്യപ്പെടുന്നു.	അദ്യ ഗ്രൂപ്പിലെ ഒരാൾ ഒരു മഞ്ഞ ത്രികോണം കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കുന്നു.
അധ്യാപിക: ഈ ഗ്രൂപ്പിലെ അനീസിന് തുല്യ ത്രികോണത്തിന്റെ എത്രഭാഗമാണ് കിട്ടിയത്	കുട്ടികൾ നാലിൽ ഒരു ഭാഗം (1/4 ഭാഗം)
അധ്യാപിക: പെൺകുട്ടികളുടെ ഗ്രൂപ്പിലെ അനന്യയോട് രണ്ട് ത്രികോണങ്ങൾ കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കാൻ ആവശ്യപ്പെടുന്നു.	അനന്യ രണ്ട് ത്രികോണങ്ങൾ കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കുന്നു.
അധ്യാപിക: ഈ ഗ്രൂപ്പിലെ അനന്യയ്ക്ക് തുല്യത്രികോണങ്ങളുടെ എത്ര ഭാഗമാണ് കിട്ടിയത്?	കുട്ടികൾ നാലിൽ രണ്ട് ഭാഗം (2/4 ഭാഗം)
അധ്യാപിക: അവസാന ഗ്രൂപ്പിലെ ഗ്രൂപ്പ് ലീഡറോട് മൂന്ന് ത്രികോണങ്ങൾ കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കാൻ ആവശ്യപ്പെടുന്നു.	ഗ്രൂപ്പ് ലീഡർ മൂന്ന് ത്രികോണങ്ങൾ കയ്യിലെടുത്ത് എണീറ്റ് നിൽക്കുന്നു
അധ്യാപിക: ഈ ഗ്രൂപ്പിലെ ഗ്രൂപ്പ് ലീഡർക്ക് തുല്യത്രികോണങ്ങളുടെ എത്ര ഭാഗമാണ് കിട്ടിയത്?	കുട്ടികൾ നാലിൽ മൂന്ന് ഭാഗം (3/4 ഭാഗം)

Consolidation

അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്നു.

അധ്യാപിക: രണ്ടളവുകൾ തമ്മിലുള്ള അംശബന്ധം a:b ആണെങ്കിൽ ആദ്യത്തെ അളവ് axഉം രണ്ടാമത്തെ അളവ് bxഉം ആകുന്നു. x എന്നൊരു അളവ് ഉണ്ടായിരിക്കും.

[അധ്യാപിക ആശയങ്ങൾ ക്രോഡീകരിക്കുന്ന ഒരു ചാർട്ട് പ്രദർശിപ്പിക്കുന്നു.]

Follow-up Activity

3) 100 രൂപയെ 5 തുല്യ ഭാഗങ്ങളാക്കി ഭാഗിച്ചശേഷം ഓരോ ഭാഗവും ഓരോ സഞ്ചിയിൽ കെട്ടി വച്ചിട്ടുണ്ട്. ഇവയിൽനിന്ന് 3 സഞ്ചി അനിലിനും 2 സഞ്ചി ബിനിലിനും കൊടുത്തു.
   (i) ആകെ തുകയുടെ എത്ര ഭാഗമാണ് അനിലിന് കിട്ടിയത്?
   (ii) ആകെ തുകയുടെ എത്ര ഭാഗമാണ് ബിനിലിന് കിട്ടിയത്?
   (iii) അനിലിന് കിട്ടിയതിന്റെ എത്ര ഭാഗമാണ് ബിനിലിന് കിട്ടിയത്?
   (iv) ബിനിലിന് കിട്ടിയതിന്റെ എത്ര ഭാഗമാണ് അനിലിന് കിട്ടിയത്?

Appendix XX

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LESSON PLAN BASED ON EXISTING METHOD OF LEARNING

Dr. P.K. Aruna
Rtd. Professor

Lisheetha P.V.
Research Scholar

LESSON TRANSCRIPT NO. I

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	C & D
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Polygons			
Topic	:	The sum of the Interior Angles of the Polygon	Date	:	

Learning Objectives

- To know the definition and characteristics of a polygon.
- To find out different types of polygons with examples
- To construct different types of polygons.
- To understand how to divide different types of polygons into triangles.
- To understand the formula for finding the sum of the interior angles of different types of polygons.

