INFLUENCE OF LEARNING STYLE APPROACHES TO STUDYING AND ACHIEVEMENT MOTIVATION ON ACHIEVEMENT IN BIOLOGY OF SECONDARY SCHOOL PUPILS

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DECLARATION

I, **Hassan Koya. M.P.**, do hereby declare that this report ***Influence of Learning Style Approaches to Studying and Achievement Motivation on Achievement in Biology of Secondary School Pupils*** has not been submitted by me for the award of a Degree, Diploma or Recognition before.

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CERTIFICATE

I, **Dr. P.K. Sudheesh Kumar**, do hereby certify that this report ***Influence of Learning Style Approaches to Studying and Achievement Motivation on Achievement in Biology of Secondary School Pupils*** submitted for the degree of Doctor of Philosophy in Education of the University of Calicut, is a record of bonafide study and research carried out by **Mr. Hassan Koya M.P**, under my supervision and guidance.

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19-12-2002.

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INTRODUCTION

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Chapter

One

Introduction

CHAPTER 1

It is argued that the educational system need to be reshaped to rapidly changing socio-economic and cultural demands, with emphasis on equal education. In line with this aim, researchers are making reform-efforts for restructuring schools and thereby improving educational quality. Though the students possess amusing abilities, it is ***not fully utilized to the desired end.*** The multifacet development of the individual remains an unfulfilled objective. One reason for the persistent school under achievement is that school culture is based largely on individualism and interpersonal competition that may be an anathema to students. Hence school culture may ***predispose*** them to failure. And therefore, ***hue*** and ***cry*** for a change in the strategies and methods cannot be underestimated. The ***reform-efforts*** in education emphasizes cultural diversity and learning, unrecognized potential, enhanced achievement through motivation, effort and resilience.

Achievement in the classroom is of paramount importance, as the school is viewed as a miniature society. One who surpass others in academic subject will most likely to outperform others in ***civic*** function too. Recent attention has focussed on the decreasing level of scholastic achievement of pupils, particularly in the area of Science and Mathematics (Stocking & Goldstein, 1992). Science education aims at developing

scientific values such as accepting truth, respect for evidence, seeking clarification, open mindedness and being objective in interpretations. These qualities are hardly developed in a ***teacher dominated classroom.*** To achieve these expected learning outcomes, the teacher is to allow students to construct their own concept, to work at their own pace and to provide all students with opportunities to engage in learning tasks. Unfortunately, it is observed that the present education is ***not conducive*** to develop these abilities.

For this reason, Science education in the country has been in ***dire straits*** for many years. To overcome this deterioration in quality and to bridge the gap, suggestions based on experiments are available. Analysis of students preferences and making accomodation to conform to those needs in classroom encourage students to become ***increasingly engaged in their learning*** (Lindvall, 1995). Optimising learning for all students in the classroom can be achieved through creating ***multiple learning opportunities*** for all students as their differences are valued and celebrated (Sulaiman, 1997).

Forces influencing high school career and technical education include: the new economy, ***public expectations,*** new cognitive science research about learning and a variety of school reform movements. The purposes of high school career identified as follows: providing career exploration and planning, enhancing ***academic achievement*** and ***motivation*** to learn more, acquiring generic work competencies and skills useful for employment. The importance of high school education for laying foundation in this concern is emphasized (Lesh, et al., 2000)

In the light of the situation discussed earlier, it is hypothesized that ***learner characteristics*** and ***individual differences has considerable bearing upon the learning process and learning outcomes.***

1.1 NEED AND SIGNIFICANCE OF THE STUDY

In search of better understanding of the learning process, the relationship of the different variables were investigated. As a consequence new concepts and issues are coming into focus. These include ***Classroom Variables*** (Classroom Climate; Classroom Interaction; Classroom Environment), ***Teacher Variables*** (Teaching aptitude, interest, efficiency) ***Student Characteristics*** (Work habits, study methods, study strategies), ***Students' Specific Characteristics*** (Learning Style, Approaches to Studying and Achievement Motivation) and ***Socio-familial Variables.***

Of the number of variables identified, the centre of attention remain ***the learner*** and ***learner characteristics.*** Students are coming to the classroom with rich experiences and investing their experiences will activate the learner. Research reports reveal that learner involvement had a significant effect on Achievement (Pine, 1980). Welden (1966) reported greater learner satisfaction obtained when students ***involved*** in learning tasks. Recognition of this fact made a shift in the research on classroom learning. Researchers accepted that it is important to understand learning from ***pupil's perspective.*** As a consequence, research in classroom take a new route – ***how students learn from students' own view point.***

Continued attempts to trace the factors of how students learn from learner's own perspective yielded new concepts. Pask's work (1976)

explored the ways students tackle a learning task and thereby a new student specific variable came into existence - ***The Learning Style.*** It is observed that the regular activities and task given to students are often ***replicated*** in classrooms. To tackle these situation students exhibit unique ***Learning Style*** to tackle the learning material.

Inspired by the work of Pask (1976) on styles and strategies Kolb (1983), Keefe and Monk (1986), Schmeck (1988), Taneja (1989), Price, *et. al.*, (1991), Dunn (1991) and Harvey (1994) have explored the various dimensions of Learning Styles. Since then in India the research on the topic ***Learning Style*** gained momentum. ***Learning Style and Achievement Motivation*** (Preetha, 1996), ***Learning Style and Approaches to Studying*** (Rehna, 1996), ***Learning Style and Achievement*** (Santhoshkumar, 1997; Kumar, 1997), ***Learning Style and Intelligence*** (Prasanna, 1997), ***Learning Style and Classroom Climate*** (Bharghavi, 1999) and ***Learning Style with regard to Sex and Locale*** (Gopalan, 1999) are some of significant studies which explain the relationship of Learning Style with other variables.

Besides these, a number of studies highlight the relevance of Learning Style in the learning process. National Science Teachers Association (NSTA) policy statement on multiculturalism listed Learning Style as an ***important concern for science teachers*** (Melear, 1995). Irvine and York (1995) argues that for enhancing academic achievement teachers to be alert to student's Learning Styles. ***Under achievement*** could be attributed to a mismatch of student's Learning Style and teaching strategies (Clooney, 1998). Moreover, Khalsa (1999) explains the importance of ***addressing*** students' ***different Learning Style*** and multiple Intelligence in

the classrooms. These studies show that students learn more often from materials designed to ***match their Learning Styles.*** However, some important studies yielded negative relationship, or no relationship between Learning Style and Achievement. The research evidences show that no ***one element of Learning Style as contributing factors to improved academic achievement*** (Howie, 1996). Cynthia (1988) argues that ***Match*** or ***mismatch*** of ***student*** and ***teacher Learning Style preference did not contributed significantly to Achievement.*** Apart from these studies indicate that students with ***diverse Learning Styles do not appear to influence*** completion of the curriculum or future professional activities. (Stickle, *et.al.*, 1991).

Miller and Polito (1999) claims that teams with ***heterogeneous Learning Styles did not perform better than homogeneous teams.*** Besides, studies reveal that Achievement was not significantly correlated with Learning Style (Day, *et al.*, 1998; Garton, *et al.*, 1999). It is also noted that no significant difference in Achievement by Learning Style preference was observed (Melara 1996; Marzalek & Lockard, 1999).

The positive and negative relationship shown by different studies lead to the assumption that the result is inconclusive and calls for ***further research*** in this area.

Researchers in the late 1970's pointed out that students differ in quality of what they had learned and understood (Entwistle & Robinson, 1976; Marton & Saljo, 1976). It is to be remembered that learning is individualistic, that is there occurs qualitative differences in ways pupils express their understanding (Entwistle, 1987). This differences in the way

one approach a learning materials is termed ***Approaches to Studying***. Survey of literature on Approaches to Studying shows that it has been studied extensively abroad. This include: ***Study Approaches*** and ***Preference*** (Biggs, 1979); ***Variability in Approach*** (Ramsden & Laurillard, 1979); ***Deep*** and ***Surface Approach*** (Speth & Brown, 1988); ***Approach*** and ***Levels of Processing*** (Entwistle & Waterston, 1988); ***Study Approach*** and ***Self Esteem*** (Watkins & Hattie, 1990); ***Study Approach*** and ***Quality of Learning Outcomes*** (Trigwell & Prosser, 1991).

In India limited studies were conducted on Approaches to Studying and most of them exclusively deal with its relationship with Scholastic Achievement (Pillai & Naseema, 1991; Asmali, 1993; Kumar, 1993; Kumar, 1994; Prasad, 1995 and Rehna, 1996), Kumar (1997a, 1998) studied the difference in Approaches to Studying between High and Low achievers and Study Approach and Cognitive Style. Majority of the studies indicate a positive influence of Approaches to Studying on student's characteristics.

Social and Psychological development shape a child's character and personality as well as academic achievement. Five factors that are critical to this development include self esteem, Achievement Motivation, social skills, coping skills and aspirations. ***Achievement Motivation refers to the ability to persist at tasks or activities to accomplish a goal or learning outcome;*** it is the drive that student generate to get things done. Students with high aspirations develop challenging and realistic ideas and plans for further careers and adult life in general. Developing such aspirations is a goal of the ***School to work*** programmes in many schools (Bartz & Mathews, 2001).

Over the years researchers know that the ***inherent force*** of the individual stimulate exploration of the environment and helps to mastering, the moderately challenging tasks. This inherent force termed ***Achievement Motivation*** exercise profound influence on Achievement in combination with other variables like ***Learning Style*** and ***Approaches to Studying.*** Studies by Abouserie (1995) show that student's personality traits in general and ***Achievement Motivation*** in ***particular*** have a substantial influence on their Approaches to Study and to levels of knowledge processing. Properly motivated students have shown high performance in their Academic Achievement (Waxman, 1997; Simons, *et al.*, 1999). Apart from these, many studies on Achievement Motivation revealed positive result with Achievement (Cain & Deweck, 1995; Preetha, 1996; Taylor, 1999). Review of literature highlights that Achievement Motivation occupies the place of a fundamental variable in educational research.

It will not be out of place to mention that a number of studies show that there is no relationship between Achievement Motivation and achievement. Studies indicate that Achievement Motivation was affecting Achievement to ***a less extent only*** (Ayishabi, 1987; Kumar, 1994). Findings ***show that Achievement Motivation has no influence on Academic Achievement*** under certain conditions (Walayathiram, 1974; Seshadri, 1980; Rajput, 1984 and Neibuhr, 1995).

The contemporary science education fail to achieve the set goals, as it is more theoretically oriented. ***Boredom is the regular feature of classrooms*** because of the monotonous methods adopted in teaching. The prevailing

chalk and ***talk*** method often do not lead to the development of skills and related attitudes. Moreover the contents or subject matter are not integrated with experience of students. The opportunity for field visit is minimum and therefore the chances for direct experience is ruled-out. The practical classes in science at secondary level is not conducted properly. Though science learning emphasises ***activity,*** students are given assignments which are mostly based on text book. As far as biological science is concerned there are enormous opportunities for activity and nature study. But unfortunately the current system of instruction do not makes use of it. In short pupils are fed up with the methods and strategies of present science education and it is high time to think for a change.

As science education is process oriented, Learning Style preference of students plays a vital role in building scientific concepts. Teaching Style complementary to students' Learning Style opens door for an easy understanding of the learning material. Further it stimulate the learner to engage in the learning task. Similarly a deep and meaning oriented approach helps the students to integrate the matter with the life experiences. Scientific principles and concepts are largely based on observation, evidence and experiments. A ***healthy approach*** to the study material paves the way for the cultivation of a scientific mind.

Since science education is viewed seriously, the students' Achievement Motivation in likely to be of very high profile. It creates a desire in the individual to attain the goal and act as a driving force to make constant effort. Specifically for biological science students may show unique Learning Style preferences. The subject offer or demand drawing

skills and other related activities. Therefore the students of Biology may show a tendency to learn by hands-on (Tactile). This style preference may be predominant over other style areas. Hence it is important to cater Learning Style preference for improving academic outcome.

Guarded analysis of the survey of related studies concerned with variables affecting Academic Achievement emphasize that Learning Style, Approaches to Studying and Achievement Motivation play vital roles in student learning. According to Dreher (1997) teachers adapt instruction to student's Learning Style to improve student motivation and allow students to reach their full potential. This indicate there is interaction between Learning Style and motivation on the potential abilities of the individual. The study conducted by Prasad (1995) shows that there was no significant positive interaction effect of Approaches to Studying and Achievement Motivation on process outcomes. But the investigator could not locate studies examining the cross-over effect of Learning style, Approaches to Studying and Achievement Motivation on student Achievement. Moreover, research in this area indicates that the concepts Learning Style and Approaches to Studying are interwoven and calls for further clarification.

This tempted the investigator to take up a study on the topic ***Influence of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology of Secondary School Pupils.*** Being a student of Natural Science the study is confined to Biology.

1.2. STATEMENT OF THE PROBLEM

The problem for the present study is entitled as ***INFLUENCE OF LEARNING STYLE APPROACHES TO STUDYING AND ACHIEVEMENT MOTIVATION ON ACHIEVEMENT IN BIOLOGY OF SECONDARY SCHOOL PUPILS.***

1.3. DEFINITION OF KEY TERMS

The key terms used in the statement of the problem are defined in the following part.

1.3.1. LEARNING STYLE

Learning Style is the general tendency to adopt similar set of strategies consistently across different tasks and settings (Eysenck, 1994).

1.3.2. APPROACHES TO STUDYING

Approaches to Studying as used in the present study refers to orientation of pupils in studying to which different strategies of learning, styles of learning and associated forms of motivations merged.

1.3.3. ACHIEVEMENT MOTIVATION

Achievement Motivation is defined as combination of Psychological forces which initiate, direct and sustain behaviour towards successful attainment of some goals which provides a sense of significance (Good, 1973).

1.3.4. ACHIEVEMENT IN BIOLOGY

Achievement in Biology is the accomplishment of proficiency of performance in Biology (cognitive domain) as measured using a standardised test.

1.3.5. SECONDARY SCHOOL PUPILS

The term refers to pupils studying in class VIII, IX and X of recognized schools of Kerala state. In the present study standard IX pupils were selected because they are the true representative of pupils of Secondary school classes.

1.4. VARIABLES SELECTED FOR THE STUDY

The Independent and Dependent Variables selected for the present study are the following.

1.4.1. INDEPENDENT VARIABLES

Three Independent Variables were selected for the study. They are:

1.4.1.1. **Learning Style:-** Four component wise and a Total score. The components are Environmental, Emotional, Social and Physical Styles. These are learning preference to a learning situation.

1.4.1.2. **Approaches to Studying:-** Four component wise and a Total score. The components are Meaning Orientation, Reproducing Orientation, Achieving Orientation and Non-Academic Orientation.

1.4.1.3. Achievement Motivation (Total score)

1.4.2. DEPENDENT VARIABLES

Achievement in Biology, four Objective wise scores and a Total score were taken as the Dependent Variables. They are achievement in the Objectives: Knowledge, Comprehension, Application and Higher Objectives.

1.5. OBJECTIVES

The objectives set for the study include:

1.5.1. To study whether there exists ***significant gender difference*** in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.5.2. To study whether there exists ***significant gender difference*** in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.5.3. To study whether there exists ***significant gender difference*** in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.5.4. To study whether there exists ***significant gender difference*** in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.5.5. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for the Total sample.

1.5.6. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Boys.

1.5.7. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Girls.

1.5.8. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Rural sample.

1.5.9. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Urban sample.

1.5.10. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Government sample.

1.5.11. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Private sample.

1.5.12. To find out the ***best predictor*** of Achievement in Biology from the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

1.5.13. To study whether there exist ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

1.6. HYPOTHESES

The hypotheses tested for the present study follows.

1.6.1. There will be ***significant*** gender difference in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.6.2. There will be ***significant*** gender difference in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.6.3. There will be ***significant*** gender difference in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.6.4. There will be ***significant*** gender difference in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

1.6.5. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for the Total sample.

1.6.6. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Boys.

1.6.7. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Girls.

1.6.8. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Rural sample.

1.6.9. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Urban sample.

1.6.10. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Government sample.

1.6.11. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Private sample.

1.6.12. Achievement in Biology can be ***predicted*** using the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

1.6.13. There will be ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

1.7. METHODOLOGY

The methodology of the present study is outlined in the following sub sections.

1.7.1. SAMPLE

The study is carried out on a representative sample of 1000 pupils studying in class IX of the secondary schools in Kerala state. ***Proportionate stratified sampling technique*** was used. Due weightage was given to ***gender, locale, management*** category and ***efficiency level*** of schools.

1.7.2. TOOLS USED

For the study, the Independent Variables and Dependent Variables were measured using the following standardised tools.

1.7.2.1. Learning Style Inventory – LSI (Kumar, *et al.*, 1996).

1.7.2.2. Approaches to Studying Inventory - ASI (Kumar, & Koya, 2001)

1.7.2.3. Scale of Achievement Motivation – SAM (Pillai & Kumar, 1993).

1.7.2.4. Achievement Test in Biology –ATB (Koya, 2001)

1.7.3. STATISTICAL TECHNIQUES USED

The following were the statistical procedures used to analyse the data.

1.7.3.1. Test of Significance of Difference Between Means

To study the gender difference in Independent Variables and Dependent Variables and to study the difference in Styles and Approaches between the High and Low achievers in Secondary school Biology this statistical technique was used.

1.7.3.2. Three-way ANOVA with 3x3x3 Factorial Design

Three-way ANOVA was used to find out the main and interaction effects of Independent Variables on the Dependent Variables.

1.7.3.3 ANOVA followed by *Scheffe'* Test of Post-hoc Comparison

Scheffe' Test of Post-hoc comparison is used to identify the groups which differ significantly in the mean achievement score. It is a follow up procedure of ANOVA.

1.7.3.4. Step-wise Multiple Regression Analysis.

This technique was used to predict Criterion / Dependent Variables from a set of three predictor variables.

1.8. SCOPE AND LIMITATIONS

The present study is an attempt to examine the influence of ***Learning Style, Approaches to Studying*** and ***Achievement Motivation*** on ***Achievement in Biology*** of Secondary school pupils. The study has been directed to examine whether variation in ***Learning Style, Approaches to Studying*** and ***Achievement Motivation*** of Secondary school pupils (Total sample and relevant sub samples) influence variation in their ***Achievement in Biology***. Appropriate standardised tools were used for the data collection. Analysis of the data was done with utmost care. And therefore, the investigator hopes that the results are reliable. Since the sample for the study includes various sections from different districts, the results can be generalised. The inference of the study may provide valuable suggestions for educators to alter the instructional methods and strategies.

Though possible precautions were taken to obtain reliable and generalisable results, the investigator would like to point out ***certain limitations likely to enter*** into the study.

1.8.1. Selection of the Independent Variables for the study is confined to three major variables viz., ***Learning Style, Approaches to Studying*** and ***Achievement Motivation.***

1.8.2. Instructional objectives, related to ***cognitive domain*** only are included in the Achievement test. The other two domains - affective and psychomotor are not included.

1.8.3. Eventhough the population for the study is secondary school pupils, sample was confined to students studying ***standard*** IX only.

1.8.4. Selection of a few schools across the state intended for data collection may not be representative of ***all institutions*** in the sate.

1.8.5. The generalisability of the study will be limited to the extent of the nature of the tools and sample selected.

1.8.6. The components of Learning Style and Approaches to Studying were not taken as Independent Variables in Three-way ANOVA.

1.8.7. The components of Learning Style and Approaches to Studying were not taken as predictor variables in the Multiple Regression Analysis.

1.9. ORGANISATION OF THE RESEARCH REPORT

The presentation of this research report is as follows.

Chapter I. This chapter include the introduction into the problem, Need and significance of the study, Statement of the problem, Definition of Key terms, Objectives and Hypotheses. A brief description of Methodology, Scope and limitations of the study and Organisation of the research report are also given.

Chapter II. It is concerned with Review of literature of variables and is organised under two headlines. The Body of theory pertaining to

Variables and the Body of Research studies pertaining to the Variables. A brief discussion on Meta Analysis is also presented.

Chapter III. Exclusively deals with the methodology adopted for the present study. Describes the Tools employed for collection of Data, Selection of sample for the present study, Data collection procedure, scoring and consolidation of data and Statistical techniques used for the analysis of data.

Chapter IV. Provides explanations of statistical procedure used to Analyse the data. Details of Preliminary Analysis, Mean Difference Analysis, Three-way ANOVA, Graphical representation, and Scheffe' test of Post-hoc comparison, Multiple Regression are presented along with the discussion of results.

Chapter V. A summary of the study – Study in Retrospect, Objectives and Hypotheses, Methodology, Major findings of the study, Tenability of Hypotheses, Educational implications and Suggestions for further research etc. are highlighted.

REVIEW OF RELATED LITERATURE AND META ANALYSIS

Hassan koya M.P. “Influence of learning style approaches to studying and achievement motivation on achievement in biology of secondary school pupils” Thesis. Department of Education, University of Calicut, 2002

Chapter

Two

REVIEW OF RELATED LITERATURE AND META ANALYSIS

CHAPTER 2

REVIEW OF RELATED LITERATURE AND META ANALYSIS

This chapter presents the underlying theories of variables, attempts to provide a better understanding of the concept and explores the relationship between variables. This chapter is organized in the following headlines.

2.1. THE BODY OF THEORY PERTAINING TO THE VARIABLES

2.1.1. LEARNING STYLE

2.1.2. APPROACHES TO STUDYING

2.1.3. ACHIEVEMENT MOTIVATION

2.2. THE BODY OF RESEARCH STUDIES PERTAINING TO THE VARIABLES

2.2.1. STUDIES ON LEARNING STYLE AND ACHIEVEMENT

2.2.2. STUDIES ON APPROACHES TO STUDYING AND ACHIEVEMENT

2.2.3. STUDIES ON ACHIEVEMENT MOTIVATION AND ACHIEVEMENT

2.2.4. META ANALYSIS

A detailed description of each of these sub sections are the following.

2.1. THE BODY OF THEORY PERTAINING TO THE VARIABLES

This section of the review exclusively deals with the theoretical aspects related to the Independent Variables, Learning Style, Approaches to Studying and Achievement Motivation.

2.1.1. LEARNING STYLE

The concept of Learning Style is based on the theory that an individual responds to educational context with ***consistant behaviour*** and ***performance*** patterns (Irvine & York, 1995). Learning Styles are ***personal ways*** in which individual processes information in the course of learning new concepts and principles. It is viable to argue that the concept Learning Style has been used ***synonymously*** with ***Cognitive Style*** by early researchers owing to its cognitive process. However, more sophisticated studies showed that Learning Style encompasses ***cognitive processes on one hand*** and ***personality on the other.***

2.1.1.1. Emergence of the Concept

The credit of pioneering research work in Learning Style goes to Pask (1976). The term Learning Style was first used by Pask while reporting the distinctions between students based on their learning strategies. This is a recent and attention captivating ***student specific characteristic*** which like Intelligence is closely associated with Learning (Pask, 1976). The identification of this fact prompted the researchers to turn their attention towards a new aspect in the learning process - ***Learning Style.***

While tracing the origin of the construct Learning Style, some of the earlier attempts especially that of Guilford (1967) is to be acknowledged.

Guilford noticed that some student prefer ***Divergent thinking*** while others are comfort with ***Convergent thinking.*** Similarly Wallach and Kogan (1965) and Hudson (1966) drew attention to the existence of two distinct groups of children ***Convergers and Divergers.*** Convergers score on Intelligence than creativity and Divergers vice versa. Hudson (1966) claims that these two groups showed markedly ***different pattern of thinking, constructing subject choices*** in school and in ***varying personality configurations.*** This inspired researchers to the idea of individual differences in which cognitive differences were accompanied with personality difference. ***Recognition of this pattern*** becomes the milestone of Learning Style research.

2.1.1.2. Widening the Concept

Bruner and associates (1956) describe various ways in which individuals learn concepts. These methods, called ***selection strategies*** control in order in which examples and non-examples of a concept appear. Four types of selection strategies are identified. They are ***simultaneous scanning; successive scanning; conservative focussing;*** and ***focus gambling.***

Kagan (1964) regard Learning Style as ***Conceptual tempos.*** These are basic dispositions of the individual either to reflect upon solution of a problem to make impulsive and unconsidered responses. Kagan (1964) identified with two different conceptual tempos. The child with ***impulsive*** or ***fast tempo*** solves a problem with a little or no delay. The child with ***reflective*** or ***slow tempo*** considers alternative solutions and therefore, delays his response.

In investigating how college students learn, Pask and Scott (1972) differentiated ***Holist*** and ***Serialist*** Learning Styles, Serialists were characterised by remembering informations in terms of lengthy ***strings of data.*** That is bits of information were related sequentially and in linear step by step fashion. The serialist style relies on memorisation. Holist on the other hand remembered in terms of ***hierarchical relations*** imaging the entire system of facts or principles in a more general manner, the focus being on ***big picture*** and ***fits details*** in later.

Pask also spotted ***versatile learners*** who shuttle between Holist and Serialist style as the situation demands. Besides, some students however, showed marked over-reliance on one or other of the styles and such students exhibit characteristic ***pathologies of learning*** (Globetrotting, Improvidence). Individuals with ***Globetrotting*** are over ready to jump to conclusion. While individual with ***Improvidence*** display over cautious reliance on details.

Studies show that Learning Style is related to other variables like Age, Aptitude, Occupation and Motivation. The following studies highlight these relationship. ***Learning Style as related to Aptitude*** (Witkin, 1973; Decosmo, 1977; Wegner, 1980). ***Learning Style as related to Age*** (Decosmo, 1977; Hunter, 1977; Wegner, 1980). ***Learning Style as related to Occupation*** and other ***Environmental Elements*** (Bennett, 1978; Pigg, *et al.*, 1980). ***Learning Style as related to Motivation*** (Vaidya, 1995).

Kolb (1983) described Learning Styles in terms of ***Convergers, Divergers, Assimilators*** and ***Accomodators.*** Here Convergers prefer ***abstract material*** and process it ***actively,*** while divergers look for

concrete information and process it ***reflectively***. Assimilators are comfort with ***abstract material*** processed ***reflectively.*** Contrary to this Accomodators prefer ***concrete information*** processed ***actively.***

Entwistle and Ramsden (1983) examined the connections between Approach, Learning Style and Personality. They found that the Deep Holists were likely to be impulsive thinking introverts with a theoretical outlook, aesthetic interest and complex conceptualisations. In contrast, surface serialists display a strong practical outlook accompanied by extrinsic motivation.

Indian investigator Verma (1996) describes Learning Style as the ***individual characteristics ways of processing information, feeling*** and ***behaving*** in the learning context.

2.1.1.3. Crystallizing the Concept

Conceptually the two variables - Learning Style and Cognitive Style - are ***interwoven*** and further precision is badly needed to crystallize the two concepts. The earlier descriptions of Learning Style were primitive in nature and reduces the concepts to ***bipolar elements***. But the recent advanced studies describe it as a multidimensional one (Harvey, 1994). This new perspective is widely accepted primarily because it accommodate the subtle ***individual difference*** as well as ***educational*** and ***social context*** in which the student learn. The Multidimensional approach on how student learn is hypothesized on the relationship between ***student characteristic*** and ***Instructional setting*** (Harvey, 1994). In contrast, Cognitive Style involves ***cognitive process only.***

Major dimensions or style areas which are included in the multidimensional approach are - ***Environmental, Emotional, Sociological, Physical*** and ***Psychological.*** A cluster of related style elements forms a style area. For instance, Environmental style area includes the learner's preference to ***noise level, light, temperature*** and ***designs;*** Emotional area includes style elements ***motivation, resistance, responsibility*** and ***structure;*** Sociological area represents learning with ***peers, authority*** and ***several ways;*** Physical area encompasses ***different modes of learning*** and ***time of learning*** such as ***auditory, visual, tactile, kinesthetic, evening/morning, afternoon*** and ***mobility*** and Psychological area includes ***psychological traits.***

Put into a nut shell, students Possess biologically based physical and ***environmental learning preferences*** which along with well established traits like ***emotional*** and ***sociological preferences*** combine to form an individuals' Learning Style profile.

The work of Harvey (1994) has made a breakthrough by distinguishing Learning Style and Approaches to Studying as ***two separate conceptualisation*** on how student learn and study. Factor analysis shows that Style and Approach load on separate factors and so it is possible to differentiate between the way student learn, in terms of either Style based or Approach based constructs.

In short, the evolution of the concept Learning Style and it's potential utility in the learning process is ***certainly appealing***. The significance lies in ***improving learning*** making learners ***aware of learning tasks,*** and to confront the different tasks (Presland, 1995).

2.1.1.4. Measurement of Learning Style

Learning Style is generally assessed through ***questionnaires*** or ***self report inventories***. Some of the Learning Style inventories used at present are described in this part.

Kolb and ***Fry*** (1975) and ***Kolb*** (1983) developed an approach in classifying Learning Style. They linked Learning Style to a model of learning process named ***experiential learning*** model. Based on this, ***Kolb*** and ***Fry*** developed a Learning Style Inventory called ***Kolb's Learning Style Inventory.***

Pask's (1976) Learning Style Inventory comprises of the strategies - Holist/comprehension learning; Serialist/operation learning; Versatile; and the pathologies of learning - Globetrotting and Improvidence.

Torrance's Inventory (Torrance & Rockenstein, 1988) helps to distinguish people in terms of whether they rely on right brain or left brain functions or they integrate those functions by both hemisphere equally.

Kolb's (1983) revised Learning Style Inventory, distinguishes four Learning Styles - Convergers, Divergers, Assimilators and Accomodators.

Productivity Environmental Preference Survey - PEPS (Price, *et al.*, 1991) based on Dunn and Dunn Model of Learning Style covers five style areas viz., Environmental, Emotional, Sociological, Physical and Psychological with their associated style elements.

Based on the Dunn and Dunn model of Learning Style in Indian context ***Kumar, et al.*** (1996) developed another Learning Style Inventory.

It is an all inclusive Inventory which accommodates student's unique preferences in major style areas like physical, emotional, environmental and sociological.

2.1.2. APPROACHES TO STUDYING

Over the years, researchers in the field of education are ***hard pressed*** to explain the factors affecting learning. The emphasis in current research of this theme is ***dynamic*** and ***process-oriented*** approaches to learning and learner characteristics. The response by the learners to new situations has contributed to the ways in which ***the learner perceives the world*** and ***events.*** Kelly (1955) showed the ***difference*** in individual perception and response to events. Events and concepts are meaningful when viewed from the individual's own perspective.

2.1.2.1. Learning From Learners Frame of Reference

Eventhough researchers on classroom learning have made many significant contributions to understand the process of learning , they often ***fail to address the personal view point of the learner.*** One cannot fail to appreciate the work of Freire (1970) in this concern. Freire argues that learners have a ***personal perception*** on the world, so that their personal meaning and constructs can only be comprehended in their unique personal and social context. Events are meaningful when viewed from individual's own perspective.

As a consequence, researchers accepted that it is essential to unfold the process of learning from ***pupil's perspective.*** This calls for the students to describe their ***unique experiences*** in the learning process. And also

explanations of learning have to be related to ***specific environments*** (Entwistle, 1987).

Peel (1972) and his co-workers categorised students' reports in terms of ***quality of thinking***. The main distinction was found between student's explanation and descriptions about how they experienced the process of learning. This led to the important conclusion that there is always ***qualitative differences in student expression of individual understanding*** (Entwistle, 1987). Heath (1978) noticed marked personality difference among student's ***method of learning.***

At this juncture, it will be meaningful to look at the work of European (Entwistle & Robinson, 1976) and Swedish (Marton & Saljo, 1976) researchers. The main theme under their research interest was shown a ***shift from cataloguing of student behaviour*** during the course of learning to ***the student description of learning and its qualitative differences.*** This trend in research paved way for a new concept - Approaches to Studying and Learning.

2.1.2.2. Approaches to Studying : Unveiling the Core Concept

The central idea of the construct ***Approaches to Studying*** is derived from the studies conducted abroad at three different places independently - in Sweden (Marton & Saljo, 1976; Fransson, 1977; Svensson, 1977); in United Kingdom (Entwistle & Robinson, 1976; Entwistle, *et al.*, 1979) and in Australia (Biggs, 1979). ***A Birds' eye view*** of these different studies show the emergence of a single concept derived from different grouping termed

as ***Deep/Surface*** Approaches. However these concepts show affinity to thoughts of Watts (1810) and Dewey (1910) long ago.

The work of Swedish researchers Marton and Saljo (1976) open door to a ***qualitative approach in research on learning.*** The main interest of the study was how student learn everyday task of reading an academic article. The study focussed on the process had used and how these related to ***levels of understanding reached.*** They have examined the differences in the types of understanding reflected in pupils own description about how they approached learning materials. This description of student experiences of learning has been called ***phenomenography.***

A ***Deep Approach*** is described as meaning oriented, transformation or internalising where as ***Surface Approach*** is superficially oriented emphasizing more on mechanical reproducing (Speth & Brown, 1988).

Intention, content and context, perception of the task and its settings, motives and academic self concept are found to influence Approaches to Studying directly. Marton (1988) built up the concept of Approaches to Studying based on the intentions of students. Long ago, Dewey (1916) recognised the importance of ***intentions in student learning.*** The reflective process resulted from intentions to learn is the heart of the learning process. ***Intentions vary*** both between individuals and within an individual depending on the task at hand. Previous knowledge and skill plays a substantial part in determining the level of understanding reached, but subsequent research was confined how important initial intention is. The work of Marton and his co-workers (1976) become significant at this point.

Entwistle (1981) was successful to ***delineate*** the concept of Deep Approach and Surface Approach. In Deep Approach ***intrinsic motivation*** is associated with an intention to reach ***personal understanding*** of the learning material. For this the learner has to interact critically with the content, integrating it to previous knowledge and experience as well as seeking evidences and evaluating logical steps by which conclusion is drawn.

In contrast, a ***Surface Approach*** is based on ***extrinsic motivation,*** learning superficially as memorisation with an ***intention to satisfy course requirement.*** Learning becomes a balancing act between ***avoiding failure*** and ***not working too hard.***

Results of the empirical work of Biggs (1979) also indicate the ***individual difference in Learning approaches*** can be reduced to Deep and Surface. But the study lift the concept to higher level by discovering a new orientation termed ***Achieving.*** It is an alternative approach to Deep and Surface. In this case, depending upon the learning material the student, shuttles between Deep and Surface with an intention to ***maximise the Grade*** (Valet & Chalmers, 1992). This approach involve ***strategic management of time*** and ***effort and intellectual resources.*** Achieving Approach is otherwise called ***Strategic Approach*** (Ramsden, 1979).

Examination of the studies mentioned earlier on learning show that student's learning fall into two categories viz., ***Deep*** or ***Surface Approach.*** These approaches are assumed to be relatively stable within the individual. However, while using the terms Deep or Surface, it is to be guarded that the ***approach is categorising and not the students.*** The approaches vary to

some extent from ***task to task*** and ***from teacher to teacher*** and ***student varied their strategies across different types of tasks*** (Entwistle, 1987).

2.1.2.3. Conceptual Linkage

Continued researches on Approaches to learning and the varying methodologies used by different investigators produced ***Conceptual overlaps*** in the constructs identified.

Entwistle and Robinson (1976), Entwistle, *et al.* (1979) conceptualised that, each of the two approaches are to be ***sub divided into two,*** depending on the degree of activity, attention and involvement shown by the student. Thus four types could be described as ***Deep active, Deep passive, Surface active, and surface passive.***

Fransson (1977) demonstrated that Approaches to learning depend on perceived ***relevance*** and ***anxiety.*** Biggs (1978) developed a Study Process Questionnaire (SPQ) and suggested ***three*** strategies as ***Reproducing, Internalising*** and ***Achieving.*** In which the first two are similar to ***Deep*** and ***Surface Approach to learning.***

Schmeck (1983) argued that ***individuals' predispositions*** play a major role in determining the approach and listed ***four orientations.*** Deep processing, Elaborate processes, Fact retention and Methodical study. Deep processing and Elaborate process are equal to ***Deep Approach of*** Marton and Fact retention is similar to ***Surface Approach.*** Methodical study is consistent with Achieving Strategy of Biggs.

Considering the work of Marton and co-workers (1976) and Pask's (1976) Learning Styles and pathologies, Entwistle, *et al.* (1979) reported

three main Orientations to studying. ***The Meaning Orientation*** (Deep Approach and Comprehension Learning), ***Reproducing Orientation*** (Surface Approach and Operation learning) and ***Achieving Orientation*** (Organised study and Achievement Motivation). Meaning and Reproducing are similar to Marton's Deep and Surface Approach. The variability in learning tasks and influence of academic departments were firmly substantiated later, and Entwistle and Ramsden (1983) added one more orientation termed as the ***Non-academic*** (Disorganised study methods + Negative Attitude to study and social motivation + Learning Style and pathologies).

2.1.2.4. Measurement of Approaches to Studying

An exhaustive review of the related studies revealed the different instruments developed to measure the student's Approaches to Studying.

Schmeck, *et al.* (1977) developed a 62 item ***Inventory of Learning Processes*** which was derived from the factor analysis of self report items. In that Schmeck reported four main factors namely, ***Surface processing, Disorganised study methods, Fact retention*** and ***Elaborative processing.***

Biggs (1978) developed a ***Study Process Questionnaire*** (SPQ) in which 10 unidimensional scales were included to assess the study process of higher education students. The dimensions are Pragmatism, Academic motivation, Neuroticism, Internality, Study skills, Role learning, Meaningful learning, Test anxiety, Openeness, and Class dependence. When factor analysed the SPQ showed a stable second order structure consisting three dimensions viz., Reproducing, Internalsing and Achieving.

Entwistle, *et al.* (1979) developed an ***Approaches to Studying Inventory*** (ASI). Three orientations to study viz., the Meaning, Reproducing and Achieving were developed from an initial pool of 15 subscales.

Entwistle, *et al.* (1979) developed a ***short version of ASI*** (30 item) included the scales viz., Achieving Orientation, Reproducing Orientation, Meaning Orientation, Comprehension learning, Operation learning, Improvidence and Globetrotting.

Entwistle and Ramsden (1983) designed another ***Approaches to Studying Inventory***. They reported four Orientations to studying viz., Achieving orientation, Reproducing orientation, Meaning orientation and Non-academic orientation.

Working within the frame-work of cognition, information processing and memory rather than intention, motivation and personality Schmeck (1983) have developed the ***Inventory of Learning Process*** (ILP) which consists of a series of behaviourally oriented statements and identified four orientations. Deep processing, Elaborate process, Fact retention and Methodical study.

Utilising the cognitive basis Weinstein, *et al.* (1983) constructed the ***Learning And Study Strategy Inventory*** (LASSI) comprising 10 scales; such as Anxiety, Attitude, Concentration, Information processing, Motivation, Scheduling, Selecting the main idea, Self testing, Study aids and Test strategies.

Pillai, *et al.* (1992) developed a ***Science Studying Approach Inventory*** (SSAI)for measuring the Approach of pupils towards learning science. It covers two aspects viz., Deep Approach versus Surface Approach and Organised study Method versus Disorgnised study Method.

Recently, ***Kumar*** and ***Koya*** (2001) developed an ***Approaches to Studying Inventory*** for measuring the variable Approaches to Studying. This Approaches to Studying Inventory (ASI) takes the advantage by encompassing the four components of Approaches to Studying viz., ***Meaning Orientation, Reproducing Orientation, Achieving Orientation*** and ***Non-Academic Orientation***. Each component in turn include four sub scales.

2.1.3 ACHIEVEMENT MOTIVATION

Theory and research pertaining to ***Achievement Motivation*** had gained much importance in the last three decades. Achievement motivation, also referred to as the ***need for achievement*** ('n' achievement) is an important determinant of aspiration, effort and persistence when an individual expects that one's performance will be rated against some standard of excellence. Truly speaking, Achievement Motivation is conceived as desire to ***accomplish something difficult.*** The desire is accompanied by action, that is the individual make intense, prolonged and repeated effort to accomplish something difficult (Murray, 1938).