Content Analysis

Facts

- A polygon is a general name for a closed figure with three or more sides.
- It is possible to understand how many triangles are contained in any polygon by drawing diagonals.
- The sum of the interior angles of the polygon is obtained by multiplying the number of triangles contained in the polygon multiplied by 180^0.
- The number of triangles contained in the polygon is obtained by subtracting two from the number of sides of the polygon.
- The sum of the interior angles of that polygon is obtained by subtracting two from the number of sides of the polygon and multiplying it by 180^0.

Concept

- The idea that the number of triangles in a polygon can be found by drawing diagonals.
- The idea that the number of triangles in a polygon can be found by subtracting two from the number of sides of the polygon.
- The idea that the sum of the interior angles of the polygon can be found by subtracting two from the number of sides of the polygon and multiplying it by 180^0.

Pre-requisites

- Knowledge that a polygon is a general name for a shape with three or more sides.
- Knowledge of the number of sides and corners of polygons such as triangles, squares, pentagons, and hexagons.
- Knowledge of how diagonals are drawn.
- Knowledge that the sum of the three angles of a triangle is 180^0.

Resources

- Textbook
- Dot grid page
- Polygons made of different colored chart
  - Triangle
  - Square
  - Pentagon
  - Hexagon
- Chart to consolidate ideas.

Product/Value

- Children draw different polygons and prepare a table containing the number of sides, number of triangles, and sum of interior angles.

Learning Activity	Assessment
Introductory Activity The students say good morning when the teacher enters the class. The teacher says good morning to them in return.	Good morning

Learning Activity	Assessment
The teacher says to the students, "I am going to ask you some questions about the lesson we are going to study today, which you learned in the previous class. Are you ready to answer them?"	The children say they are ready to answer.
Teacher : Name the polygons that you already know.	Children say triangle, square, pentagon, hexagon, etc.
Teacher: Have you seen any shapes outside that are similar to the polygons you are talking about? Can you tell me what they are?	Halva, brick, book
The teacher congratulates the students for their answers.	
Teacher: You know what are the different types of polygons? So what are polygons?	Students answered
Developmental Activity	
The activity of discovering the relationship between the number of sides and the number of angles of various types of polygons.	
<u>Activity 1</u>	
The teacher gives each group a dot grid page and asks them to draw a triangle by connecting three dots, a square by connecting four dots, a pentagon by connecting five dots, and a hexagon by connecting six dots, and to prepare a table by writing down the polygon, number of sides, and number of corners.	Each group draws polygon and prepares a table
The teacher asks each group to read out the table they have prepared.	
She congratulates each group for giving the correct answer.	Each group reads aloud the list they have prepared
<u>Activity-2</u>	
An activity to find the relationship between the number of sides of a polygon and the number of triangles it contains.	

Learning Activity	Assessment
The teacher gives each group a quadrilateral, pentagon, and hexagon of different colors. They are asked to draw a diagonal on each and find out how many triangles there are in each one, and prepare a table in their notebooks containing the polygon and the number of triangles. (The teacher draws a table on the board containing the polygon, the number of sides, and the number of triangles. The teacher calls the children from each group and asks them to complete the table drawn on the board. The teacher encourages the children to write the correct answer.)	
Teacher: Can you see any relationship between the number of sides of the polygon given to each group and the number of triangles?	Yes, subtracting two from the number of sides of the polygon gives the number of triangles
The teacher congratulates the students.	
Teacher: How many triangles will there be in a polygon of 'n' sides?	Students replied there would be (n-2) triangles.
Very good, the teacher congratulates the students.	
<u>Activity-3</u> An activity to find the sum of the interior angles of a polygon by multiplying the number of sides of the polygon by 180^0. The teacher asks each group to find the sum of the interior angles of the quadrilateral, pentagon and hexagon of different colors given to them and present it. The teacher congratulates each group for giving the correct answer.	Each group comes and reads the answers they got.

Learning Activity	Assessment

Consolidation

The teacher consolidates the ideas.

To find the number of triangles contained in a polygon with 'n' sides, we need to subtract two from the number of sides.

The number of triangles in a polygon with 'n' sides will be (n-2).

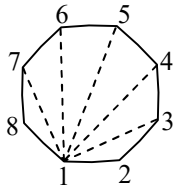
To find the sum of the interior angles of a polygon, we need to multiply the answer obtained by subtracting two from the number of sides by $180^{0.}$

The sum of the interior angles of a polygon with 'n' sides is (n-2)x 180^{0}.

(The teacher displays a chart that consolidates the ideas.)

Follow-up Activity

1) Draw an octagon and find the sum of its interior angles.



2) If the sum of the interior angles of a polygon is 8100^{0}, how many sides does it have?

LESSON TRANSCRIPT NO. II

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	F & G
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Area of Quadrilateral			
Topic	:	Area of Equilateral Parallelogram	Date	:	

Learning Objectives

- To know the definition and characteristics of an equilateral parallelogram.
- To understand different types of equilateral parallelograms with examples.
- To understand how to construct an equilateral parallelogram using the lengths of diagonals.
- To understand how to construct right-angled triangles by joining the diagonals of an equilateral parallelogram.
- To understand the formula for finding the area of an equilateral parallelogram.

Content Analysis

Facts

- A parallelogram is a quadrilateral whose opposite sides are parallel and equal, and whose opposite triangles are equal.
- An equilateral parallelogram is a parallelogram whose four sides are equal.
- A square can be divided into four equal isosceles triangles.
- An equilateral parallelogram can be divided into four right-angled triangles.
- The area of an equilateral parallelogram is half the product of the diagonals.

Concept

- The idea that a square can be divided into four isosceles triangles by using the diagonals.
- The idea that the equilateral parallelogram which is not a square can also be divided into four right-angled triangles.
- The idea that the area of an equilateral parallelogram is half the product of the diagonals.

Pre-requisites

- Knowledge that an equilateral triangle is a parallelogram with all four sides equal.
- Knowledge that the area of a square is half the square of the diagonal.
- Knowledge of how to draw diagonals to convert a square into triangles.

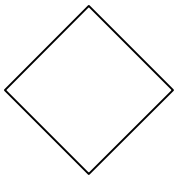
Resources

- Textbook
- Colored A-4 sheets
- Equilateral Parallelograms made of different colored chart
- Chart to consolidate ideas.

Product/Value

- Construct an equilateral parallelogram using the measure of the diagonal and convert it into right-angled triangles to find the area.

Learning Activity	Assessment
When the teacher enters the class, the students greet her. The teacher greets her in return.	
Introductory Activity	
Teacher: Did you collect the facts about equilateral parallelograms that you have learned in the previous classes?	Yes, Teacher
Teacher: Can you read the collected information to everyone?	One by one, each student from each bench comes forward and shares the concepts and examples with the others related to the equilateral parallelograms that they have learned in the previous class.
Teacher: A chart containing mathematical facts related to the equilateral parallelogram is displayed for the children.	
Developmental Activity	

Learning Activity	Assessment
The teacher provides the children with different colored A-4 sheets.	
Activity-1	
Can you construct a square with diagonals of 6 centimeters on the colored A-4 sheet given to you?	Children construct a square with a diagonal of 6 centimeters. 
Activity-2	
Teacher: Can you convert the squared equilateral parallelogram into four equal isosceles triangles?	The children transform the square equilateral parallelogram they drew into four equal equilateral triangles.
Teacher: Now, using the measurements of the isosceles triangle can you find the area of the equilateral parallelogram?	Children discuss in their groups and find the area of an equilateral parallelogram.
Teacher: Very good, everyone did well.	
Activity-3	
The teacher gives the model of an equilateral parallelogram of different colors with diagonals of 6 cm and 4 cm.	
Teacher: Can you find the area of the given equilateral parallelogram?	The children discuss in groups and find the area of the given equilateral parallelogram.
Teacher: Each group explains how they found the solution and asks them to read the answer they got.	One student from each group comes and explains how they found the area and shares the answer they got.
Teacher: When each group has finished their explanation, the teacher told everyone to clap.	Children applaud the groups by clapping .

Learning Activity	Assessment

Consolidation

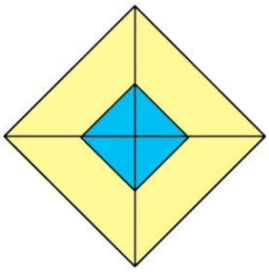
The teacher consolidates ideas.

"The area of an equilateral parallelogram is half the product of its diagonals."

[Teacher displays chart consolidating ideas.]

Follow up Activities

1. In the figure, a small quadrilateral is drawn by joining the midpoints of the half-diagonals of an equilateral parallelogram



(i) Prove that this quadrilateral is a parallelogram.

(ii) The area of the smaller equilateral parallelogram is 3 square centimeters. What will be the area of the larger equilateral parallelogram?