2.1.3.1. An Offshoot of Motivational Theory

The construct ***Achievement Motivation*** came to existence as an off-shoot of motivational theory proposed by Murray (1938). Murray in the theory made explicit that individual ***differ considerably in the needs,*** and the major needs characterise the individual. The theory is organised around a list of ***twenty needs.*** Out of the different needs, the focus of attention was given to ***social needs*** such as need for affiliation, need for power and need for Achievement.

To Murray, need is a construct which stands for a ***force in the brain region,*** a force which organises perception, appreciation, conation and action in such a way as to transform in a certain direction an existing, unsatisfying situation. Needs are either internally aroused or set into action as a result of external stimulation. The need energises ***activity*** on the part of organism and ***maintains this activity*** till the organism alters the situations so as to reduce the need.

Maslow (1954) identified a ***hierarchy of needs*** ranging from the physiological need to the self actualisation need. The most urgent need will monopolise the individual attention while other needs remain ***dormant for the time being.*** Once a need is fully satisfied it no longer motivates behaviour and ***next higher need*** becomes the motivator. If it is the case – a lower one conflict with a higher one of equal strength – the ***lower one will predominate.*** The higher level of functioning occurs when a person is ***self actualised*** having had all other need in the hierarchy are satisfied.

2.1.3.2. Why Achievement Motivation Varies Among Individuals?

It was Mc Clelland (1961) who provided a theoretical base for the ***variation of Achievement Motivation.*** McClelland argues that Achievement Motivation develops in some people more than in others. It is because in some people Achievement Motivation outcomes have positive effect, that is those outcome are only of moderate discrepancy from what has been previously experienced. For the others the outcomes are of great discrepancy and thus have negative, avoidance effect on the individual.

According to Mc Clelland those who were high in n-achievement shows a ***greater preference for intermediate risk*** than those who were low in n-achievement. In other words an achievement oriented person select intermediate task to begin with and choose progressively greater difficulty whenever the individual experiences success.

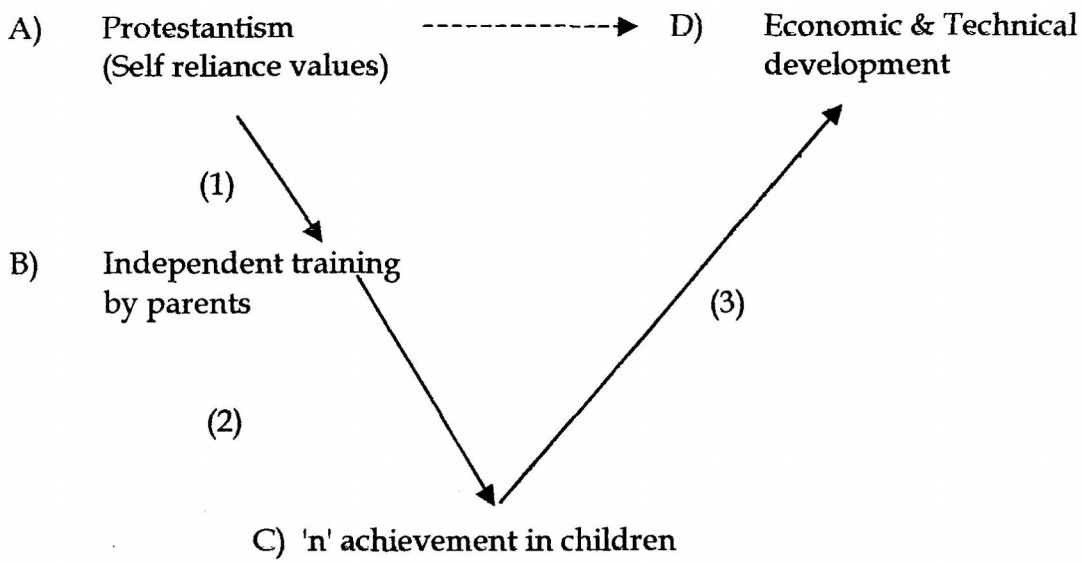
In order to arouse the achievement motivation, the individual must be prepared to ***shoulder responsibility*** for the outcome, whether it is success or failure. As there is a slogan ***No pain, No gain*** the willingness to accept the risk element hidden in the given task varies from individual to individual.

2.1.3.3. Need for Achievement Precede Economic Growth

Mc Clelland (1961) hypothesised that need for achievement is ***related to economic growth.*** Mc Clelland's hypothesis was guided by findings relating to ***child rearing practices.*** It had been reported that ***boys*** relatively high in need for achievement had mothers who retrospectively reported that they expected their sons to be ***self reliant and independent at***

an early age. These mothers believed that their sons should know their way round city, make their own friends and the like, at an early age than the mothers whose sons were low in need for achievement.

Mc Clelland noticed that ***Protestantism*** (Protestant reformation and growth of captialism/economic and technological development) is related to child rearing practices in the following way.



Mc Clelland examined

(1) ***Protestantism*** and ***early independent training***

(2) ***Early independent training*** and ***need for achievement***

(3) ***Need for Achievement*** and ***economic growth.***

Protestant families expect earlier mastery from their sons than Catholican families and that early independent training produces concern about achievement. The crucial question was whether the association between Protestantism and economic activity is mediated by achievement

needs. It is hypothesized that Achievement needs preceed economic growth.

Indeed, achievement related dispositions are formed early during childhood, and if the dispositions are relatively enduring, then attempts to modify an adult level of achievement needs are fruitless. The only practical way to alter the achievement needs of the members of the society and, as a probable consequence the economic growth would be to change child-rearing practices and wait sometime to determine whether or not changes were effective.

2.1.3.4. Dancing On the Edges of 'Hope for Success' and 'Fear for Failure'

Achievement oriented behaviour was viewed by Atkinson (1964) as a resultant of a conflict between ***Approach*** and ***Avoidance*** tendencies. Associated with every achievement related action is the possibility of success (with the consequent emotion of pride) and the possibility of failure (emotion of shame). The ***strength of the anticipated emotions*** determine whether an individual will approach or avoid achievement oriented activities. In other words achievement behaviour is viewed as the resultant of an emotional conflict between ***hope for success*** and ***fear for failure.***

Atkinson recgnizes two types of people. They are ***a) person whom the need to achieve is greater than the fear of failure and b) the person for whom the fear of failure is greater than the need to achieve.*** Each of these individuals is motivated by the desire to achieve some pleasant effect. The difference being that for the former the pleasant effect is in achieving, where as for the later the pleasant effect is avoiding a sense of failure.

2.1.3.5. Achievement Motivation: A Cognitive Model

Deei's (1975) cognitive model of behaviour include ***five important elements.*** They are ***Stimulus Inputs, Awareness of Potential Satisfaction, Selection of Goal, Goal directed Behaviour*** and ***Rewards and Satisfaction.*** Deei asserts that people seeks goals which they expect to bring rewards. When a person gets the reward for achieving a goal, he feels ***satisfied*** and this satisfaction is the final step in the sequence and will lead to termination of the sequence.

2.1.3.6. Contributing Factors

Ohja (1973) while investigating the relationship of Achievement Motivation to parental behaviour and certain socio-economic variables found that ***mother's love*** and ***father's permissiveness*** were positively related to n-achievement. Ohja also noted that encouragement for independence by parents was associated with high n-achievement in children where as sons of entrepreneur fathers, boys from nuclear families had higher n-achievement than sons of bureaucrat fathers and boys from joint families.

Certain psychological variables also exercise profound influence on n-achievement. They include ***anxiety, self esteem, curiosity, level of aspiration*** etc. Out of these, level of aspiration is incorporated into the achievement motivation literature under the terms ***expectancy*** and ***risk-taking.***

2.1.3.7. Measurement of Achievement Motivation

It was Mc Clelland (1961) who initiated research for the development of techniques for a measurement of human motivation. The measurement technique of motivation can be broadly classified into five categories (Singh, 1981). They are following :

i) ***Production measures***: behaviour measures theoretically related to motivation and activities representative of academic interest and endeavour grade point average.

ii) ***Self concept measures***: Consist of questionnaires, rating scales and check list which elicit an individuals' assessment of his own behaviours, belief of preferences.

iii) ***Observers ratings:-*** they are ratings made by the observers instead of the individual.

iv) ***Projective techniques:-*** based on the assumption that individuals project some part of themselves in everything they do.

v) ***Objective tests***: they are assessment procedures which obtain consistent scores.

Recently, Casssidy and Lynn (1989) developed a ***multifactorial scale,*** enables the researchers to incorporate a more comprehensive analysis of Achievement Motivation. Multidimensional analysis overocme the limitations laid by unidimensional approaches.

Pillai and Kumar (1993) developed a ***Scale of Achievement Motivation,*** which is modelled after Cassidy and Lynn (1989). It comprises

seven factors viz., Work ethics, Acquisitiveness, Dominance, Excellence, competitiveness, Status aspiration and Mastery.

2.2. THE BODY OF RESEARCH STUDIES PERTAINING TO THE VARIABLES

This section is confined to the body of research studies related to the Independent Variables with Student Achievement.

2.2.1. STUDIES ON LEARNING STYLE AND ACHIEVEMENT

Extensive survey of related literature helped the investigator to gather a large number of studies on Learning Style and Academic Achievement. They are grouped into two; studies showing positive relationship and studies showing negative relationship/no relationship between the variable ***Learning Style*** and ***Achievement.***

2.2.1.1. Learning Style and Academic Achievement : Positive Relation

Green, et al. (1984) explored the relationship between students Learning Style and Attainment and found Learning Style was equally or somewhat ***more predictive of future attainment*** compared to IQ.

Okahayashi, et al. (1984) studied the preference and attitudes towards learning of 148 intellectually gifted children and reported that practice of integrative styles of information processing ***contributed to Academic Achievement.***

Pollock (1984) using Kolb's Learning Style Inventory found that students preferring ***Abstract Conceptualisation matched with Abstract conceptualising teacher showed high performance.***

Smith and ***Holliday (1986)*** investigated the relationship of Learning Style and Academic Achievement on fourth, fifth and sixth grade students. The findings showed that the ***high achievers display a significant preference for a particular Learning Style.***

Harpole (1987) conducted a study focused on the difference between male and female secondary school chemistry students is an effort to determine the relationship of gender and Learning Style to achievement and laboratory skills. The Canfield Learning Style inventory Form SA was used to determine student's Learning Style. The result of the study indicated that male chemistry students preferred situation that involve numbers and logic, computing and solving mathematical problems and ***benefitted from the course work that was logically and clearly organized.*** Female chemistry students tended to need laboratory activities in which they could work with people and help each other.

Verma and ***Verma (1987)*** conducted a study on 120 adolescents, found that there were significant ***difference in the Achievement*** in various subjects and total areas of study based on Learning Style adopted by adolescents.

An effort by ***Atchinson (1988)*** to determine the relationship of sixth grade students, revealed that there exist statistically ***significant relationship between style and total Reading Achievement.***

A study by the ***Dunn*** and ***Griggs (1989)*** revealed that when students are taught through their learning strengths, they ***internalise more, retain it***

longer and enjoy the process better than when they are taught through their weakness.

Potter and ***Emanuel*** ***(1990)*** revealed through their study that Learning Style preferences was a ***strong prediction of Achievement*** after studying the preference in Learning Style of 327 eighth and 12th grades.

Titus, et al. (1990) examined Learning Style among 918 high school students with Learning Style Inventory and came to the conclusion that ***adolescents tended somewhat more towards concrete,*** with female scoring high on this aspect.

In a comparative study by ***Cooper*** and ***Miller*** ***(1991)*** for 113 students and 16 faculty, the level of Learning Style Teaching Style congruency was related to academic performance and to student's evaluation of the course and the instructor. ***Difference in these evaluations were significant, while difference in course grade were not.***

After a brief review of the literature on sound, a study by ***Pizzo, et al.*** (***1991***) described involving Learning Style preference of 64 sixth graders. Result of exposure to either noise or sound revealed that students who ***preferred quiet performed best in quiet Acoustic Environment (AE), students who preferred sound, performed best in a very noisy Acoustic Environment (AE).***

Kalous (1992) investigated differences in association among Learning Styles, Study Approaches and within major Grade Point Average across a variety of academic majors of 151 undergraduate students. It was found that grade point averages ***positively related to Meaning Oriented cognitive***

learning strategies and good study habits for Biology students. But Reproducing Orientations to learning and shallow cognitive learning strategies were found to be negatively related to Academic success.

Moskwa and ***Claire (1992)*** investigated the correlation between student's Learning Style and their Academic Achievement. The Learning Style Inventory by Brown and Cooper was administered to 58 fifth grade students. Result indicate that overall, ***there was a negligible relationship between Learning Style and academic achievement,*** but there seem to be ***relationship between certain Learning Style and academic performance when they were examined on an individual basis.***

In a study by ***Ainley (1993)*** it was found that the ***Style of engagement in learning were significantly related to achievement.*** The sample was 137 eleventh grade students.

Barbara (1993) from her studies on effect of Learning Style Intervention on 1089 college student's Retention and Achievement revealed that students in the highest intensity group achieve ***significantly higher grade point average*** and higher intention rates than those in other groups.

Carthey (1993) attempted to find the relationship between Learning Styles and Academic Achievement and brain hemisphere dominance and academic performance. Findings suggest that post-secondary business and accounting instructors should consider testing their students to determine student's Learning Style and brain hemisphere dominance so that the instructors may suggest ***study approaches and methods that may increase Academic Achievement.***

Corlett (1993) examined the Learning Style profiles of 99 elementary and 47 secondary student teachers. Reading style Inventory was administered to assess the Learning Style. ***The higher visual styles were proved to be positively related to higher grades.***

Kim and *Michael (1993)* suggests that ***Right Brain (RB) dominated Learning Style is dominating over Left Brain (LB) dominating Learning Style for Academic Achievement*** of Korean high school students.

O'Brien (1994) assessed cognitive Learning Style and Academic Achievement in Secondary education and confirmed ***concrete - sequential students having highest grade point averages*** outperforming males.

Dunn (1995) conducted experimental studies based on the Dunn and Dunn Learning Style Model to determine the values of teaching students through their Learning Style preferences. Meta analysis determined that ***matching student's Learning Style preference with educational interventions compatible with those preferences is beneficial to their Academic Achievement.***

Dunn and *Griggs (1995)* analyzed and synthesized the similarities and differences among Learning Style of culturally diverse populations and describe how to teach and counsel adolescents with different Learning Styles. Research suggests that students whose ***instruction is not responsive to their Learning Style achieve significantly less than whose instruction is responsive.*** The instruments designed to identify Learning Style and ***21 elements of Learning Styles are identified.***

Evans and *Goodman (1995)* analyzed the factors behind children's learning difficulties in Mathematics from three kinds of characteristics: characteristics of the child, of the teacher/teaching method, and of the subject. The results suggests that ***perceived under achievement comes mainly from poor self-image, Learning Style, poor*** language skill, dyslexic type difficulties, different cultural background and dyscalculia.

Mathews (1995) examined the Learning Styles of post secondary and secondary students in selected institution of south Carolina. The study focused on the Learning Style of first year college students. It also examined the relationship between retention and Learning Style. The study found that first year college students ***preferred social and conceptual styles of learning to other styles, and that students with applied styles performed better*** in school and higher on standardised tests than did student with other styles.

A study conducted by *Mathews* and *Jones (1995)* among 101 Blacks, 226 whites and seven other races in teacher training programme shows that selection of social and conceptual style of learning as their predominant styles. Study also reveals a ***significant difference between Black and whites in their Learning Styles.***

Investigation by *Nunn (1995)* examined the effect of Learning style and strategies intervention upon at risk middle school student's Achievement. Result shows a ***significant relation exist between Learning Style and Achievement.***

Welch (1995) describes how to help low achievers to improve their grades and their self-concept. A middle school teacher adapted traditional testing procedures to student's Learning Style. The students were grouped based on their achievement level and participation in the alternative assessment programme. ***Participants had higher test grades, fewer behavioural problems and increased confidence.***

Mathews (1996) in a study shows that the students with styles of learning favouring a deemphasis of human relationship and an emphasis on deductive thinking rated themselves ***higher academically than did their peers with other styles of learning*** and that students who were people-oriented had the lower overall academic self assessment (SR).

Preetha (1996) investigated the effect of Learning Style and Achievement Motivation on Achievement in Biology on 650 secondary school pupils. Results showed that the ***main effect of Learning Style is significant for total sample and all the sub sample except for boys, rural boys and urban girls out of the nine ANOVA employed.***

Rehna (1996) examined the interaction effect of Learning Style and Approaches to Studying on Achievement in Biology of 700 standard IX students. Results indicated that the ***main effect of Learning Style on Achievement in Biology was significant, but not so with Approaches to Studying.***

Rech and *Stevens (1996)* in a study examined black 4th and 8th grader's Mathematics achievement and attitudes. The effects of gender ,

self concept, economic status and Learning Style were studied. ***Learning Style and gender predicted 8th graders' achievement.***

Sathy (1996) studied the relationship between Achievement in Hindi and Learning Style of secondary school pupils. Result indicated that ***significant correlation exists between Achievement in Hindi and Learning Style.***

Braio, et al. (1997) introduced varied Learning Style strategies in five stages to special education and low-achieving general education students. Pre and Posttest of Reading achievement and assessment of student's learning preference indicated that ***students with Learning Style preferences benefitted from Learning Style accommodation.***

Kumar (1997) investigated the effect of Learning Style on Achievement in secondary school Biology on 650 students. Analysis of the data indicated that ***Learning Style has significant main effect on Achievement in Biology.***

Kumar (1997a) studied the differences in Approaches to Studying and Learning Style between High - Achievers and Low - Achievers in secondary school Biology. 350 standard IX pupils were selected as sample. The investigator reported that ***there is significant differences between High and Low Achievers based on their Learning Style.***

Warren (1997) conducted a study to gather information on students participating in supplemental instruction at the University of Central Florida. Kolb's Learning Style Inventory was administered to the students. Findings show that ***Science students displayed assimilator and coverger***

Learning Style, while non-science students displayed accomodator Learning Style.

Burns, et al. (1998) investigated Learning Style differences of 500 students in grades four to eight using Learning Style Inventory. Although significant overall ***differences were found between average and above average achieving students in Learning Style preferences,*** specific findings contradicted on earlier study suggesting that it is inappropriate to categorise groups of learners of assuming similar Learning Style preferences.

Clooney (1998) describes a program for decreasing students under achievement. Persistent student under achievement was documented through homework percentages, overall grades and anecdotal accounts. Analysis of probable cause suggested that ***under achievement could be attributed to a mismatch of student Learning Style and teaching strategies,*** the student's negative relationship to learning in the past and insufficient parental support and involvement in student learning.

Dwyer (1998) found that (1) trait and context communication apprehension correlated significantly with Learning Style preference for women, but not for men. (2) high communication apprehensive women prefer the Hands-on-experimenter and analytical evaluation Learning Styles and (3) communication apprehension is not correlated with age, sex or self reported grade point average (GPA), but ***Learning Style preference is correlated with GPA and sex.***

Miller (1998) investigated the effect of Programmed Learning sequence. Classes in anatomy and sonography were both taught using lectures and programmed learning sequences in book format. Achievement was higher with Programmed learning sequences than lecture; and there was ***significant correlation between Learning Style preferences and Achievement.***

Moore and *Dwyer (1998)* in a study examined the effect of colour on information processing strategies of internal and external locus of control of learners. Specific objectives were to (i) examine the instructional effectiveness of the two types of visualized instruction in facilitating achievement for students with different Learning styles and instructional treatment. Result indicated that ***students who received colour-coded treatment scores significantly higher on the identification, drawing and overall assessment.***

Roark (1998) attempted to show that students that are classified as visual learner will score higher on standard tests than those students that are classified as non-visual learners. The Vocational Learning Styles Inventory, Piney Mountain Press, Inc., was used to determine the Learning Style. Result shows that ***visual learners group had higher mean scores than non-visual learners group in all area assessed.***

Geiser (1999) examined the effect of traditional versus Learning Style responsive study strategies on eighth grader's Mathematics Achievement, frequency of studying and attitudes. Found that students applying Learning Style - responsive study strategies had ***significantly higher***

Mathematics Achievement and attitude scores than students using traditional strategies.

Hong and ***Lee (1999)*** investigated the effect of parental awareness of their children's home work style on academic achievement. Result indicate that a higher ***degree of parental awareness of the child's homework style preferences was associated with a child having higher achievement.***

Garton, et al. (2000) found that college freshmen who preferred field independent and field neutral Learning Styles had higher grade point averages. ***Learning Style scores best predicted student retention.***

Rourke and ***Lysynchuk (2000)*** investigated the influence of Learning Style on Achievement in hypertext. The Learning Style was assessed using Learning Style Inventory (Kolb, 1985). Achievement was assessed with 420 multiple choice quizzes. ***Significant difference was found between Divergers, who scored highest, and Accomodators, who scored lowest.***

Thomas, et al. (2000) studied Learning Style preferences of Japanese college students pursuing an undergraduate degree at a New Zealand college. The goal is to learn more about between style and achievement. Result showed the ***most preferred sensory style to be kinesthetic, auditory, tactile and hands-on. It is also noted that there was a significant relationship between kinesthetic style preference and higher grade*** in the practical, skill based course.

Wingenbach (2000) in a study found that students with a ***field independent Learning Style scored significantly higher than field dependent students.***

Drysdale, et al. (2001) investigated the effects of cognitive learning style on first year academic performance in 19 University courses. ***Academic performance based on Learning Style was significant in 11 courses. Science and mathematics courses appear best suited to sequential thinkers.***

Dunn, et al. (2001) examines the multiple intelligence and Learning Style. ***Focus on the Dunn and Dunn Learning Style model that identifies individual's preferences*** for specific instructional environments, strategies and resources ***and the extent to which they affect Academic Achievement.***

Doss and ***Muthiah (2002)*** carried out investigation to identify the Learning Style prevalent among college students, to study the influence of personal factors and institutional background and to correlate styles of learning with academic performance of college students. The results indicate that the ***predominant styles of learning among the college students are collaborative styles and academic performance of the college students is related to their Learning Styles.***

2.2.1.2. Learning Style and Academic Achievement: Negative Relation/ No Relation

Crisman (1984) studied the influence of Learning style on Academic Achievement on the sample of 11th grade children and reported that

Learning Style appeared to be significantly different from student's Academic Achievement.

Ferris (1984) reported ***no correlation similarity in Learning Style and Achievement.*** The study was conducted among 147 fifth grade students.

Hanpol (1987) studied the relationship between Learning Style and Achievement of 74 Thai University students. Result shows that ***no statistically significant relationship exist between Learning Style and Achievement.***

Sanley (1987) investigated the relationship between Learning Style and problem solving success of 180 freshman college preparatory students. Result shows no ***relationship between Learning Style and problem solving success.***

Cynthia (1988) done an effort to find out the relationship between match or mismatch of Learning Style preference of students and teachers and actual student achievement. It was found that ***students' Learning Style did not contribute significantly in Achievement.***

Knight (1990) studied the effect of Learning Style accommodation on Achievement on 158 second graders. The result showed that the ***Learning Styles of the students are not positively related to the Academic Achievement.***

Leiden, et al. (1990) administered two Learning Style tests to 79 medical students at the University of Neveda school of Medicine and

concluded that ***Learning Inventory tests are not good predictors of Academic performance.***

O'Brien (1991) investigated the relationship between Learning Style and other characteristics and conditions, such as teaching styles, Achievement, students' age and students' gender. The Gregore Style Delineator (GSD) was employed to determine the dominant style of both teachers and students. GSD uses a quaternary design to place study subjects in one of the following Learning styles: Concrete Sequential (CS), Abstract Sequential (AS), Concrete Random CR) and Abstract Random (AR). ***No significant main effect was present for either student Learning Style or matched and mismatched conditions.***

Farrell (1992) studied the relationship between students Learning Style and Academic Achievement of fifth graders in a suburban middle school. The result showed ***negligible relationship between Learning Styles and Academic Achievement.***

Orr and ***Davidson (1993)*** investigated the effect of group computer-based instruction and Learning Style on Achievement and attitude. The study conducted for 190 elementary school students in grade IV and V in Austin. Students were assigned to six experimental conditions of cooperative or individual learning stratified by Learning Style. ***Result do not support the hypothesis of interaction between instructional delivery and Learning Style for both performance and attitude.***

Harasym (1995) administered Gregore Style Delineator (GSD) to 260 nursing students. The results were compared with Achievement scores in a

human anatomy and physiology course. Factor analysis and VARIMAX rotation demonstrate that there is ***no relationship between any of the four Learning Styles allegedly identified by the GSD and Achievement in*** Anatomy and Physiology.

Howie (1996) in a study investigated the reading style of students in grades II,IV and V. Special attention was given to independent variables gender, grade level, and at-risk status. Result appeared that ***no one element of Learning style was the contributing factor to improved Academic Achievement.***

Melara (1996) examined the effect of Learning Style on the performance of college students within two different hypertext structure. Result indicate both structures equally accommodated learners with preferences on experimentation and learners with preferences on observation; net work structures accommodated Learning Style better than hierarchical structures; and ***no significant differences was found in the learners' Achievement.***

Myers and ***Munsinger (1996)*** investigated the relationship between Learning Style and programming achievement in two paradigms; imperative and functional. Learning Style was measured by the Kolb Learning Style Inventory, and achievement was measured by programming course grades. Subjects were 32 undergraduate computer science students at Trinity University. ***General ability in programming proved much stronger on effect than Learning Style on success in programming course.***

Horton and ***Oakland (1997)*** tested the hypothesis that students learn best when teachers use strategies consistent with student's temperament based Learning Style. ***Analysis of 417 seventh graders did not support the hypothesis.***

Santhoshkumar (1997) investigated the influence of Learning Style and Gender on Achievement in Chemistry of 591 standard IX students. The findings revealed that ***there is no significant single effect of Learning Style and Gender on Achievement for the total sample and sub sample.***

Day, et al. (1998) investigated the effect of world wide web Instruction and Traditional Instruction and Learning Styles on Achievement and changes in students' Attitudes in Technical writings in Agri-communication course. Traditional instruction in technical writings was given to 29 students and 29 were instructed via world wide web. Examination scores and Group Embedded Figures Test results showed the web class had significantly higher Achievement and attitudes towards writing. ***No correlation was found between Learning Style and achievement or attitude.***

Garton, et al. (1999) studied the relationship between Learning Style and achievement among 187 animal science students. ***Achievement was not significantly correlated with Learning Style.***

Gopalan (1999) explored sex and locale difference existed in Learning Style of secondary school pupils. Results show that in Environmental, Emotional and Sociological component, no significant difference between total boys and total girls. But for the Physical component of the Learning

Style there exist difference. ***It is also found that there is no statistical significant difference between the Learning Style (Component wise and Total score) of Rural sample and the Urban sample.***

Marszalek and *Lockard (1999)* investigated and compared the level of initial and long-term retention of frog internal anatomy using an interactive CD tutorial, a desk top microworld and conventional frog dissection. Additional data on student's preferred Learning Style were used to explore possible interaction effect with their respective instructional activity. ***No significant difference in Achievement by Learning Style was observed.*** However the interaction between Learning Style and treatment was significant in some cases.

Miller and *Polito (1999)* grouped college agriculture students into cooperative learning teams based on their Learning Style: field dependent, field independent, field neutral or mixed. Result show that ***Teams with heterogeneous Learning Style did not perform better than homogeneous teams.***

Stickle, et al. (1999) collected Kolb Learning Style Inventory data from veterinary medical students and compared the data with transcript and career data. ***It was found that students have diverse Learning Styles do not appear to influence completion of the curriculum or future professional activities.***

Seng and *Yeo (2000)* in a study explored the role of cognitive style, spatial visualization in student achievement. The study focuses on relationship between Learning Styles and brain hemisphericity. Result

indicate that there are no significant differences in Learning Style preferences from three brain dominance groups.

A ***summary of studies*** on Learning Style and Achievement follows.

Studies Showing Positive Relation		
Author	**Variables**	**Result**
Green, *et al.* (1984)	Learning Style and Achievement	Learning Style predicted future attainment
Okahayashi, *et al.* (1984)	"	Learning Style contribute to Achievement
Pollock (1984)	"	Student Style preference match with teachers style
Smith and Holliday (1986)	"	High Achievers show Style preference
Harpole (1987)	"	Male and female show difference in Learning Style preference
Verma and Verma (1987)	"	Difference in Achievement based on Learning Style
Atchinson (1988)	"	Relationship exist between Style and Achievement
Dunn and Grigggs (1989)	"	Students learn more when taught through their learning strength
Potter and Emanuel (1990)	"	Style preference predicted Achievement
Titus, *et al.* (1990)	"	Adolescents tended towards concrete Style preference
Cooper and Miller (1991)	"	Learning Style –Teaching style congruency related to academic performance

contd...

Author	Variables	Result
Pizzo, *et al.* (1991)	Learning Style and Achievement	Academic performance vary according to Style preference.
Kalous (1992)	"	Good study habit positively related to Grade points
Moskwa and Claire (1992)	"	Negligible relationship with Achievement
Ainley (1993)	"	Style of engagement related to Achievement
Barbara (1993)	"	Positively related to Achievement
Carthey (1993)	"	Detection of Style preference increase Achievement.
Corlett (1993)	"	Higher visual Styles Positively related to higher grades
Kim and Michael (1993)	"	Right brain dominated Learning Style improve Achievement
O' Brien (1994)	"	Concrete sequential students have higher grade points
Dunn (1995)	"	Matching students' Learning Style preference with educational interventions is beneficial to Achievement
Dunn and Griggs (1995)	"	Instruction responsive to Learning Style enhances Achievement
Evans and Goodman (1995)	"	Under achievement comes from poor Learning Style
Mathews (1995)	"	Students with preferred Styles perform better
Mathews and Jones (1995)	"	Difference between Black and White in their Learning Styles

contd...

Author	Variables	Result
Nunn (1995)	Learning Style and Achievement	Significant relation exist between the variables
Welch (1995)	"	Adaptation of testing procedure to students Learning Styles help to obtain higher grade
Mathews (1996)	"	Style of learning emphasizing deductive thinking had higher grade
Preetha (1996)	"	Significant main effect on Achievement
Rehna (1996)	"	Significant main effect on Achievement
Rech and Stevens (1996)	"	Learning Style predicted Achievement
Sathy (1996)	"	Significant correlation exist
Braio, *et al.* (1997)	"	Student with Style preferences benefitted from Style accommodation
Kumar (1997)	"	Significant main effect on Achievement
Kumar (1997a)	"	Significant differences in high and low achievers based on their Learning Styles
Warren (1997)	"	Science students and Non science students displayed different Learning Styles.
Burns, *et al.* (1998)	"	Above average and Average students differ is Style preference
Clooney (1998)	"	Under achievement attributed to mismatch of Learning Style and Teaching strategies
Dwyer (1998)	"	Learning Style preference correlated with GPA
Miller (1998)	"	Significant correlation exist.

contd...

Author	Variables	Result
Moore and Dwyer (1998)	Learning Style and Achievement	Positive relation
Roark (1998)	"	Visual learner group had higher mean score
Gieser (1999)	"	Learning Style responsive strategy had higher Achievement
Hong and Lee (1999)	"	Parental awareness of child's home-work Style preferences associated with high Achievement
Garton, *et al.* (2000)	"	Learning Style best predicted retention
Rourke and Lysynchuk (2000)	"	Divergers scored higher than Accomodators
Thomas, *et al.* (2000)	"	Relationship exist between kinesthetic Style preference and Achievement
Wingenbach (2000)	"	Field independent Learning Style group scored higher in Achievement
Drysdale, *et al.* (2001)	"	Science and Maths suited to sequential thinkers
Dunn, *et al.* (2001)	"	Identifies Learning Style preferences and how they affect Achievement
Doss and Muthiah (2002)	"	Performance of college students related to Learning Style

contd...

Studies Showing Negative Relation / No Relation		
Author	**Variables**	**Result**
Crisman (1984)	Learning Style and Achievement	Learning Style significantly different from Achievement
Ferris (1984)	"	No Correlation between Learning Style and Achievement
Hanpol (1987)	"	No significant relationship between Learning Style and Achievement
Sanley (1987)	"	No relationship between Learning Style and success
Cynthia (1988)	"	Learning Style did not contribute in Achievement.
Knight (1990)	"	Not positively related to Achievement
Leiden, *et al.* (1990)	"	Learning Style Inventories are not good predictors of Achievement
O'Brien (1991)	"	No main effect on Achievement
Farrell (1992)	"	Negligible relationship with Achievement
Orr and Davidson (1993)	"	No interaction between Learning Style and Instructional delivery on Performance.
Harasym (1995)	"	No relationship with Achievement
Howie (1996)	"	No one element of Learning Style was contributing Achievement
Melara (1996)	"	No effect on Learners Achievement
Myers and Munsinger (1996)	"	No Considerable effect on success in programming course
Horton and Oakland (1997)	"	Use of strategies consistent with Learning Style do not improve Achievement.
Santhoshkumar (1997)	"	No significant single effect

contd...

Author	Variables	Result
Day, *et al.* (1998)	Learning Style and Achievement	No correlation exist
Garton, *et al.* (1999)	"	Not correlated with Achievement
Gopalan (1999)	"	No difference between the Learning Style of Rural and Urban sample.
Marzalek and Lockard (1999)	"	No significant difference in Achievement by Learning Style
Miller and Polito (1999)	"	Heterogeneous Learning Style group did not perform better than homogeneous
Stickle, *et al.* (1999)	"	Diverse Learning Style do not influence future professional activities
Seng and Yeo (2000)	"	No difference in Learning Style preference from three brain dominant groups.

2.2.2. STUDIES ON APPROACHES TO STUDYING AND ACHIEVEMENT

Lion's share of the studies relating to ***Approaches to Studying and Achievement*** have been conducted in foreign land. Indian studies related to these variables are comparatively limited. For convenience to comprehend, the review of studies are grouped under two headings – studies showing Positive relationship and studies showing Negative relationship / No relationship.

2.2.2.1. Approaches to Studying and Achievement : Positive Relationship

Ramsden and ***Laurillard (1979)*** reported that the variability in Approach is partly function of ***difference between individual academic***

tasks. But there was also evidence that the students respond to the context of learning defined by the teaching and assessment method of academic departments.

The relationship between study methods and Academic Achievement was investigated by ***Watkins*** and ***Hattie (1981).*** They found that ***males were utilising strategies and females were higher on internalising motivation and internalising strategies.***

Watkins and ***Hattie (1986)*** conducted a longitudinal study on Fillipino students to examine the relationship of Approaches to Study and School Grades. It was found that a ***Deep and Competative well ogranised approach are positively related to academic success. Reproducing and pathology of learning were negatively correlated with school grades.***

Entwistle and ***Waterston (1988)*** examined Approaches to Studying and levels of processing in 117 science and 101 Arts University students. Findings revealed that ***surface processing being correlated to Surface Approach and Elaborative processing to Deep Approach.***

Hattie and ***Watkins (1988)*** in a study of preferred classroom Environment and Approaches to Learning on a sample of 1266 Australian school students indicated a relationship between ***Learning Strategies and high quality Learning outcomes.***

In a factor analytic study by ***Speth*** and ***Brown (1988)*** on study processes and strategies and found ***Surface Approach is linked to Failure*** and ***Deep Approach to Elaborative Processing.***

Beina (1989) conducted a study to find the relation between science Learning Approach and Biology Achievement of secondary school pupils and obtained a ***positive correlation between Science Learning Approach and Achievement in Biology.***

Naseema (1989) found ***low positive correlation between Science Learning Approach and Achievement in Physics.***

Prosser and ***Miller (1989)*** based on their investigation observed ***close relationship between the student Approaches to Learning and outcomes at the course level.***

Ramsden, et al. (1989) studied the sixth form pupils' Approaches to Learning. The result yielded ***negative association between Surface Approach and Exam performance, Deep Approach marginally associated with Aggregate mark.***

Uzhunnan (1989) made a comparative study of Science Learning Approach and science Learning Environment among High, Average and Low creative groups of secondary school students. Result indicated a ***significant difference existing in Science Learning Approach among these groups.***

Watkins and ***Hattie (1990)*** designed a study to assess the secondary school students' Approaches to Learning. Result indicates a ***positive correlation between subjects' level of self-esteem and their perceptions of the learning environment as enjoyable with both Deep and Achieving Approaches to Learning.*** Subject with versatile learning strategies were more academically successful.

BouJaoude and ***Giuliano (1991)*** investigated the relationship among Approaches to Studying, prior knowledge, logical thinking ability, attitude and performance in college freshman Chemistry students. Instruments used included seven sub scales of the Approaches to Studying Inventory. Students in this study had ***slightly higher scores on Reproducing Orientation than Meaning Orientation.***

Enhancement in Academic Achievement was reported by ***Carns*** and ***Carns (1991)*** in 117 fourth graders. The students were exposed to study skill approach designed to increase study skill, learning strategies and Learning style.

Pillai and ***Naseema (1991)*** conducted a study on a sample of 600 secondary school students and reported significant and positive but ***low relationship between Science Learning Approach and Achievement in Physics.***

Relationship between the Approaches to Study and learning outcomes at the course level was studied by ***Trigwell*** and ***Prosser (1991)*** and confirmed the ***Positive correlation between a Deep Approach to Study and qualitative learning outcomes.***

Anilkumar (1992) studied the impact of Socio-Economic Status and science Studying Approach on Achievement in Science of secondary school pupils and found ***Significant main effect of Science Studying Approach on Achievement in Science.***

Ekins (1992) investigated skills and Approaches to study for 549 students from Hong Kong. Correlations between the study skills and Study

Approaches as measured by Bigg's Study Process Questionnaire (SPQ), and three measures of success - persistence, number of credits gained and grades achieved were investigated. The conclusion was that ***deep motivation was key to success,*** but to succeed in gaining credits and good grades, ***deep strategy, achieving motive, and achieving strategy were also needed.***

Lancaster Approaches to Studying Inventory was administered by ***Gledhill*** and ***Vander Merwe (1992)*** on 41 female and 135 male medical students. Males scored higher on the subscale negative attitude to study implying a lesser degree of interest and application. ***Lower values on extrinsic motivation among females suggest they were lesser concerned men students.*** Lower scores on operation learning and improvidence indicate that females were respectively less inclined to concentrate on facts or to display an over cautious reliance on details.