LESSON TRANSCRIPT NO. III

Name of the Teacher	:	Lisheetha. P.V.	Class	:	VIII
Name of School	:	G.V.H.S.S. Payyanakkal	Division	:	C & D
Subject	:	Mathematics	Duration	:	40 mts
Unit	:	Ratios			
Topic	:	Relation of parts	Date	:	

Learning Objectives

- To know the definition and characteristics of ratios.
- To understand the uses of ratios in daily life situations.
- To understand how to divide the square into equal triangles and to find the ratio between them.

Content Analysis

Facts

- In mathematics, the ratio is used to compare two numbers.
- A square can be divided into four equal triangles to understand the relationship between each part.
- If the ratio between two quantities is a: b, then there will be a quantity x which makes the first quantity ax and the second quantity is bx.

Concept

- Understand how much we use the mathematical concept of ratios in everyday life.
- The concept of how to divide a mathematical figure into equal parts and find the relationship between the parts.
- The concept of how to find the relationship between two quantities.

Pre-requisites

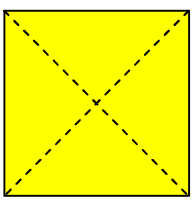
- The knowledge of ratios and the uses of the concept of ratio in mathematics.
- Knowledge that the area of a square is half the square of its diagonal.
- Knowledge about equilateral triangles.
- Knowledge about right-angled triangles.
- Knowledge about how to convert a square into triangles by joining the diagonals.

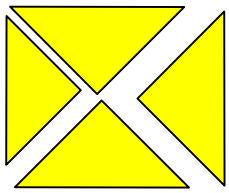
Resources

- Textbook
- Yellow squares and triangles
- Chart for organizing ideas.

Product/Value

- Children discover how to divide various mathematical shapes into equal parts and find the relationship between the parts.

Learning Activity	Assessment
When the teacher enters the class, the students greet the teacher. The teacher greets the children in return.	
Introductory Activity	
The teacher says to the children, "Haven't you gathered facts today about how the mathematical concept of ratio is related to everyday life?"	Yes, teacher
The teacher told the children to read out the information they had collected one by one to everyone.	Students read what they wrote one by one.
The teacher compiles the children's ideas and examples and displays a color chart to the children that contains the mathematical facts of the concept of ratios.	
Developmental Activity	
The teacher gives each group yellow square models.	
<u>Activity 1</u>	
Teacher: Draw diagonals on the yellow square given to you and find the equilateral triangles in it.	Students draw diagonals on a yellow square and make them into four equal triangles. 

Learning Activity	Assessment
Activity -2	
Teacher : Didn't you divide the square into four triangles using the diagonals? Can you cut out four triangles from those squares?	Students cut out all four equal triangles in the square. 
Teacher applauds the students and congratulates them.	
Activity -3	
Teacher: Ask someone from the first group to stand up holding a yellow triangle.	One student in the first group stands upholding a yellow triangle in his hand.
Teacher: How much of the equilateral triangle did Anees get in this group?	1/4 parts
Teacher: Ananya from the girls' group is asked to stand up holding two triangles in her hands.	2/4 parts
Teacher: How many parts of the equilateral triangles did Ananya get in this group?	
Teacher: The group leader of the last group is asked to stand up holding three triangles in his hands.	The group leader stands tall holding three triangles
Teacher: How many parts of the equilateral triangles did the group leader get in this group?	Children: 3/4 part
Consolidation	
The teacher consolidates ideas.	
Teacher: If the ratio between two quantities is a:b, then the first quantity is ax and the second quantity is bx. Then there will be a quantity called x.	
[Teacher displays a chart that consolidates ideas.]	

Learning Activity	Assessment

Follow-up Activity

1) After dividing Rs. 100 into 5 equal parts, each part is tied in a separate bag. Out of these, 3 bags are given to Anil and 2 bags to Binil.
   (i) How much part of the total amount did Anil get?
   (ii) How much part of the total amount did Binil get?
   (iii) How much portion of Anil's part will get to Binil?
   (iv) How much portion of Binil's part will get to Anil?

Appendix XXI

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

CLASSROOM ENVIRONMENT INVENTORY

(Secondary Level)

Mrs. ARUNA. P.K
Lecturer in Education

Sureshan. K
Unnikrishnan. M
(M.Ed. Students)

നിർദ്ദേശങ്ങൾ

താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകൾ ക്ലാസ്മുറിയിലെ പഠനവുമായി ബന്ധപ്പെട്ടവയാണ്. ഓരോ പ്രസ്താവകൾക്കും രണ്ടുവീതം പ്രതികരണങ്ങൾ കൊടുത്തിരിക്കുന്നു. ഉണ്ട്/ഇല്ല (അതെ/അല്ല). ഉത്തരക്കടലാസ്സുകൾ പ്രത്യേകം തന്നിട്ടുണ്ട്. പ്രസ്തവകൾ വായിച്ച് ഉത്തരക്കടലാസ്സിലെ അതേ നമ്പറിന് നേരെയുള്ള ഉചിതമായ ഏതെങ്കിലും ഒരു പ്രതികണത്തിലുള്ള വൃത്തത്തിൽ 'x' ചിഹ്നം രേഖപ്പെടുത്തുക.

1. ക്ലാസ്മുറിയിൽ ആവശ്യത്തിനുള്ള ബഞ്ച്, ഡസ്ക്, മേശ, കസേര എന്നിവ ഉണ്ട്.
2. ക്ലാസിൽ കുട്ടികളുടെ ഇരിപ്പിടം അധ്യാപകൻ ഇടയ്ക്കിടെ മാറ്റാറുണ്ട്.
3. ചാർട്ടുകളും മാപ്പുകളും, ചിത്രങ്ങളും തൂക്കിയിടുവാൻ ക്ലാസിൽ സൗകര്യമുണ്ട്.
4. ചാർട്ടുകളും മാപ്പുകളും ചിത്രങ്ങളും തൂക്കിയിട്ടാൽ അവ എല്ലാ കുട്ടികൾക്കും ഒരു പോലെ കാണുവാൻ സാധിക്കുന്നു.
5. ക്ലാസ്മുറിക്ക് പരീക്ഷണങ്ങൾ ചെയ്ത് പഠിക്കുവാനുള്ള വലിപ്പവും സൗകര്യവുമുണ്ട്.
6. ക്ലാസിലെ കുട്ടികൾക്ക് ഒരു ബുള്ളറ്റിൻ ബോർഡുണ്ട്.
7. പരമാവധി കുട്ടികളുടെ പങ്കാളിത്തം ഉറപ്പുവരുത്തിക്കൊണ്ട് ക്ലാസിൽ നിന്ന് ഒരു കൈയെഴുത്ത് മാസിക പ്രസിദ്ധീകരിക്കാൻ അധ്യാപകൻ പ്രോത്സാഹിപ്പിക്കാറുണ്ട്.
8. അധ്യാപകൻ ക്ലാസ്സിൽ എല്ലാവരോടും സംസാരിക്കാറുണ്ട്.
9. ക്ലാസിൽ കൃത്യസമയത്ത് പഠനം തുടങ്ങുകയും അവസാനിക്കുകയും ചെയ്യാറുണ്ട്.
10. ക്ലാസിലെ പെരുമാറ്റ രീതിയെക്കുറിച്ച് അധ്യാപകൻ പറഞ്ഞുതരാറുണ്ട്.
11. ക്ലാസിൽ അനുസരണക്കേടു കാണിക്കുന്ന കുട്ടികളെ അധ്യാപകൻ ഉപദേശിക്കുകയും ശിക്ഷിക്കുകയും ചെയ്യാറുണ്ട്.
12. അധ്യാപകൻ ശിക്ഷിക്കുമ്പോൾ ദേഷ്യവും സങ്കടവും തോന്നാറുണ്ട്.
13. അധ്യാപകൻ ക്ലാസിലെ എല്ലാ കുട്ടികളെയും വ്യക്തിപരമായി അറിയാൻ ശ്രമിക്കാറുണ്ട്.
14. ക്ലാസിലെ കുട്ടികളെ പല ഗ്രൂപ്പുകളായി തിരിച്ച് കലാകായിക മത്സരവും പ്രശ്നോത്തരി മത്സരവും നടത്താറുണ്ട്.
15. മത്സരങ്ങളിൽ വിജയിക്കുന്ന ഗ്രൂപ്പിനെയും കുട്ടികളെയും അധ്യാപകൻ അഭിനന്ദിക്കാറുണ്ട്.