Jayaseelan (1992) investigated the influence of Achievement Motivation and Science Studying Approach on Achievement in Biology of 675 standard IX students. In his study ***he found significant relationship between science studying Approach and Science Achievement.***

Valet and ***Charlmers (1992)*** studied the qualitative differences in University students' learning goals on their management of study. ***Significant relationships were found between students' learning goals and their perceptions on the learning situations and their course performance.***

Wong (1992) conducted a survey of 89 on-campus and 50 teleconferencing students showed that 83 per cent of externals were over 19

and 94 per cent internals were 18 or less. ***External students had higher scores for intrinsic motivation, and Deep Approach; internal students for fear of failure, Surface Approach, Achievement Motivation*** and ***Extrinsic Motivation.***

Areefa (1993) investigated group difference in Approaches to Studying science of secondary school pupils and reported the ***existence of significant difference between High-, Average- and Low Biology Achievement Group with respect to Science Studying Approach.***

Kumar (1993) examined the interaction effect of Intelligence, Cognitive Style and Approaches to Studying on Achievement in Biology of Secondary school pupils reported significant ***main effect of Approaches to Studying on Achievement in Biology.***

Pillai and *Kumar (1994)* examined whether variation in Achievement in Biology (N=700) was depended on variables like Sex, Locale, Cognitive Style and Approaches to Studying sciences. It was ***found a main effect of Locale, Cognitive Style and Approaches to Studying on Achievement in Biology.***

Kumar (1994) conducted study on a sample of 700 students to examine the interaction of Achievement Motivation and Approaches to Studying on Secondary school pupils' Biology Achievement. ***The study reported a significant main effect of Approaches to Studying on Achievement in Biology.***

Bolen, et al. (1995) assessed the factorial structure of SPQ with 532 U.S. students and found that ***surface Approach like Deep Approach was goal oriented but attempted to get it with minimum work.***

Frontera and ***Horowitz (1995)*** studied the Reading and Study behaviour of 57 fourth graders and revealed that ***successful students tend to have superior organisation.***

John (1995) investigated certain Motivational variables and Approaches to Studying as predictors of Process outcomes in Physics. The sample was 500 secondary school pupils. Results revealed ***a significant positive relation between Approaches to Studying and Achievement.***

Kember (1995) investigated the study habit and Approaches to Study tasks of 34 mechanical engineering students over the course of one week. Found that use of ***Surface Approach to Learning was positively correlated with high class attendance and greater study time, suggesting an inefficient approach.***

Pillai (1995) explored the influence of Cognitive Style and Approaches to Studying on process outcomes in Physics of secondary school pupils. ***Significant main effect of Approaches to Studying on process outcome was observed.***

Richardson (1995) made comparison of the study skills of 38 adult and 60 traditional age college students in the same course. It was found that older students had ***significantly higher scores on Meaning Orientation and lower scores on Reproducing Orientation.***

Pillai and ***Kumar (1996)*** explored the causal relationship of Intelligence, Cognitive Style and Approaches to Studying and Achievement in Secondary school Biology. The sample consisted of 700 standard IX students. Findings indicated that ***Approaches to Studying has a direct effect on Achievement in Biology.***

Kumar (1997a) investigated the difference in Approaches to Studying and Learning Style between High-Achievers and Low-Achievers in Secondary school Biology. The sample consisted of 350 standard IX students and the result revealed that ***significant differences exist between High and Low-Achievers based on their Approaches to Studying.***

Kumar (1998) studied the impact of Approaches to Studying and Cognitive Style on Achievement in Biology of 700 secondary school pupils. Result indicated that ***Approaches to Studying has significant main effect on Achievement in Biology.***

Richardson, et al. (1999) investigated the Study Approaches to students in upper division distance learning course at Britains Open University. ***Study Approaches of upper division students were affected by background variables. The relationship of Study Approaches to Academic Achievement was also assessed.***

Pimparyon, et al. (2000) in a study examines the relationship among students' Approaches to Learning, their perceptions of the educational environment and their Academic Achievement. Uses the ***Approaches to Studying Questionnaire*** (S-ASQ) and ***reports on the usefulness of using***

this instrument as a diagnostic measurement tool to enhance learning outcomes at a health care professions institution.

2.2.2.2. Approaches to Studying and Achievement: Negative Relationship/ No Relationship

Lyn, et al. (1989) explored the Approaches to Learning and Learning Style of first years and final University students. It was found changes toward ***less desirable learning approaches might be due to contextual variables such as curriculum demands, work load, time pressure and didactic teaching.***

Cristensen, et al. (1991) explored the relation of students' performance on the five learning strategies identified by *Weinsten* and *Mayer (1986)* with the student performance on the SPQ of Biggs. ***No significant difference was found on either the basic or complex tasks between the Deep or Surface score for students using the rehersal, organisation and elaborative stage.***

Tooth, et al. (1992) found that on 1986 medical school students' study habit showed declining Deep and Strategic Approaches and increasing Surface Approaches. ***Surface learning correlated with poor performance and was a result of previous poor sessional examination performance.***

Boujaoude and *Guiliano (1994)* investigated the relationship between student's Approaches to Studying, poor knowledge, logical thinking and gender and their performance in college freshman chemistry

course. It is found that ***prior knowledge was the best predictor of Achievement followed by formal reasoning ability.***

Prasad (1995) investigated the interaction of Approaches to Studying and Achievement Motivation on process outcomes in Physics of secondary school pupils. ***A negative relation was noted between Independent variables and process outcomes in Physics.***

Jones and ***Jones (1996)*** investigated the relationship of 46 College students' preferred teaching method and their own Approaches to Study (Surface, Deep and Achieving). Result indicated that ***while students preferred the conventional lecture method, preference did not correlate with their Study Approach and neither method was found to be more effective.***

Kember (1996) investigated interrelationship between workload, study time, Learning Approaches and Academic outcomes. The sample consist of 174 mechanical engineering students at Hong Kong University. ***Findings indicated that the variables were weakly interrelated.***

Rehna (1996) investigated the interaction effect of Learning Style and Approaches to Studying on Achievement in Biology of Secondary School pupils. Results ***showed that the Approaches to Studying in both dimensions viz., Deep/surface Approach and Organised/Disorganised study method did not yield any significant main effect on Achievement in Biology.*** The study revealed that boys and girls differ significantly in their Learning Style and Approaches to Studying. However, the interaction effect of Learning Style and Approaches to Studying on Achievement in Biology is not found to be significant.

Provost and ***Bond (1997)*** administered a short version of the Approaches to Studying Inventory to 169 college psychology students. Study revealed that ***scores for Meaning Orientation did not predict academic performance in any way,*** whereas there was a very small ***negative correlation between Reproducing Orientation and Academic Achievement***

A ***summary of studies*** on Approaches to Studying and Achievement follows.

Studies Showing Positive Relation		
Author	**Variables**	**Result**
Ramsden and Laurillard (1979)	Approaches to Studying and Achievement	Variability in Approach is a function of difference in academic tasks.
Watkins and Hattie (1981)	"	Males were utilising strategies and females were higher on internalising motivation
Watkins and Hattie (1986)	"	Deep Approach positively related to Achievement
Entwistle and Waterston (1988)	"	Elaborate processing related to Deep Approach.
Hattie and Watkins (1988)	"	Relationship exist between Learning strategies and outcomes
Speth and Brown (1988)	"	Surface Approach linked to failure
Beina (1989)	"	Positive correlation with Achievement
Naseema (1989)	"	Low-positive correlation
Prosser and Miller (1989)	"	Relationship with Achievement

contd...

Author	Variables	Result
Ramsden, *et al.* (1989)	Approaches to Studying and Achievement	Negative association between Surface Approach and Exam performance.
Uzhunnan (1989)	"	Difference exist in Approach among High, Average, low creative group.
Watkins and Hattie (1990)	"	Pupils with versatile strategies were more successful
BouJaoude and Giuliano (1991)	"	Students with Reproducing Orientation obtained higher scores
Carns and Carns (1991)		Positive relationship with Achievement
Pillai and Naseema (1991)	"	Low positive relationship with Achievement
Trigwell and Prosser (1991)	"	Positive correlation between Deep Approach and learning outcome.
Anilkumar (1992)	"	Significant main effect on Achievement
Ekins (1992)	"	Grade is associated with Achieving strategy
Gledhill and Vander Merwe (1992)	"	Females obtained lower scores on Operation Learning and Improvidence
Jayaseelan (1992)	"	Significantly related to Achievement
Valet and Charlmers (1992)	"	Significantly related to course performance.
Wong (1992)	"	External students had higher scores on Deep Approach
Areefa (1993)	"	Significant difference between High, Average and Low Achievement Groups with respect to Approach.
Kumar (1993)	"	Significant main effect on Achievement

contd...

Author	Variables	Result
Pillai and Kumar (1994)	Approaches to Studying and Achievement	Significant main effect on Achievement
Kumar (1994)	"	Significant main effect on Achievement
Bolen, *et al.* (1995)	"	Confirmed the influence of the Variable
Frontera and Horowitz (1995)	"	Superior organisation leads to successful outcomes
John (1995)	"	Significant Positive relationship exist.
Kember (1995)	"	Surface Approach correlated with greater study time and high class attendance
Pillai (1995)	"	Significant main effect on Process outcomes
Richardson (1995)	"	Older students obtained higher scores on Meaning Orientation
Pillai and Kumar (1996)	"	Direct effect on Achievement in Biology
Kumar (1997a)	"	Significant differences exist between High and Low Achievement based on their Approaches to Studying
Kumar (1998)	"	Significant main effect on Achievement
Richardson, *et al.* (1999)	"	Study Approaches were affected by background variables
Pimparyon, *et al.* (2000)	"	Diagnosis of Approaches to Studying enhance Achievement

contd...

Studies Showing Negative Relation / No Relation		
Author	**Variables**	**Result**
Lyn, et al. (1989)	Approaches to Studying and Achievement	Less Desirable Approaches related to contextual variables
Cristensen, *et al.* (1991)	"	No significant difference on Achievement tasks based on Approaches to Studying.
Tooth, et al. (1992)	"	Surface learning related to poor performance in previous exam.
Boujaoude and Guiliano (1994)	"	Approaches to Studying did not predict Achievement
Prasad (1995)	"	Negative relationship with Achievement
Jones and Jones (1996)	"	Preference did not correlate with their Study Approach.
Kember (1996)	"	Variables were weakly correlated
Rehna (1996)	"	Approaches to Studying did not yield significant main effect on Achievement
Provost and Bond (1997)	"	Meaning Orientation did not predict Academic performance

2.2.3. STUDIES ON ACHIEVEMENT MOTIVATION AND ACHIEVEMENT

A good number of studies are gathered by surveying the related literature. Majority of the studies show positive relationship between the variables, ***Achievement Motivation*** and ***Achievement.*** Few studies, however show no relationship or negative relationship. Reviewed studies are presented under the following two sub sections.

2.2.3.1. Achievement Motivation and Academic Achievement: Positive Relation

Zargar (1980) in a study to find out the relation between Intelligence, Creativity and Scholastic Achievement with n-achievement found out ***positive correlation between Achievement Motivation and Achievement.***

Gopinathan (1981) in a study of cognitive and affective variable of High and Low-Achievers in Malayalam showed that Achievement Motivation can ***differentiate High-Achievers*** from low -Achievers.

Lynn (1982) estimated the relationship of Achievement Motivation in different award systems with grade point average, gender and locus of control of senior high school students found that ***highly motivated students of both genders received most awards.***

Rajeeva (1982) conducted a correlative study of Achievement motive and performance among grade IX students of Banglore city. Result showed ***a significant difference between Achievement scores of High and Low Achievement Motivated students.***

Reddy (1983) in a study explored the relationship between Scholastic Achievement and Achievement Motivation. Results show that there exist a positive correlation between Achievement Motivation and Achievement.

Deshpande (1984) conducted a study to find out the determinants of achievement of students at SSC exam. The study showed that Achievement Motivation is ***positively related to Achievement.***

Sween (1984) made a study to ascertain the effect of n-achievement on student's performance. The sample of the study was 1401 students of Andigarh city. Results of the study indicate a ***positive correlation between Achievement Motivation and Achievement.***

Ahluwalia (1985) in order to determine the factors affecting Achievement Motivation conducted a study on a sample of 200 children of 8-12 years of age. The findings were that ***Academic performance was positively and significantly related to Achievement Motivation; Achievement Motivation is not affected by birth order*** and ***size of the family did not show any significant relationship with Achievement Motivation.***

Gandhi (1985) studied the Academic Achievement and its relation to Achievement motive, affiliation motive and power motive. The study showed that ***Achievement Motive significantly and positively related to Academic Achievement.***

Geetha (1985) while studying the influence of anxiety and Achievement Motivation of secondary school pupils found a ***significant and positive correlation between Biology Achievement and Achievement Motivation.***

Gosh (1985) conducted a study to find out the relationship of Achievement in Chemistry and its determinants. He found ***positive correlation between Achievement in Chemistry and Academic Motivation.***

Fatmi (1986) in a study of achievement related motivation among tribal and non-tribal high school students found that Achievement Motivation is ***positively related with Achievement.***

Ayishabi (1987) investigated the kind of relationship between Achievement Motivation and Achievement in Biology of 800 nineth grade children and found that Achievement Motivation may be acting as a predictor of ***Achievement*** in biology ***only to a less extent.***

Mehta (1987) investigated the effect of some psychological factors on school Achievement of scheduled caste and scheduled tribe students and found a ***positive correlation between Achievement Motivation and Achievement.***

Narayanan (1987) studied the relationship of Achievement Motivation and Achievement in Hindi of Socially advantaged and disadvantaged secondary pupils and found a ***positive relationship between Achievement Motivation and Achievement in Hindi*** for total sample and for socially advantaged and disadvantaged groups.

Haynes, et al. (1988) assessed study behaviour, cognitive skills and motivation of 148 high, average and low achieving high school students and indicated that low achieving students ***differed significantly*** from their average and high achieving peers on cognitive skills, habits and motivation and ***motivation was the powerful discriminating factor between the groups.***

Sherill (1988) in a study of Achievement, attitude and Achievement Motivation of grade three and six pupils found ***significant positive***

relationship between Science Achievement and Motivation for both the grade levels.

Higbee (1989) in his study on college students found that students having self motivation ***have potential to be successful*** in college level Mathematics course.

Andrews (1991) conducted a study which made use of data from a three years longitudinal study of adolescent substance use to clarify the direction of influence between the adolescent's Academic Achievement and Motivation and Substance use Adolescents (N=464), ages 12-16, from grade six through seven and their parent(s) completed parallel questionnaire measuring cigarette and alcohol use; Achievement Motivation and Academic Achievement. The results suggest that the ***relation between substance use and Achievement with motivation is bidirectional.***

Cassidy and ***Lynn (1991)*** conducted a study on Achievement Motivation and Educational Attainment and found that ***Educational Attainment was influenced by Achievement Motivation.***

Validity evidence for a new instrument, the Situation-Response Measure of Achievement Motivation was brought out by ***Grote*** and ***James (1991)*** for analysing cross-situational consistency of Achievement related behaviour in a sample of 246 college students. Results of exploratory factor analysis indicated the presence of ***striving for Achievement and apprehensiveness as the base of consistent Achievement.***

Lewis (1991) in a study of 400 Carribean immigrant student studied the relationship between Achievement Motivation and academic performance and found that ***Motivation influence Academic Achievement.***

Rajani (1991) in her study to find out the relationship of attitude towards education and Achievement Motivation with social Achievement of high school pupils found that there is marked ***relationship between Achievement Motivation and Social Achievement*** for the total sample and for the rural-urban students.

Glacia and ***Tapia (1992)*** compared three model of Achievement Motivation in the classroom. Result with 135 high school students suggest that the model of C.S. Dweck and E.S. Elliott offers a ***better explanation of the relationship among Achievement Motivation, attribution expectancies and performance*** than do the other models.

Hagborg (1992) in a study compared school motivation, scholastic competence and intrinsic motivation of 157 white grade IX and grade X students and found that on measures of scholastic competence and motivation orientation the ***High-group different from both the Medium and Low groups.***

Jayaseelan (1992) conducted a study to examine the influence of Achievement Motivation and Science Studying Approach on Achievement in Science of Secondary School pupils. Found ***significant combined effect of Achievement Motivation and Science Studying Approach*** on Achievement in Science.

Reynolds and ***Herbert (1992)*** conducted a study to formulate a structural model of high school Mathematics outcomes and reported that ***motivation had significant effect on Mathematics outcomes.***

Kumar (1994) studied the relationship of Achievement Motivation and Approaches to Studying on Achievement in Biology of nineth grade children and found that Achievement Motivation was affecting the Achievement in Biology to ***less extent only.***

Cain and ***Dweck (1995)*** assessed the beliefs of first, third and fifth graders about their ability and achievement and their motivational response to challenging puzzles. Results suggested that individual differences in childrens' cognition about ability and ***Achievement are related to their motivational responses throughout the school years.***

Gandara (1995) examined the factors influencing the academic success of 50 Mexican - American from low income families who received Ph.D., J.D., or M.D. degree from prestigious Universities. The study found that, in spite of serious economic disadvantage most of the subject's parent were doing precisely the right things in regard to instilling in their ***children Achievement Motivation, a strong work ethic, and the belief in education as the key to advancement.***

Singh and ***Singh (1995)*** reported that Achievement Motivation was effective in ***producing students' academic performance*** from a study conducted on 120, four to ten years old children.

Unnikrishnan (1995) investigated the effect of Social Adjustment and Achievement Motivation on Achievement in Biology of standard IX pupils

and the study revealed that there was ***significant positive relation between Achievement Motivation and Academic Achievement in Biology.***

Eaton and ***Dembo (1996)*** explored the differences in motivational beliefs of nineth grade Asian American and Non-Asian students. The statistical findings suggest that the differences in type of belief between two groups may help to explain their achievement behaviour. More specifically, Asian American students' ***fear of negative consequences of academic failure*** best explained their performance on the achievement task. ***Asian American students out performed non-Asian students on the Achievement task.***

Huang and ***Waxman (1996)*** claims that focusing on predictors of academic success may help in the design of effective educational interventions. Multivariate analysis and post hoc test of student responses showed that ***high achieving students had significantly higher perception of involvement, affiliation, satisfaction, academic self-concept and Achievement Motivation than low-achieving students*** within each ethnic group.

Preetha (1996) investigated the effect of Learning Style and Achievement Motivation on Achievement in Biology. The sample consisted of 700 students of standard IX. The study found that ***Achievement Motivation has significant positive effect on Achievement in Biology.***

Mc Lean (1997) conducted a study involving 69 High-Achieving and 55 Low-Achieving high school students in North Western Alberta, found that ***High Achievers had significantly more positive scores than Low***

Achievers on motivation for Schooling, academic self-concept, internal locus of control, reference based academic self-concept and instructional mastery.

Waxman (1997) have used the Mathematics Achievement to distinguish between resilient and non-resilient Latino middle school students, speaking English as a second language. ***Resilient students had greater involvement*** and satisfaction in Mathematics class, Academic self-concept and ***Achievement Motivation*** than non-resilient students ***and were less likely to have been left back.***

Leondari, et al. (1998) investigated the relationship between possible selves, Academic Achievement motivation, and self esteem with 289 high school students. Result show that those who ***imagined themselves achieving as a result of hard work and referred to specific, elaborative positive selves outperformed the other groups in Academic Achievement*** and persistence on tasks.

Mc Ewan and ***Goldenberg (1999)*** conducted a study among 41 graduate nursing students and reported that they had ***high Achievement Motivation and academic ability.*** Trait anxiety was the only valid predictor of academic success. Academic ability and inherent anxiety had greater potential for predicting student who would succeed.

Simons, et al. (1999) examined the Achievement Motivation of 316 University student athletes. The relationship of motivation orientation to academic performance and identification was investigated based on self

worthy theory. ***Fear of failure plays an important role in academic motivation*** in both revenue and non revenue student athletes.

The study conducted by ***Taylor (1999)*** examines two ideas that have emerged from research involving African-American adolescents with respect to Academic Achievement. The study examines the relation of Peer support to academic achievement and academic performance in a normative sample of African-American adolescents (n=1515). Structural equation modelling analysis revealed ***positive relation among social competence, peer support, school belonging, Achievement Motivation and grade point average*** for African American Adolescents.

Accordino, et al. (2000) examines the relationship of perfectionism with measures of Achievement and Achievement Motivation and mental health aspects of depression and self-esteem in high school students. ***Result indicate that student's personal standards were significant predictors of academic achievement and academic motivation.***

Anderson (2000) claims that the expectancy value model of Achievement Motivation, first described by Atkinson (1957) and refined by Eccles and her colleagues (1983, 1992, 1994) predicts Achievement Motivation based on expectancy for success and perceived task value. Result shows that ***Achievement choice of men was seen to be relatively unaffected by value or cost, and Achievement choice of women was significantly related to attainment value.***

In a study, ***Eom*** and ***Reiser (2000)*** examined the effect of learners' reported use of self regulated learning strategies on achievement and

motivation in learner controlled and program-controlled computer based instruction. ***Discusses results of post tests, scores on a motivational survey and the amount of instructional time spent.***

Flowers, et al. (2000) investigated the impact of teachers' instructional strategies (direct or non-direct) and college student's conceptual levels (high or low) on students' achievement and motivation to learn. ***Students in the non direct instruction group, regardless of conceptual level, were more motivated than students in the direct instructional group.***

Kember (2000) argues that the motivation displayed by Asian students is not an extrinsic form of motivation, which depresses intrinsic motivation, and that high levels of Achievement Motivation of these students has a collective nature. The study is based on review of evidence from over 90 action research projects.