16. ക്ലാസിൽ ആർട്സ് ക്ലബ്ബുകൾ, പഠന ക്ലബ്ബുകൾ എന്നിവ സംഘടിപ്പിച്ച് പ്രവർത്തിക്കാറുണ്ട്.
17. ക്ലാസിലെ ക്ലബ്ബുകളിലും മത്സരങ്ങളിലും പരമാവധി കുട്ടികളെ പങ്കെടുപ്പിക്കാൻ അധ്യാപകൻ ശ്രമിക്കാറുണ്ട്.
18. പഠനകാര്യങ്ങളിൽ കുട്ടികൾ പരസ്പരം സഹായിക്കാറുണ്ട്.
19. ക്ലാസിൽ ചില കുട്ടികൾ പരസ്പരം സ്നേഹത്തോടു കൂടി കഴിയാറുണ്ട്.
20. ചില കുട്ടികൾ ക്ലാസിൽ പ്രശ്നങ്ങളുണ്ടാക്കാറുണ്ട്.
21. പഠനയാത്രയ്ക്ക് പോയ സ്ഥലങ്ങളെക്കുറിച്ചും അവയുടെ പ്രാധാന്യത്തെക്കുറിച്ചും ക്ലാസിൽ ചർച്ചകൾ നടത്താറുണ്ട്.
22. കുട്ടികൾ പഠനകാര്യങ്ങളിൽ മത്സരബുദ്ധി പ്രകടിപ്പിക്കാറുണ്ട്.
23. പഠനകാര്യങ്ങൾ ചെയ്തു തീർക്കുന്നതിന് വളരെ പ്രയാസം തോന്നാറുണ്ട്.
24. പഠന ഉകരണങ്ങൾ തയ്യാറാക്കുന്നതിനും കൈകാര്യം ചെയ്യുന്നതിനും അധ്യാപകൻ പരിശീലിപ്പിക്കാറുണ്ട്.
25. വർക്ക് ബുക്കുകൾ, പാഠാഭ്യാസം എന്നിവ കുട്ടിഖൽ തെറ്റു കൂടാതെ ചെയ്യുവാൻ അധ്യാപകൻ പരിശീലിപ്പിക്കാറുണ്ട്.
26. പ്രശ്നോത്തരി മത്സരം, പൊതു വിജ്ഞാനപരീക്ഷ തുടങ്ങിയവയ്ക്കുവേണ്ടി തയ്യാറെടുക്കുവാൻ അധ്യാപകൻ കുട്ടികളെ സഹായിക്കാറുണ്ട്.
27. പുതിയ കണ്ടുപിടുത്തങ്ങളെക്കുറിച്ചും കാലിക പ്രാധാന്യമുള്ള വിഷയങ്ങളെക്കുറിച്ചും ക്ലാസിൽ ചർച്ച ചെയ്യാറുണ്ട്.
28. ക്ലാസിൽ നടക്കുന്ന ചർച്ചകളിൽ കുട്ടികൾ അവരുടെ അഭിപ്രായം തുറന്നു പറയാറുണ്ട്.
29. ക്ലാസ് ചർച്ചകളിൽ അഭിപ്രായം പറയാൻ കുട്ടികളെ പ്രോത്സാഹിപ്പിക്കാറുണ്ട്.
30. പുതിയ കണ്ടുപിടുത്തങ്ങളെകുറിച്ചും കാലിക പ്രാധാന്യമുള്ള വിഷയങ്ങളെക്കുറിച്ചും ഉപന്യാസം തയ്യാറാക്കാൻ പരിശീലിപ്പിക്കാറുണ്ട്.
31. പഠനയാത്രകളെക്കുറിച്ചും അവയുടെ പ്രാധാന്യത്തെക്കുറിച്ചും ലേഖനമെഴുതുവാൻ അധ്യാപകൻ പരിശീലിപ്പിക്കാറുണ്ട്.
32. കുട്ടികളുടെ അഭിപ്രായങ്ങൾക്ക് അധ്യാപകൻ പരിഗണന നല്കാറുണ്ട്.
33. കുട്ടികളുടെ സ്വയം പഠനരീതിയെ അധ്യാപകൻ പ്രോത്സാഹിപ്പിക്കാറുണ്ട്.
34. അധ്യാപകൻ ക്ലാസ് എല്ലാവർക്കും കേൾക്കത്തവിധത്തിലും മനസ്സിലാകത്തക്കവിധത്തിലുമാണ് എടുക്കാറുള്ളത്.
35. അധ്യാപകൻ കുട്ടികളെ ഉത്തരം പറയുവാൻ പ്രോത്സാഹിപ്പിക്കാറുണ്ട്.
36. പഠനഭാഗങ്ങൾക്കനുസരിച്ച് അധ്യാപകൻ ചാർട്ടുകളും മോഡലുകളും മാപ്പുകളും മറ്റു പഠനോപകരണങ്ങളും ഉപയോഗിക്കാറുണ്ട്.
37. കുട്ടികൾ പാഠഭാഗത്തെ സംബന്ധിച്ച് സംശയങ്ങൾ അധ്യാപകനോട് ചോദിക്കാറുണ്ട്.
38. അധ്യാപകൻ പാഠഭാഗത്തെ സംബന്ധിച്ച കുട്ടികളുടെ സംശയങ്ങൾ തീർത്തു കൊടുക്കാറുണ്ട്.
39. അധ്യാപകൻ ബോർഡിൽ വ്യക്തമായും അടുക്കോടുകൂടിയും എഴുതാറുണ്ട്.