A study conducted by ***Lesh, et al. (2000)*** measured and compared the pre- and post-course differences in college students' attitudes toward and achievement in an asynchronous, web-based, health profession course. ***Identified domains related to Achievement Motivation.***

Lynch (2000) identifies four forces underlie reform of high school vocational education: new economy, public expectations, learning and motivational research and overall school reform. The study ***recognizes the purposes of an enhancement of achievement and motivation, competence and skills, and pathways for continuing education and life long learning.***

Mendez (2000) in a study compared early adolescent girls in gifted and general education on constructs related to gender-role stereotyping.

Gifted girls held stronger self perceptions of instrumentality and evidenced higher Achievement Motivation.

Littlewood (2001) examined learner attitudes toward classroom learning of English with particular focus on collectivism versus individualism, attitude towards authority, and ***types of Achievement Motivation.*** Data are collected from eight Asian and three European countries. Although many attitudinal differences occur between individual countries, striking similarities are found across cultures.

Portes and *Zady (2001)* in a study examined the effect of demographic and Psychological factors on immigrant adolescent's reading achievement. ***Results show that for Asian-origin students, Achievement Motivation was most significant.***

Rea (2001) in a study explains how the theory of the ***motivated mind conceptualizes the productive interaction of intelligence, creativity and Achievement Motivation and how this theory can help educators to maximize students' emergent potential for giftedness.***

2.2.3.2. Achievement Motivation and Academic Achievement: Negative Relation/No Relation

Walayathiram (1974) studied the effect of some non-cognitive factors on the high school examination results and reported that ***Achievement Motivation has no influence on Academic Achievement*** under certain conditions.

Girija, et al. (1975) investigated the relationship of study habits with study skills, Achievement Motivation and Achievement and found ***no***

conclusive evidence that Achievement Motivation and Achievement is related to study habit.

Seshadri (1980) in a study regarding programmed instruction reported that Achievement Motivation has ***no influence on Academic Achievement under certain conditions.***

Shanmuga (1981) investigated the relationship of Academic Achievement to Motivation and self -concept. The study found that no ***positive relationship exist between Achievement Motivation and performance.***

Rajput (1984) claims that under neutral classroom conditions, the Achievement of students in Mathematics is not affected by their Achievement Motivation. This conclusion is based on a sample of 100 central school students.

Niebuhr (1995) in a study examined the relationship between several antecedent variables and student Academic Achievement. The research also examined the role of motivation as a moderator between ability and Academic Achievement and as a mediating variable between family environment and Academic Achievement and between School Climate and Academic Achievement. A survey questionnaire was administered to 241 high school fresh men of whom 76 were white and seven were classified as others. Findings indicated that ***Motivation showed no significant effect on the relationship between ability and Academic Achievement.***

Prasad (1995) studied the interaction of Approaches to Studying and Achievement Motivation on process outcomes in Physics of 480 standard IX

students and reported that there was ***no significant positive effect of Approaches to Studying and Achievement Motivation*** on process outcomes in Physics.

Dai (2000) studied the relevance and significance of goal orientation theories to 158 high ability, high achieving adolescents in summer programs for the gifted. Results show that adolescents are not free from ego concerns, and ***that ego orientation may be more detrimental to Achievement Motivation for girls.***

Hancock (2001) investigated the interactive effects of students', level of test anxiety and teachers' evaluation practises (evaluative threat) on the achievement and motivation of graduate students randomly assigned to high or low evaluative threat conditions. All students, but particularly ***test anxious students, performed poorly and were less motivated when exposed to highly evaluative classrooms.***

A ***summary of studies*** on Achievement Motivation and Achievement follows

Studies Showing Positive Relation		
Author	**Variables**	**Result**
Zargar (1980)	Achievement Motivation and Achievement	Positive correlation
Gopinathan (1981)	"	Achievement Motivation can Differentiate High Achievers from Low Achievers.

contd...

Author	Variables	Result
Lynn (1982)	Achievement Motivation and Achievement	Highly motivated students received awards
Rajeeva (1982)	"	Significant difference in Achievement scores of High and Low Achievement Motivated students
Reddy (1983)	"	Exist positive correlation
Deshpande (1984)	"	Positively related to Achievement
Sween (1984)	"	Found Positive correlation
Ahluwalia (1985)	"	Positively and significantly related to Achievement.
Gandhi (1985)	"	Significantly and positively related to Achievement.
Geetha (1985)	"	Significantly and positively related to Achievement.
Gosh (1985)	"	Positive correlation between the variables
Fatmi (1986)	"	Positively related with Achievement
Ayishabi (1987)	"	Achievement Motivation acting as a predictor of Achievement to a less extend.
Mehta (1987)	"	Positively correlated with Achievement
Narayanan (1987)	"	Positive relationship exist between the variables.
Haynes, *et al.* (1988)	"	Motivation was the discriminating factor between the High-Average and Low groups

contd....

Author	Variables	Result
Sherrill (1988)	Achievement Motivation and Achievement	Significant Positive relationship with Achievement
Higbee (1989)		Students with self motivation have potential to be successful in college.
Andrews (1991)	"	Relation between substance use and Achievement with motivation is bidirectional
Cassidy and Lynn (1991)	"	Attainment was influenced by Achievement Motivation
Grote and James (1991)	"	Presence of striving for Achievement as the base of Consistent Achievement.
Lewis (1991)	"	Achievement Motivation influence Achievement
Rajani (1991)	"	Marked relationship with Achievement
Glacia and Tapia (1992)	"	Positively related with Achievement
Hagborg (1992)	"	On measures of Motivation orientation High group differs from Low group
Jayaseelan (1992)	"	Significant combined effect of Achievement Motivation and Approaches to Studying on Achievement
Reynolds and Herbert (1992)	"	Motivation had significant effect on Maths outcome
Kumar (1994)	"	Achievement Motivation was affecting the Achievement to a less extend.
Cain and Dweck (1995)	"	Achievement related to Motivational response

contd....

Author	Variables	Result
Gandhara (1995)	Achievement Motivation and Achievement	Achievement Motivations as key to Advancement
Singh and Singh (1995)	"	Achievement Motivation was effective in producing Achievement
Unnikrishnan (1995)	"	Significant positive relation
Eaton and Dembo (1996)		Fear of negative consequences of Academic failure increased Achievement
Huang and Waxman (1996)	"	Positive relationship with Achievement
Preetha (1996)	"	Significant Positive effect on Achievement
Mc Lean (1997)	"	Positively related to Achievement
Waxman (1997)	"	Resilient students had greater Achievement Motivation and Satisfaction in classroom
Leondari, *et al.* (1998)	"	Students with Achievement Motivation outperform others in Achievement
Mc Ewan and Golderberg (1999)	"	High Achievement Motivation and Academic Ability is related
Simons, *et al.* (1999)	"	Fear of failure plays role in Academic Motivation
Taylor (1999)	"	Positive relation with Grade point Average
Accordino, *et al.* (2000)	"	Personal standard were predictors of Achievement and Academic Motivation
Anderson (2000)	"	Achievement choice of women is significantly related to attainment value.

contd....

Author	Variables	Result
Eom and Robert (2000)	Achievement Motivation and Achievement	Discusses results of scores on motivational survey.
Flowers, *et al.* (2000)	"	Students of non direct instruction group were more motivated than direct instruction group.
Kember (2000)	"	Asian students display high levels of Achievement Motivation of collective nature
Lesh, *et al.* (2000)	"	Identified domains related to Achievement Motivation
Lynch (2000)	"	Recognizes the purposes of a enhanced Achievement and Motivation as a reform.
Mendez (2000)	"	Gifted Girls held Higher Achievement Motivation
Littlewood (2001)		Studied types of Achievement Motivation among Asian and European countries. Striking similarities found
Portes and Zady (2001)	"	For Asian - Origin students Achievement Motivation was most significant.
Rea (2001)	"	Explains how the Achievement Motivation help educators to maximise students' potential

Studies Showing Negative Relation / No Relation		
Walayathiram (1974)	Achievement Motivation and Achievement	No influence on Academic Achievement
Girija, *et al.* (1975)	"	No conclusive evidence for the relationship with Achievement

contd...

Author	Variables	Result
Seshadri (1980)	Achievement Motivation and Motivation	No influence on Achievement
Shanmugha (1981)	"	No positive relationship exist
Rajput (1984)	"	Achievement not affected by Achievement Motivation
Niebuhr (1995)	"	No significant effect on Achievement
Prasad (1995)	"	No significant positive effect of Approaches to Studying and Achievement Motivation on Achievement
Dai (2000)	"	Ego orientation is detrimental to Achievement Motivation for girls
Hancock (2001)	"	Test anxious students performed poorly and were less motivated.

2.2.4. META ANALYSIS

In this part of the report the investigator made an attempt to analyse the reviewed studies on Learning Style, Approaches to Studying and Achievement Motivation statistically to compute percentage of studies having different types of results.

Till now the review of studies focuses on the description of each studies separately. Since enormous number of studies are reviewed on Learning Style, Approaches Studying and Achievement Motivation and the ***studies yield different types of results,*** it is necessary to consolidate the studies in a more meaningful way. This will help the investigator to

understand the ***trends of the research studies*** in the concerned area at a glance. Moreover, it provides an easy reference to the period of years reviewed, the number and percentage of positive and negative studies related to the variables.

For this purpose the number of studies on Learning Style, Approaches to Studying and Achievement Motivation having positive and negative relationship / no relation with Achievement is calculated and percentage were computed. Number of studies in each category and its percentage are given in Table 2.1.

TABLE 2.1

Meta Analysis of Reviewed Literature on Learning Style, Approaches to Studying and Achievement Motivation

Variables	Total No. of Studies Reviewed	Year	Studies showing Positive Relation		Studies showing Negative/No Relation	
			No.	Percentage (%)	No.	Percentage (%)
Learning Style	74	1984 to 2002	51	68	23	32
Approaches to Studying	46	1979 to 2000	37	80	9	20
Achieve-ment Motivation	63	1974 to 2001	54	85	9	15

Meta analysis shows that out of 74 studies reviewed 51 studies shows positive relationship between ***Learning Style*** and ***Achievement*** while negative studies are restricted to 23. Percentage wise, ***68 percentage yield positive relationship and 32 per cent studies*** are of opposite nature either showing ***negative relationship / no relationship.*** It leads to the conclusion that research in this area is inconclusive and thereby suggest further research.

In case of Approaches to Studying out of the 46 studies reviewed so far, 37 studies indicate positive relationship between Approaches to Studying and Achievement. Meanwhile studies showing negative relationship are only marginal (nine studies). The trend is more clear from percentage wise computation. 80 percentage of studies favour positive relationship between the variables, while 20 percentage of studies are showing no relationship. It suggest that the Approaches to Studying plays a vital role in determining Achievement.

As per Table 2.1, 63 studies were reviewed on the variable Achievement Motivation. Out of this 54 studies indicate positive relationship between Achievement Motivation and Achievement, while nine studies show negative relationship or no relationship. According to percentage wise computation, 85 percentage of studies on Achievement Motivation and Achievement show positive relationship. On contrary, the studies showing negative relationship / no relationship is limited to 15 percentage. This indicates that Achievement Motivation exercise profound influence on Achievement.

From the review of literature related to the variables, it is obvious that most of the studies on Learning Style and Approaches to Studying were conducted abroad. Apart from these, the investigator could not locate any study showing the ***Interaction of Learning Style, Approaches to Studying and Achievement Motivation on Academic Achievement.*** In this context the present study is found significant.

METHODOLOGY

Hassan koya M.P. “Influence of learning style approaches to studying and achievement motivation on achievement in biology of secondary school pupils” Thesis. Department of Education, University of Calicut, 2002

Chapter

Three

METHODOLOGY

CHAPTER 3 METHODOLOGY

This chapter deals with the techniques and methods adopted to complete the procedure of investigation. A master plan is prepared beforehand to carry out the investigation in a scientific manner. It helped the investigator to utilize time and effort in an economic way. In this chapter the details of the methodology adopted during the different phases of investigation is explained in the order of hierarchy.

3.1. VARIABLES

3.2. OBJECTIVES

3.3. HYPOTHESES

3.4. TOOLS USED FOR MEASUREMENT

3.5. SAMPLE FOR THE STUDY

3.6. MODE OF DATA COLLECTION SCORING AND CONSOLIDATION OF DATA

3.7. STATISTICAL TECHNIQUES USED

3.8. SUMMARY OF METHODOLOGY

A detailed description of each of these follows.

3.1. VARIABLES

The study is intended to explain the main and ***interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology of Secondary school pupils.*** The main focus is to unveil whether there is any variation in Achievement in Biology of Secondary school pupils attributable to variation in their Learning Style,

Approaches to Studying and Achievement Motivation. Further, the study explores to predict the Achievement in Biology from a set of three predictor variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

For the present study ***Learning Style, Approaches to Studying*** and ***Achievement Motivation*** are treated as Independent Variables. Achievement in Biology (Total score and four Objective wise scores) are the Dependent variables.

The variables for this study have been selected on the basis of the following rationale.

3.1.1. SELECTION OF VARIABLES

First of all the investigator made an attempt to identify the variables or factors which exercise substantial influence on ***Achievement***. The variables related were located by reviewing the research studies conducted abroad and India. The selection of any variable as Independent Variables was based on the hypothesis that the variable might be related to student performance and Achievement. Moreover, it could be used as predictor of Achievement. An analysis of the research studies helped to categorise the variables as follows.

3.1.1.1. Cognitive Variables

Cognitive variables include Intelligence and information processing abilities like Spatial Ability, Numerical Ability, Critical thinking, Verbal Reasoning and Cognitive Style and the like. The studies show that these

variables individually or in combination influence the Achievement of pupils.

3.1.1.2. Personality Variables

Personality variables include factors of non-cognitive and affective nature. This category include variables such as Attitude, Interest, Achievement Motivation, Adjustment, Anxiety, Neuroticism and the like. There is ample research evidence showing relationship between these variables and Science Achievement.

3.1.1.3. Instructional Methods and Infra-structural Facilities

This include variables such as Methods of Teaching, Instructional Effectiveness, Evaluation Procedure, Classroom Climate, use of Audio-Visual materials and Text Book, Size of Classroom etc. A number of studies support the relation between these variables and achievement.

3.1.1.4. Cultural Variables

This include variables of social and familial origin. Parental Education, Profession and Income, Previous Social and Educational Experience, Family Integration, Rejection/Acceptance, Autocracy/ Democracy with family etc., comes under this category.

3.1.1.5. Student Specific Variables

Variables such as Study Habits, Approaches to Learning, Learning Style, Learning Strategies etc. are included in this category. Since these variables are relatively new, the empirical evidence showing the

relationship with achievement is not very clear. Inconsistent relationships were reported by previous researchers.

3.1.2. CRITERIA USED FOR SELECTION OF VARIABLES

From the pool of variables listed earlier the investigator selected few variables which are most relevant to student learning. The specific variables are selected based on the following criteria.

(i) Make sure that the factors fall under student specific variable and personality domain.

(ii) High degree of influence is shown by the selected factors with Achievement.

(iii) The factors selected can be objectively measured.

(iv) Standardised tests are readily available or could be developed to assess the variables.

Keeping these criteria the Independent Variables were selected. They are the following.

3.1.2.1. Independent Variables

The Independent Variables selected are:

a. Learning Style (Four Component wise and Total score)

They are: Environmental, Emotional, Sociological, Physical and Learning Style (Total)

b. Approaches to Studying (Four Orientations and Total score)

They are : Meaning Orientation, Reproducing Orientation, Achieving Orientation, Non-Academic Orientation and Approaches to Studying (Total).

c. Achievement Motivation (Total score only)

3.1.2.2. Dependent Variables

Achievement in Biology is treated as Dependent Variables (four Objective wise score and a Total score). Specific Dependent variables are, Achievement in the Objectives : Knowledge, Comprehension, Application, Higher Objectives and Achievement in Biology (Total).

3.2. OBJECTIVES

The objectives formulated for the presented study are described in this part.

3.2.1. To study whether there exists ***significant gender difference*** in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.2. To study whether there exists ***significant gender difference*** in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.3. To study whether there exists ***significant gender difference*** in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.4. To study whether there exists ***significant gender difference*** in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.5. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for the Total sample.

3.2.6. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Boys.

3.2.7. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Girls.

3.2.8. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Rural sample.

3.2.9. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Urban sample.

3.2.10. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Government sample.

3.2.11. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Private sample.

3.2.12. To find out the ***best predictor*** of Achievement in Biology from the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

3.2.13. To study whether there exist ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

3.3. HYPOTHESES

The hypotheses set for the present study follows.

3.3.1. There will be ***significant*** gender difference in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.2. There will be ***significant*** gender difference in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.3. There will be ***significant*** gender difference in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.4. There will be ***significant*** gender difference in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.5. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for the Total sample.

3.3.6. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Boys.

3.3.7. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Girls.

3.3.8. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology

(Objective wise and Total score) of Secondary school pupils will be significant for Rural sample.

3.3.9. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Urban sample.

3.3.10. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Government sample.

3.3.11. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Private sample.

3.3.12. Achievement in Biology can be ***predicted*** using the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

3.3.13. There will be ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

3.4. TOOLS USED FOR MEASUREMENT

In the present study the three Independent Variables and Dependent Variables were measured using standardised tools of proven psychometric properties. A brief description of the tools follows.

3.4.1. LEARNING STYLE INVENTORY - LSI (Kumar, *et al.*, 1996)

Learning Style of Secondary school pupils was measured through ***Learning Style Inventory*** (LSI) constructed and standardised by Kumar *et al.* (1996). This Learning Style Inventory is constructed on the theoretical framework of Dunn and Dunn Model of Learning Style (Dunn, *et. al.*, 1989), which depicts the Learning Style as multidimensional rather than bipolar (Harvey, 1994).

Five style areas viz., ***Environmental, Emotional, Sociological*** and ***Physical*** characterises the Inventory. Psychological style area is dropped owing to the fact that it is not tapped objectively through the items of the inventory.

A style area include a cluster of style elements. These are learner preferences to the factors in the learning situations. A self explanatory sketch of the style area and style elements follows in Table 3.1.

TABLE 3.1

Style Areas and Style Elements of Learning Style Inventory

Style area	Style element	Preference for
Environment	1. Noise Level	1. Sound vs. quiet
	2. Light	2. Bright vs. dim light
	3. Temperature	3. Warm vs. cool environment
	4. Design	4. Informal(sofa, floor) vs. formal (table, chair) seating arrangement
Emotional	5. Motivation	5. Desire to achieve
	6. Persistence	6. Engaging in a task until complete or 'take breaks'
	7. Responsibility	7. Conforming to expectations
	8. Structure	8. Specific direction vs. latitude
Sociological	9. Peers	9. Learning alone vs. with others (pairs, groups)
	10. Authority	10. Directions from 'expert'
	11. Several Ways	11. Variety of methodologies and/or ability to cope with same
Physical	12. Auditory	12. Learning by listening/hearing
	13. Visual	13. Learning by watching/reading
	14. Tactile	14. Learning by hand-on e.g. note taking
	15. Kinesthetic	15. Learning by active involvement e.g. direct experience
	16. Intake	16. Eating, drinking to help concentration
	17. Evening/Morning	17. Learning in the evening vs. morning
	18. Late Morning	18. Learning in the late morning
	19. Afternoon	19. Learning in the afternoon
	20. Mobility	20. 'Taking breaks' vs. able to sit still for long periods.

The Learning Style Inventory comprised of **45** items which is supposed to be answered within a time span of **25** minutes. Out of the total 45 items 31 items are positive while the remaining 16 being negative. The items required the pupils to respond on a three point scale as ***Always, Sometimes*** and ***Never.*** For a positive item in the Inventory a score of ***two*** was given to the response category - ***Always , One*** to the category ***Sometimes*** and ***Zero*** to the category ***Never.*** The scheme was reversed for the negative items. Scores of ***Zero, One,*** and ***two*** for ***Always, Sometimes*** and ***Never*** respectively. All items are in Malayalam with a maximum score of 90 and a minimum score of zero. The Learning Style Inventory, the response sheet and the corresponding English version are presented in Appendices I, IA, IB and IC respectively.