40. ചെലവു കുറഞ്ഞ വസ്തുക്കളും പാഴ്വസ്തുക്കളും ഉപയോഗിച്ച് പഠനോപകരണങ്ങൾ നിർമ്മിക്കുന്നതിന് അധ്യാപകൻ പരിശീലനം നല്കാറുണ്ട്.
41. അധ്യാപകൻ പ്രകൃതി നിരീക്ഷണത്തിന് പ്രചോദനം നൽകാറുണ്ട്.
42. പരിസര ശുചീകരണത്തെക്കുറിച്ചും പ്രകൃതി സംരക്ഷണത്തെക്കുറിച്ചും അധ്യാപകൻ ബോധവൽക്കരണം നടത്താറുണ്ട്.
43. വിജ്ഞാനോത്സവങ്ങളിലും പൊതു പരീക്ഷകളിലും പങ്കെടുക്കുന്നതിന് അധ്യാപകൻ പ്രചോദനം നൽകാറുണ്ട്.
44. പാഠ്യവിഷയത്തിൽ കൂടുതൽ അറിവുനേടാൻ വേണ്ട പുസ്തകങ്ങളും മറ്റു പുസ്തകങ്ങളും അധ്യാപകൻ പറഞ്ഞു തരാറുണ്ട്.
45. സ്കൗട്ട്, ഗൈഡ് എന്നീ സന്നദ്ധസംഘടനകളിൽ പ്രവർത്തിക്കാൻ പ്രചോദനം നല്കാറുണ്ട്.
46. കമ്പ്യൂട്ടർ പരിശീലിക്കാൻ അധ്യാപകൻ സഹായിക്കാറുണ്ട്.
47. പുതിയ സാങ്കേതികവിദ്യയുടെ സഹായത്തോടെ പഠനം നടത്താൻ അധ്യാപകൻ സഹായിക്കാറുണ്ട്.

Appendix XXII

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

CLASSROOM ENVIRONMENT INVENTORY

(Secondary Level)

Dr. P.K. Aruna
Lecturer in Education

Sureshan, K.
Unnikrishnan, M.
M.Ed. Students

Instructions

The following statements given below are related with your classroom learning. Two responses are given for each statement (Yes/No). Separate answer sheet is provided. Read each statement carefully and mark your response in the answer sheet by putting 'X' in the relevant circle.

1. Adequate number of benches, desks, tables and chairs are provided in the classroom.
2. Teacher changes the place where the students sit.
3. There is enough space in our classroom for hanging charts, maps and pictures.
4. Students can see the charts, pictures and maps fixed in the classroom.
5. There is adequate space and facilities in the classroom to study by conducting experiments.
6. There is a bulletin board in our class.
7. Teacher encourages to publish a manuscript magazine with maximum participation of the students.
8. Teacher talks with each student in the class.
9. Class starts and ends in the right time.
10. Students are told how to behave in the classroom.
11. Teacher gives advices or punishments to students who are not obedient in the class.
12. We feel angry and sadness while teacher punishes.
13. Teacher takes personal interest to know each student in the class.
14. Conduct art and sport competition or quiz competitions by making students in different group.
15. Teacher appreciates the group or student who win the competition.
16. Art club and science club are formed and working in our class.
17. Teacher encourages the student to participate in club activities.
18. Students help each other in their studies.
19. Students are friendly in our class.

20. Some students make problem in our class.
21. Conduct discussion in the class about the importance of place visited during study tour.
22. Students show competition in the field of their study.
23. Students feel difficulty in completing in some academic matters.
24. Teacher trains the students to prepare and handle teaching aids.
25. Teacher trains the students to do their workbook and other exercises without mistakes.
26. Teacher help the students to prepare themselves for quiz competition and general knowledge test etc.
27. Teacher makes discussions on new inventions and current affairs.
28. Students express their opinions in their classroom discussions.
29. Teacher encourages the students to participate in the classroom discussions.
30. Teacher trains the students in writing essays related to new inventions and current affairs.
31. Teacher trains the students in writing essays related to their study tour program.
32. Teacher gives consideration to the opinion of the students.
33. Teacher encourages the self-study method of the students.
34. Teacher takes his class in way that all students can clearly hear and understand.
35. Teacher encourages the students to say the answers.
36. Teacher uses charts, maps, models and other teaching aids suitable for the lesson.
37. Students have doubts related to their subjects.
38. Teacher clears the doubts of the students on their lesson.
39. Teacher writes on the blackboard clearly and systematically.
40. Teacher trains the students to make teaching aids using cheap and waste materials.
41. Teacher encourages the students to observe the nature.
42. Teacher makes awareness about the importance of environmental cleanliness and protection of nature.
43. Teacher inspire the students to participate in ‘Vijnanothsava’ and other public examinations.
44. Teacher tells the reference books useful for getting more knowledge about the subject studied.
45. Teacher gives inspiration to the students for joining voluntary organizations like scouts and guides.
46. Teacher helps the students to learn computer.
47. Teacher encourages the students to learn with the help of new technology.

Appendix XXIII

CLASSROOM ENVIRONMENTAL INVENTORY

RESPONSE SHEET

Sl. No	Yes	No	Sl. No	Yes	No
1	◯	◯	25	◯	◯
2	◯	◯	26	◯	◯
3	◯	◯	27	◯	◯
4	◯	◯	28	◯	◯
5	◯	◯	29	◯	◯
6	◯	◯	30	◯	◯
7	◯	◯	31	◯	◯
8	◯	◯	32	◯	◯
9	◯	◯	33	◯	◯
10	◯	◯	34	◯	◯
11	◯	◯	35	◯	◯
12	◯	◯	36	◯	◯
13	◯	◯	37	◯	◯
14	◯	◯	38	◯	◯
15	◯	◯	39	◯	◯
16	◯	◯	40	◯	◯
17	◯	◯	41	◯	◯
18	◯	◯	42	◯	◯
19	◯	◯	43	◯	◯
20	◯	◯	44	◯	◯
21	◯	◯	45	◯	◯
22	◯	◯	46	◯	◯
23	◯	◯	47	◯	◯
24	◯	◯			

Appendix XXIV

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

SOCIO ECONOMIC STATUS SCALE

Dr. Aruna P.K.
Association Professor & Head

Sumi, V.S.
Research Scholar

Instructions

Read the following carefully and write the details. Put a correct mark against the correct answer where answers are given.

1.Name:.....

2. Male/Female/Others:..... 3. Age:.....

4. School/Institution:.....

5. Date: .....

6. Information about family members can be mentioned in columns 1 to 9 below. Mark the '✓' mark in the required column in it.

Members	No Literacy	Std. I to IV	Std. V to VII	Std VIII to X	Pre University, Pre-Degree T.T.C. Intermediate	BA, B.Sc., B.Com., B.Ed., NTTC, Eng. Diploma	MA, MSc, M.Ed., BL, B.Sc(Tech), Ph.D. etc.	If there is a job, Name of the Job	Monthly Income
	1	2	3	4	5	6	7	8	9
Father (Guardian)									
Mother									

Appendix XXV

STANDARD PROGRESSIVE MATRICES
SETS A, B, C, D & E

SCORING KEY

SET A	
Sl. No	Answer
1	4
2	5
3	1
4	2
5	6
6	3
7	6
8	2
9	1
10	3
11	4
12	5

SET B	
Sl. No	Answer
1	2
2	6
3	1
4	2
5	1
6	3
7	5
8	6
9	4
10	3
11	4
12	5

SET C	
Sl. No	Answer
1	8
2	2
3	3
4	8
5	7
6	4
7	5
8	1
9	7
10	6
11	1
12	2

SET D	
Sl. No	Answer
1	3
2	4
3	3
4	7
5	8
6	6
7	5
8	4
9	1
10	2
11	5
12	6

SET E	
Sl. No	Answer
1	7
2	6
3	8
4	2
5	1
6	5
7	1
8	6
9	3
10	2
11	4
12	5