3.4.1.1. Validity

The Learning Style Inventory was revalidated by the investigator. Validity of the test was established through ***Pearson's Product Moment Correlation*** by correlating the scores on Learning Style inventory against those on Science Studying Approach Inventory as an external criteria. The two scales were administered on a sample of 50 secondary school students. Th corresponding index obtained was **0.62.**

3.4.1.2. Reliability

Reliability was re-established through ***test-retest*** method gave the reliability index ***0.64.*** It was worked out on a representative sample of 50 students. Two consecutive testing had an interval of three weeks between them. Eventhough, the test constructors had maintained the specified time

limit, the work of Dunn (1991) reported that Learning Style is ***largely resistant*** to ***Change.***

Inter-correlations among the scores of four style areas and with the total Learning Style score (Total sample) were employed to study the internal consistency of the Inventory. The correlation matrix is presented in the following.

Correlations	**Environmental**	**Emotional**	**Sociological**	**Physical**	**Total**
Environmental		0.139	0.088	0.155	.557**
Emotional			0.143	.0217	.607**
Sociological				0.144	.487**
					.726**

** P< 0.01

The validity and reliability indices of the Inventory shows that the inventory has successfully proven the criteria of a standardised test.

For an immediate reference, some of the illustrative items are presented.

a) **Style area** : **Environmental**

Style element : ***Noise level***

I am not disturbed by any sound in utmost concentration

Always	Sometimes	Never

b) Style area : Emotional

Style element : Structure

Often, I succeed in rising up to the expectations of my parent regarding my studies.

Always	Sometimes	Never

c) Style area : Sociological

Style element : Authority

I like to study in a way which is different from that of my peers.

Always	Sometimes	Never

d) Style area : Physical

Style element : Mobility

The short recesses during the study time boost up my enthusiasm to learn.

Always	Sometimes	Never

3.4.2. APPROACHES TO STUDYING INVENTORY - ASI (Kumar & Koya, 2001)

The Approaches to Studying Inventory developed and standardised by Kumar and Koya (2001) was used to measure the variable, Approaches

to Studying. The following steps were adopted in the construction and standardisation of the Inventory.

Planning

The investigator studied thoroughly the literature on Psychology of learning process to get a theoretical footing for the Inventory. Special attention was given to those kinds of literature dealing the process of learning in pupil's own perspective, because pupils have personal conceptions and motives about how their learning might be. To get an insight about this aspect, special emphasis was given to the work done by ***Watts (1810),Dewey (1910), Marton*** and ***Saljo (1976), Fransson (1977), Sevensson (1977), Entwistle, et al. (1979), Biggs (1979), Entwistle (1981), Entwistle (1987)*** and ***Biggs (1990)***.

The investigator searched for an appropriate inventory to measure the Approaches to Studying of the sample selected. Though such inventories were available, but were constructed and standardised in the foreign context. An **ASI** which was prepared in Indian context was also found available. But it has a limitation of being subject specific. Thus the investigator decided to construct a general Approaches to Studying Inventory which is ***culture free*** and standardised in Indian context.

The investigator reviewed a vast amount of literature and inventories relating to the Learning Style, Study Processes, Approaches to Studying etc. Previous factor analyses of the Approaches to Studying Inventories (Schmeck, *et al.*, 1977, Entwistle, *et al.*, 1979; Entwistle and Ramsden, 1983;

Biggs, 1987a; Pillai, *et al.*, 1992) were thoroughly reviewed and studied before preparing the new ASI.

This ASI was prepared in tune with the Approaches to Studying Inventory (Entwistle & Ramsden, 1983) which was a product of research on student learning. It included ***motivations*** and ***study methods*** as well as contrasting ***intention to understand*** with the ***intention to reproduce*** the information being processed. This inventory also attempted to measure differences in style or kind of learning, as described by Pask (1976) who identified two strategies: ***Comprehension learning*** and ***Operation learning;*** and two pathologies; ***Improvidence*** and ***Globetrotting*** (Pask, 1976). It also included the ideas of ***syllabus-boundness*** described by Hudson (1968) and strategic approach based on responding to contextual cues on what study behaviours are most rewarded by assessment system (Entwistle, *et al.*, 1979).

Preparation

The draft form of ASI developed comprised of four component scales with four sub scales each. The details of scales and subscales that constitute the ASI are given in Table 3.2.

TABLE 3.2

Scales and Sub-scales of Approaches to Studying Inventory

Scales	Subscales
Meaning Orientation	Deep approach Inter relating ideas Use of evidence Intrinsic motivation
Reproducing Orientation	Surface approach Syllabus-boundness Fear of failure Extrinsic motivation
Achieving Orientation	Strategic approach Disorganised study method Negative attitude to studying Achievement motivation
Non Academic Orientation	Comprehension learning Operation learning Globetrotting Improvidence

As per Table 3.2 the four component scales and their sub scales are the following.

1. ***Meaning Orientation***: It involves an intention to understand and give meaning and focussing on relations between parts of subject matter, the author's message in association with the evidence used to support it. The subscales of Meaning Orientation are:

    a. ***Deep Approach:-*** In deep approach the learner involves in active questioning while learning.

b. ***Inter Relating ideas:-*** Here the learner is trying to relate the content matter with other parts of the course.

c. ***Use of Evidence:-*** The learner uses evidence while concluding a learning material.

d. ***Intrinsic Motivation:-*** Here the learner is involved in active learning for learner's own sake.

2. ***Reproducing Orientation***: It involves minimalist engagement with the task, focussing on memorising or applying procedures unreflectively. The learner sees school learning as a mean towards some other end, such as obtaining a better job or just keeping out of trouble. The strategy is thus limited to the target of essentials and reproducing through rote learning. Its subscales are –

(a) **Surface Approach**:- The learner is preoccupied with memorisation for reproducing it when the need arises.

(b) **Syllabus Boundness:-** The learning process is centred around the syllabus and the learner is relying on staff to define the learning tasks.

(c) **Fear of Failure:-** The learner shows pessimism and anxiety about academic outcomes and the learning is guided by the goal of avoiding a failure.

(d) **Extrinsic Motivation:-** The student is interested in courses and studies for the qualifications and benefits they offer.

3. *Achieving Orientation:-* This is related to the competitive form of motivation called need for achievement (n'ach) or hope for success. It's related strategies are organising time, working space and syllabus coverage in most efficient way. It's subscales are:-

   (a) **Strategic Approach**:- In this subscale learners are aware of implications of academic demands made by staff.

   (b) **Disorganised Study Method**:- In this learning strategy learners are unable to work regularly and effectively.

   (c) **Negative Attitude to Studying**:- Pupils show a negative attitude to studying by lack of interest in content matter and in the application.

   (d) **Achievement Motivation**:- Learners are showing confidence and highly competitive.

4. *Non Academic Orientation:-* It involves broad strategies of Learning with logical sequences and overreliance on details. The techniques adopted for learning are ineffective and weak to achieve higher level of understanding. It's subscales are:-

   (a) **Comprehension Learning:-** The learners are ready to map out subject area and think divergently.

   (b) **Operation Learning:-** While learning the learners emphasize on facts and logical analysis.

   (c) **Globetrotting:-** The learners show a tendency to jump into conclusion without adequate factual basis.

(d) **Improvidence**:- It is a learning pathology characterised by overreliance on details and failure to develop overall understanding.

The investigator initially pooled 112 items falling equally in to the respective Approaches to Studying component Scales and Subscales. Each subscale consisted of seven items. Utmost care was taken to make the items ***clear, precise*** and ***comprehensive*** to the construct measured. Items were prepared by abiding to the rules of Attitude Scale Construction (Edwards, 1969). Four items from each subscale were selected and subjected to expert judgement. Based on the advice, some items were deleted and others modified. The draft form of ASI then comprised of 64 items.

Try out

The draft inventory was administered on a sample of 400 secondary school pupils who were randomly selected. Adequate weightage was given to each strata of sample like Sex, Locale and Type of Management of the schools. As per the instructions in the draft ASI, the pupils were required to respond on a three point scale as ***Always, Sometimes*** and ***Never.*** For a positive item in the inventory a score of ***two*** was given to the response ***Always, one*** to the response ***sometimes*** and ***zero*** to the response ***Never.*** For negative items the scoring scheme was reversed. All the items were presented in Malayalam with a maximum score of 128 and a minimum score of zero. The time required for the completion of all the items was found to be 35 minutes.

Item Analysis

For item analysis 400 response sheets, completed in all respects were selected. When the incomplete response sheets were rejected the number for item analysis reduced to 380. The item analysis was carried out using the method suggested by ***Edwards*** (1969). In order to facilitate computational procedures, 370 sheets out of 380 were randomly drawn and arranged in the descending order of scores. The upper 100 sheets (27%) and lower 100 sheets (27%) were treated as high and low groups respectively.

Under each group, for each item, the number of pupils making response to ***Always, Sometimes*** and ***Never*** were found out and presented in the form of a frequency table. Then the *t*-value for each item was calculated to find out the discriminating power. The *t*-value showed the extent to which the high group and the low group are differentiated on a given item in the inventory.

The following formula was used to calculate the *t* value.

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\Sigma(X_H-\bar{X}_H)^2+\Sigma(X_L-\bar{X}_L)^2}{n(n-1)}}}$$

where

$$\Sigma(X_H - \bar{X}_H)^2 = \Sigma X_H^2 - \frac{(\Sigma X_H)^2}{n}$$

and $\Sigma(X_L - \overline{X}_L)^2 = \Sigma X_L^2 - \frac{(\Sigma X_L)^2}{n}$

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

$\overline{X}_L$ = The mean score on the same item for the low group.

X_H = Score of high group

X_L = Score of low group

n = number of cases

Those items exceeding a *t* value of 1.88 were selected for the final inventory. The *t* values of items and the items selected are given in Table 3.3.

TABLE 3.3

Details of Item Analysis of Approaches to Studying Inventory

Item Number	Scales	Sub scales	Positive/ Negative	t-value	Items Selected/ Rejected
1.	Meaning Orientation	Deep Approach	Positive	1.41	Rejected
2.			Negative	3.90	Rejected
3.			Positive	4.49	Selected
4.			Negative	8.05	Selected
5.		Interrelating Ideas	Negative	3.58	Selected
6.			Positive	4.77	Rejected
7.			Positive	7.01	Selected
8.			Negative	2.73	Rejected
9.		Use of Evidence	Positive	3.52	Rejected
10.			Negative	3.06	Rejected
11.			Positive	4.33	Selected
12.			Negative	3.55	Selected
13.		Intrinsic Motivation	Positive	2.42	Rejected
14.			Negative	1.26	Rejected
15.			Positive	3.90	Selected
16.			Negative	3.14	Selected

contd.....

Item Number	Scales	Sub scales	Positive/ Negative	t-value	Items Selected/ Rejected
17.	Reproducing Orientation	Surface Approach	Positive	3.91	Selected
18.			Negative	3.42	Selected
19.			Positive	1.26	Rejected
20.			Negative	1.00	Rejected
21.		Syllabus Boundness	Negative	4.39	Selected
22.			Positive	7.01	Selected
23.			Positive	5.27	Rejected
24.			Negative	0.18	Rejected
25.		Fear of failure	Positive	0.00	Rejected
26.			Negative	5.11	Selected
27.			Positive	5.05	Rejected
28.			Negative	5.84	Selected
29.		Extrinsic Motivation	Positive	2.57	Selected
30.			Negative	4.51	Rejected
31.			Positive	1.87	Rejected
32.			Negative	5.9	Selected
33.	Achieving Orientation	Strategic Motivation	Negative	0.66	Rejected
34.			Positive	5.38	Selected
35.			Negative	1.08	Rejected
36.			Positive	1.88	Selected
37.		Disorganised Study method	Negative	7.15	Selected
38.			Negative	6.12	Rejected
39.			Positive	2.71	Selected
40.			Positive	0.90	Rejected
41.		Negative Attitude to studying	Negative	4.41	Selected
42.			Positive	7.62	Selected
43.			Positive	2.31	Rejected
44.			Negative	3.60	Rejected
45.		Achievement Motivation	Negative	1.88	Selected
46.			Positive	1.91	Rejected
47.			Negative	1.82	Rejected
48.			Positive	3.39	Selected
49.	Non Academic Orientation	Comprehension Learning	Positive	5.98	Selected
50.			Negative	1.31	Rejected
51.			Positive	5.91	Rejected
52.			Negative	3.05	Selected
53.		Operation Learning	Positive	6.74	Rejected
54.			Positive	7.81	Selected
55.			Negative	2.41	Rejected
56.			Negative	2.56	Selected
57.		Globetrotting	Negative	0.00	Rejected
58.			Positive	6.60	Selected
59.			Negative	0.99	Rejected
60.			Positive	6.32	Selected
61.		Improvidence	Positive	4.30	Selected
62.			Negative	4.29	Selected
63.			Positive	0.99	Rejected
64.			Negative	1.28	Rejected

The Final Approaches to Studying Inventory was thus comprised of 32 items of which 17 are positive and 15 are negative. Each scale contained ***eight*** items, with ***two*** items each from each sub scale. The time required to respond to the ASI was fixed to be 20 minutes. The inventory had a maximum score of **64** and a minimum score of ***zero***. All items were presented in Malayalam.

Validation

Criterion related validity of the Final ASI was established through Pearson's Product Moment Correlation by correlating the scores obtained by ASI with the scores of ***Science Studying Approach Inventory*** - SSAI (Pillai, *et al.*, 1992) which was used as a criterion and also meant to measure the same on a representative sample of 46 secondary school pupils. The validity index obtained was ***0.60***. Pearson's Product Moment Correlation was calculated by the following formula.

$$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2]\,[N\Sigma Y^2 - (\Sigma Y)^2]}}$$

Reliability:- The reliability of the Final ASI was established by the ***split-half*** method on a representative sample of 46 students. The items in the inventory were divided into two equal halves with 16 items each and the scores on the first half were correlated with the scores on the second half. The reliability index obtained after correcting with Spearmen – Brown formula was found to be 0.729. The Spearman – Brown formula used was the following.

$$r_{xx} = \frac{2r_{xx}}{1 + r_{hh}}$$

Where r_{xx} is the sample estimate of the reliability coefficient and r_{hh} is the reliability of a half test.

Further the ***intercorrelations*** among the scores of four scales of Approaches to Studying with the Total score of Approaches to Studying were employed to study the ***internal consistency*** of the test. The correlation matrix with their coefficients are given as follows.

Correlations	Meaning Orientation	Reproducing Orientation	Achieving Orientation	Non-Academic Orientation	Total
Meaning Orientation		0.288	0.200	0.279	0.648**
Reproducing Orientation			0.233	0.345	0.714**
Achieving Orientation				0.264	0.623**
Non-Academic Orientation					0.700**

** $P < 0.01$

The obtained ***validity*** and ***reliability*** indices of the **ASI** show that the inventory is a ***valid*** and ***reliable*** tool for measuring the approaches to Studying of Secondary School Pupils.

The draft inventory of **ASI**, and the response sheet are presented in Appendices II and IIA respectively and the final **ASI**, the response sheet,

the English version of final **ASI** and the response sheet of English version of final **ASI** are given in Appendices IIB, IIC, IID, and IIE respectively

Some illustrative items from the Final Inventory are given in the following.

a. Scale :Meaning Orientation

1. Subscale : Deep Approach

I conduct practically possible experiments and observations related to my lessons.

Always	Sometimes	Never

a. Scale: Meaning Orientation

2. Subscale :Inter-relating Ideas

While studying I do not check whether one subject is related with any other subject or not.

Always	Sometimes	Never

a. Scale : Meaning Orientation

3. Subscale :Use of Evidence

I evaluate the conclusions on the basis of observations and experiences.

Always	Sometimes	Never

a. Scale :Meaning Orientation

4. Subscale : Intrinsic Motivation

I do the exercises given with the lessons without a direction from my teacher.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

1. Subscale : Surface Approach

While studying I frequently check whether the learned facts are there in my mind or not.

Always	Sometimes	Never

b. Reproducing Orientation

2. Subscale : Syllabus boundness

I do not have the habit of reading the lessons as directed by the teacher.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

3. Subscale : Fear of failure

I am not afraid of examinations.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

4. Subscale : Extrinsic Motivation

I study because of the compulsion of elders.

Always	Sometimes	Never

c. Scale : Achieving Orientation

1. Subscale : Strategic Approach

I study for applying the acquired knowledge in real life.

Always	Sometimes	Never

c. Scale : Achieving Orientation

2. Subscale : Disorganised study method

I do not have the habit of doing homework regularly.

Always	Sometimes	Never

c. Scale : Achieving Orientation

3. Subscale : Negative Attitude to Studying

I do not feel that studying is a tedious experience.

Always	Sometimes	Never

c. Scale : Achieving Orientation

4. Subscale : Achievement Motivation

I take passing the examination as a challenge.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

1. Subscale : Comprehension learning

I have the habit of recording the similar concepts in content material in a note book.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

2. Subscale : Operation Learning

I check the conclusions using empirical evidences.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

3. Subscale : Globetrotting

I arrive at conclusions only after cautious and detailed study.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

4. Subscale : Improvidence

Before accepting concepts from study materials, I thoroughly check every details related to it.

Always	Sometimes	Never

3.4.3. SCALE OF ACHIEVEMENT MOTIVATION - SAM (Pillai & Kumar, 1993)

The Independent Variable, Achievement Motivation was measured using the ***Scale of Achievement Motivation*** standardised by Pillai and Kumar (1993) in Malayalam modelled after the Achievement Motivation Questionnaire (Cassidy & Lynn, 1989). It comprises seven factors viz., ***Work ethics, Acquisitiveness, Dominance, Excellence, Competitiveness, Status aspiration*** and ***Mastery.***

The factor work ethics comes from the Weberian concept of work ethic (Weber, 1904). Other factors were evolved from various other sources on Achievement Motivation. A brief description of each factor follows.

(i) Work Ethics

It means the desire to study hard and is based on the reinforcement in the performance itself. As a motivational attribute, it ***influences attitude, values*** and ***behaviour.***

Example: ***I like to avoid those lessons which I find difficult to study.***

ii) Persuit of Excellence

It is defined as a ***competition with a standard of excellence.*** It is the reward obtained by making the best performance in studies.

Example: ***I find satisfaction in doing work better than my earlier work even if I don't outperform others.***

iii) Status Aspiration

It incorporate the ***desire to be a dominant member or a leader among other students. It is reinforcement in climbing the social status hierarchy.***

Example: ***I want others to come to me for clearing their doubts.***

iv) Competitiveness

It is the ***Satisfaction obtained while competing with others.***

Example: ***If there is tough competition, my performance will be better.***

v) Acquisitiveness

This is motivation ***based on the reinforcement properties of position or possession attained by the individual.***

Example: ***There is continuous effort behind the success of my accomplishment in studies.***

vi) Mastery

It is the ***satisfaction obtained*** when succeeding in the study of difficult matters.

Example: ***I find satisfaction in studying material which require high Intellectual ability and skill.***

vii) Dominance

It includes the desire ***to lead or to take initiative*** or to become ***a dominant member of the group.***

Example: ***When we plan an activity I would like to direct it myself rather than someone else take the lead.***

The Scale of Achievement Motivation consists of ***50*** items both in positive and negative. Out of the ***50*** items, ***Eight*** items belong to Work Ethics, ***six*** items of Pursuit of Excellence, ***Ten*** items of Status Aspiration, ***six*** items of Competitiveness, ***six*** items of Acquisitiveness, ***Four*** items of Mastery and ***Ten*** items of Dominance.

The scale is a ***three point*** one demanding responses in the category ***Yes, Undecided*** and ***No.*** For a positive item, a score of ***two*** was given to the category ***Yes,*** score ***one*** to the category ***Undecided*** and ***zero*** to the category ***No.*** The scoring procedure was reversed for the Negative items - ***zero, one*** and ***two*** for ***Yes, Undecided*** and ***No*** respectively. ***Sum*** of the obtained scores for individual items indicate the Achievement Motivation

score of the subject. The maximum score is ***100*** and the minimum score is ***zero.*** The scale of Achievement Motivation, the response sheet and the corresponding English version are presented in the Appendices III, IIIA, IIIB and IIIC respectively.

3.4.3.1. Validity of the Scale

The scale was modelled after the well known scale, Cassidy – Lynn Achievement Motivation Questionnaire (1989). The scale was re-validated by the investigator against a popular scale used for many research purpose in Kerala viz., The Kerala Scale of Achievement Motivation (Nair, 1980). The two scales were administered on a sample of 50 secondary school students and the scores were correlated using Pearson's Product Moment Correlation. The validity coefficient is found to be ***0.70.***

3.4.3.2. Reliability of the scale

Reliability of the scale was also re-established by estimating the internal consistency of the items. For this purpose Cronbach's reliability coefficient ***alpha*** was calculated by the investigator using the formula.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\Sigma \text{var}(i)}{\text{Var } X}\right) \qquad \text{(Cronbach, 1971)}$$

Cronbach's reliability coefficient ***alpha*** estimate for the Achievement Motivation factors for a representative sample of 100 secondary school pupils selected at random is presented in Table 3.4.

TABLE 3.4

Cronbach's Reliability Coefficient *alpha* for the Achievement Motivation Factors

	Factor	Alpha Coefficient
i)	Work ethic	0.71
ii)	Persuit of Excellence	0.66
iii)	Status aspiration	0.82
iv)	Competitiveness	0.64
v)	Aquisitiveness	0.67
vi)	Mastery	0.60
vii)	Dominance	0.68

The obtained ***validity*** and ***reliability*** indices of the scale shows that this scale is a valid and reliable tool for measuring Achievement Motivation of Secondary School Pupils.

3.4.4. Achievement Test in Biology - A T B (Koya, 2001)

Achievement in Biology of the sample was estimated using an Achievement Test developed by the investigator (Koya, 2001). The test consist of 40 multiple choice items which can be attempted within a maximum time of 40 minutes.

The procedure followed and technique used in the construction and standardisation of Achievement Test in Biology is given in the following.

Preparation of the Test

The science curricula of the secondary school in Kerala especially the syllabus for standard IX was analysed carefully. Text books, reference materials, Question Banks and Question papers and other standardised tests of science Achievement were utilised as sources for framing items. The special literature used for developing item format are:

1. ***Science Education in Nineteen countries*** - An Empirical study (Comber & Keeves, 1973)

2. ***Science Teaching and Testing*** (Nadalsky, 1965).

3. ***Preparing Objective Examinations***: A Hand book for Teachers (Harper & Harper, 1990).

Based on the objectives of Bloom's (1979) Taxonomy of cognitive domain the items were prepared. The objectives considered were ***Knowledge, Comprehension, Application, Analysis, Synthesis*** and ***Evaluation***. The objectives Analysis, Synthesis and Evaluation were clubbed and labelled as ***Higher Objectives***.

Weightage to the Content

Due weightage was given to the important units in Biology syllabus of standard IX in the secondary schools of Kerala. A blue print was prepared to ensure the weightage assigned to different objectives and content units. Since the items are of multiple choice format, objective scoring can be employed which ensure economy of time and effort.

Blue Print

The objectives and content areas were scrutinised by the experts in the field of test construction and science education. A blue print ensuring the content coverage of the test with respect to the weightages given for various objectives was prepared.

Accepting this as a skeleton, the investigator initially pooled 60 multiple choice items. The item formats of reputed standardised tests in science achievement were referred for developing items for the test. The prepared items were scrutinized by a team of experts in the field of tests construction and evaluation. Some items were deleted and re-edited in the light of expert criticism. Thus a draft test comprising ***60*** items in Biology was pooled. These items were arranged objective wise according to Bloom's Taxonomy of Cognitive Domain viz., Knowledge, Comprehension, Application and Higher Objectives (Analysis, Synthesis and Evaluation). The Knowledge items come at the beginning and those of the Higher Objectives at the end of the test. Items 1-17 measuring the out-put in knowledge level, items 18-35 Comprehension, items 36-50 Application, items 51-54 Analysis, items 55-57 Synthesis and items 58-60 Evaluation level. The draft test was used as a pilot test for the present study. The blue print specifying the weightage to Objectives and content area for the final test is presented in Table 3.5.

TABLE 3.5

Blue Print of Achievement Test in Biology

Sl. No.	Name of the Topic	Objectives						Total
		Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	
1	Meaning and Scope of Biology	3	1					4
2	Structure and function of cell, structure, organisation of living beings	2	4					6
3	Movement of particles in the cell, chemical basis of life	1	2			1	1	5
4	Physiology of plant and Animals	4	2	4	1	1		12
5.	Transportation of particles in plant and animals	1	2	1	1		1	6
6.	Health Science	1	2	4				7
		12	13	9	2	2	2	40

Direction for Test administration, time limit, scoring scheme and separate answer sheets were developed in consultation with the experts. The ***conventional procedure*** for the test construction were strictly followed.

Try-out

The draft-test was tried out on a representative sample of 450 students who have completed the course in standard IX. Students from six schools were randomly selected for the pilot testing.

Item Analysis

Item analysis was done using the method suggested by Ebel (1972). The answer sheets of 450 students were scored. Incomplete answer sheets were rejected. For a correct response one score was alloted and for an incorrect answer no score was given. 395 answer sheets were obtained for analysis. The number was again reduced to 370 by random rejection of 25 answer sheets to facilitate computational procedures. The answer sheets were arranged from highest score to the lowest score to get two extreme groups. From this the upper 100 (27 per cent of the total group) answer sheets having highest scores and the lower 100 having lowest score were selected.

Adopting the procedure suggested by Ebel (1972) the test was item analysed by computing the indices of ***item difficulty*** and ***discrimination power***. This was done using the following formula.

$$\text{Index of item difficulty} = \frac{U+L}{2N} \times 100$$

$$\text{Index of Discrimination Power} = \frac{U - L}{N} \times 100$$

Where, U = Number of correct responses in the upper group.

L = Number of correct response in the lower group.

N = Number of subjects in both the group.

Items having the difficulty index ranging between 0.60 and 0.40 with discrimination power 0.30 and above were readily selected. But few items having of difficulty index 0.30 and the discrimination power between 0.20 and .30 were also chosen so as to comply with the Blue print. 40 items were thus selected for including in the final test. All the items were arranged on the basis of increasing order of difficulty. A list of the selected items were given in the following.

Achievement Test in Biology – Item Analysis Data

Sl. No.	DI	DP
*1	.80	.30
*2	.30	.33
*3	.42	.37
*4	.63	.32
5	.12	.08
*6	.60	.41
*7	.49	.33
8	.22	.14
9	.68	.17
10	.38	.16
*11	.79	.39
*12	.56	.20
13	.58	.11
*14	.57	.40
*15	.76	.54
*16	.78	.20
*17	.28	.21
*18	.50	.38
19	.61	.13
*20	.31	.59
21	.44	.05
*22	.47	.37
*23	.38	.13
24	.38	.22
*25	.33	.21
*26	.31	.12
27	.73	.32
*28	-31	.24
*29	.71	.32
*30	.67	.31

Sl.No.	DI	DP
31*	.74	.30
32*	.31	.20
33	.37	.17
34*	.54	.35
35*	.47	.29
36	.19	.16
67*	.47	.27
38*	.70	.41
39*	.39	.33
40*	.87	.15
41	.57	.10
42	.22	.27
43	.28	.10
44	.05	-.03
45*	.59	.27
46*	.48	.54
47	.39	.24
48*	.72	.29
49*	.39	.25
50*	.46	.35
51	.33	.25
52	.33	.25
53*	.51	.33
54*	.53	.30
55	.26	.21
56*	.58	.40
57*	.43	.27
58	.36	.28
59*	.40	.42
60*	.68	.42

* Items selected for the final test.

DI – Difficulty Index; DP- Discrimination Power.

The final test includes items relating to various objectives namely, ***Knowledge, Comprehension, Application and Higher Objectives.*** The Objectives - Analysis, Synthesis and Evaluation were grouped together in ***Higher Objectives*** category. The test comprised of ***40*** multiple choice items in Malayalam with a time span of ***40*** minutes. A score of ***one*** was given to the correct answer and ***zero*** to wrong answers. Maximum and the minimum scores being ***40*** and ***zero*** respectively. The Achievement Test in Biology (Draft) and the response sheet are presented in Appendices IV and IVA respectively. Achievement Test in Biology (Final), response sheet, corresponding English versions and scoring key are presented in Appendices, IVB, IVC, IVD, IVE and IVF respectively.

Some of illustrative items are presented in following.

a) Knowledge

Name the branch of science dealing with hereditary characteristics?

A. Biology B. Zoology C. Botany D. Genetics

A	B	C	D✓

b) Comprehension

Which is the pigment that gives red colour to the red blood corpuscles?

A. Plasma B. Albumin C. Platelets D. Haemoglobin

A	B	C	D✓

c) Application

When marine fishes are included in the diet of a Goiter patient, the disease is seen gradually cured. Which of the following elements accounts for this?

A. Sodium B. Cholorine C. Iodine D. Calcium

A	B	C✓	D

d) Higher Objectives

The ratio of Hydrogen and Oxygen in a chemical compound is 2:1 as in water. There are 6 carbon atoms, 12 hydrogen atoms and 6 oxygen atoms in it. Which of the following is the best conclusion.

A. It is hydrocarbon B. It is $C_6 H_{12} O_6$ carbohydrate

C. It contains six water molecules D. It is an amino acid

A	B✓	C	D

3.4.4. 1. Validity and Reliability of the Test.

Estimation of the validity of the Achievement Test in Biology was done by correlating against the annual examination marks of standard IX students in Biology. ***The correlation coefficient obtained is 0.86.***

The ***split half reliability of the test was*** worked on a representative sample of 50 students and the index after correction using Spearman-Brown Formula was ***found to be o.77.*** the objective wise inter-correlation with the

Total Achievement Score was also employed to study the ***internal consistency*** of the test. The coefficients were reasonably high and the correlation matrix for the intercorrelation follows.

	Know-ledge	Compreh-ension	Applicat-ion	Higher objectives	Achievement in Biology (Total)
Knowledge	1.000	0.5036	0.4436	0.2653	0.7888**
Comprehension		1.000	0.4552	0.3147	0.8146**
Application			1.000	0.3328	0.7379**
Higher objectives				1.000	0.5780**

** $P < 0.01$

The indices of ***validity*** and ***reliability*** indicate that the Achievement Test has acceptable psychometric properties to measure the Achievement in Biology of standard IX students of Secondary schools in Kerala.

3.5. SAMPLE FOR THE STUDY

The study is carried out on a representative sample of ***1000*** pupils studying in class IX of Secondary school of Kerala state. Students of standard IX were given preferences on the assumption that these pupils form a ***true representative*** sample of the Secondary school population comprising of standard VIII, IX and X.

3.5.1. SAMPLING TECHNIQUE

More important than the size ***is the care with which the sample is selected.*** It is advisible to ***sub divide the*** population into ***smaller homogenous groups*** to get more accurate representation. This method results in stratified sampling. Therefore, in the present study, the technique adopted is ***proportionate stratified sampling technique.*** Due representations was given to the factors like sex, locale, management and efficiency of the schools.

3.5.1.1. Factors Represented in the Sample

For the present study the investigator considered the following factors as strata from which the necessary sample was drawn.

(i) *Gender of the subject*
(ii) *Locale of the school (Rural/urban)*
(iii) *Type of management of school (Government/private)*
(iv) *Efficiency of school*
(v) *Geographical distribution of school*

A description of each strata follows.

(i) Gender

It is a well established fact that Instructional efficiency depends on the gender of the subject. The environmental conditions and instructional pattern may be different in Boys and Girls schools. Hence equal consideration to either group is given during selection of the sample (Boys and Girls in the ratio ***1:1***).

(ii) Locale

It is noted that the location of the schools (***Rural/Urban***) influence the students performance to a considerable extend. Though greater propotions of the school belongs to Rural areas, greater efficiency is found associated with Urban schools. The students of Urban schools hails from socio-economically affluent families, while students of Rural schools mostly belongs to socio-economically backward families. Therefore, in the present sample, the consideration were given to Rural and Urban in the Ratio *3:2*.

(iii) Management

In Kerala state more than sixty per cent of the schools are run by private sector. The private school on comparison to government schools are found to be more efficient. Due weightage is given to both Private and Government in the ratio *2:1*.

(iv) Instructional Efficiency

Based on the result of the S.S.L.C. examinations of three preceeding Academic years (98-99, 99-2000, 2000-2001) schools were classified as above Average, Average and Below Average. Schools with 60% and above were given the Above Average Status. Schools with 40-60 per cent results were grouped into Average and schools which record 40 per cent and below belongs to Below Average group. While selecting the sample equal representation were given to all three groups.

3.5.2. SAMPLE SIZE

Considering all relevant factors, the size of the sample was initially fixed to be ***1000***. This ideal sample is large enough to serve as adequate representation of the population about which the investigator wishes to generalize.

A break up of the initial sample is given in the following.

Break up of the Initial Sample

Sex of the sample	Rural		Urban		Total
	Government	Private	Government	Private	
Boys	111	222	56	111	500
Girls	111	222	56	111	500
Total	222	444	112	224	
	666		334		
	1000				1000

3.6. MODE OF DATA COLLECTION SCORING AND CONSOLIDATION OF DATA

The procedure adopted for data collection follows.

3.6.1. MODE OF DATA COLLECTION

Once the sample was finalized, the next step was to prepare a list of schools. Schools were selected by strictly adhering to the all factors mentioned. Before administering the tests, the permission from concerned

Heads were ensured. Two days visit to each school required to conduct the tests. At a time the test were conducted on a single division selected randomly. Each test took it's own time schedule.

The students were supplied printed form of test materials and response sheets. Prior to the administration of tests, the students were requested to read the instructions carefully and the doubts were cleared immediately. To the level best, the students were given ideal testing conditions.

3.6.2. SCORING AND CONSOLIDATION OF DATA

Scoring was done as per the schemes of various tests. The response sheets which are not duly filled were excluded. All the obtained data were consolidated and recorded for computer processing.

Though the initial sample is 1000, a number of incomplete response sheets were deleted and the size of final sample is reduced to 917. A break-up of the final sample follows.

Break up of the Final Sample

<table>
<tr><th rowspan="2">Sex of the sample</th><th colspan="2">Rural</th><th colspan="2">Urban</th><th rowspan="2">Total</th></tr>
<tr><th>Government</th><th>Private</th><th>Government</th><th>Private</th></tr>
<tr><td>Boys</td><td>98</td><td>178</td><td>57</td><td>109</td><td>442</td></tr>
<tr><td>Girls</td><td>108</td><td>227</td><td>51</td><td>89</td><td>475</td></tr>
<tr><td rowspan="3">Total</td><td>206</td><td>405</td><td>108</td><td>198</td><td rowspan="2"></td></tr>
<tr><td colspan="2">611</td><td colspan="2">306</td></tr>
<tr><td colspan="4">917</td><td>917</td></tr>
</table>

The final sample comprises *917* students from 20 schools belongs to four districts of Kerala viz., Calicut, Malappuram, Kannur, and Kasragode. The details of the schools and number of students from each school is presented in Table 3.6.

TABLE 3.6

Details of the Final Sample

Sl. No.	Name of school	Locale (Rural/ Urban)	Manage-ment (Govt./ Private)	Type (Boys/Girls/ Co-Edn)	Sex	
					Boys	Girls
1.	C.H.M.K.S. Govt. H.S.S. Mattool	R	Govt.	Co.Edn.	16	19
2.	Moothedath High School, Thaliparamba	U	Pvt.	Co.Edn.	42	39
3.	Puthiyangadi Jama-ath H.S. Madai	R	Pvt.	Co.Edn.	21	21
4.	Iqbal High School, Kanhagad	U	Pvt.	Co.Edn.	24	13
5.	N.S.S. Higher Secondary School,Alakkode	R	Pvt.	Co.Edn.	15	24
6.	Govt. High School, Kadannapalli	R	Govt.	Co.Edn.	17	21
7.	Govt. High School, Kunhimangalam	R	Govt.	Co.Edn.	18	18
8.	Chatanchal H.S.S. Chattanad	R	Pvt.	Co.Edn.	17	19
9.	Rajas H.S. Neelaswaram	R	Pvt.	Co.Edn.	17	21
10.	Govt. Higher Sec. School, Vellur	U	Govt.	Co.Edn.	35	29
11.	M.K.S.H.S., Kuttamath	R	Pvt.	Co.Edn.	17	21

Sl. No.	Name of school	Locale (Rural/ Urban)	Manage-ment (Govt./ Private)	Type (Boys/Girls/ Co-Edn)	Sex	
					Boys	Girls
12.	Farooque Higher Sec. School	R	Pvt.	Co.Edn.	25	25
13.	V.P.K. High School, Pallikkal, Malappuram	R	Pvt.	Co.Edn.	19	20
14.	St. Joseph's High Sec. School, Calicut	U	Pvt.	Boys	43	-
15.	Calicut Girls School, Calicut	U	Pvt.	Girls	-	37
16.	Chackalakkal High School, Calicut	R	Pvt.	Co.Edn.	23	19
17.	M.C.C High School, Medical College	U	Govt.	Co.Edn.	22	22
18.	Govt. High School Koduvally	R	Govt.	Co.Edn.	47	50
19.	S.O.S. High School, Arecode	R	Pvt.	Co.Edn.	24	19
20.	Kunnamangalam High School, Calicut	R	Pvt.	Girls	-	38
	TOTAL				442	475
					917	

3.7. STATISTICAL TECHNIQUES USED

The statistical techniques used for Preliminary analysis and Major analysis include - Test of Significance of Difference between Means, Three-way ANOVA with 3x3x3 factorial design, Scheffe' Test of Post-hoc Comparison and Multiple Regression (Step-wise) analysis. A brief discussion of each of these follows:

3.7.1. TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS

It is used to identify the gender difference among Independent and Dependent variables. The Boys and Girls may show difference in Learning Style (Component wise and Total score), Approaches to Studying (Component wise and Total score), Achievement Motivation (Total score) and Achievement in Biology (Objective wise and Total score). To identify this difference, means of Independent and Dependent variables obtained for Boys and Girls were subjected to two-tailed test of significance of difference. Test of Significance of Difference between Means is also used to study the difference in Styles and Approaches between the High and Low achievers in secondary school Biology.

3.7.2. THREE WAY ANALYSIS OF VARIANCE (ANOVA)

Three-way analysis of variance (ANOVA) was used with 3x3x3 ***factorial design*** to determine the ***main*** and ***interaction effects*** of the select Independent Variables on Dependent Variables.

Analysis of variance employing three Independent Variables involving three-way classification is the Three-way ANOVA, which involves **R** levels of one factor, **C** levels of second factor and **L** levels of a third factor, the number of treatment combinations **RCL**.

Three levels of Learning Style (Highly Preferred, Moderately Preferred and Less Preferred), three levels of Approaches to Studying (Highly Desirable, Moderately Desirable and Less Desirable Approaches to Studying) and three levels of Achievement Motivation (High, Average and Low Achievement Motivation) are adopted for the 3x3x3 ***factorial design.***

ANOVA was employed separately for Achievement in Biology Total score and Objective wise scores such as Knowledge, Comprehension, Application, and Higher Objectives (Analysis, Synthesis and Evaluation clubbed) for the Total sample and the sub samples based on the Gender, Locale and Management. A model of Three-way ANOVA follows in Table 3.7.

TABLE 3.7

Three-way Model ANOVA

A	a – 1	$SS_A = nbc\ \Sigma_i\alpha_i^2$
B	b – 1	$SS_b = nct\ \Sigma_i\beta_i^2$
C	a – 1	$SS_a = nbt\ \Sigma_k\chi k^2$
A*B	(a-1) (b-1)	$SS_{A+B} = nc\ \Sigma_{ij}\ (\alpha\beta)_{ij}^2$
A*C	(a-1) c-1)	$SS_{A+C} = nb\ \Sigma_{ik}\ (\alpha\chi^2)_{ik}$
B*C	(b-1) (c-1)	$SS_{B+C} = nb\ \Sigma_{jk}\ (\beta\chi)_{jk}^2$
A*B*C	(a-1) (b-1) (c-1)	$SS_{A+B+C} = n\Sigma_{ijk}\ (\alpha\beta\chi)_{ij}^2$
error	abc (n-1)	$SS_{ERROR} = \Sigma_{ijkl}\ (\chi_{ijkl} - L_{ijk})^2$

3.7.3. SCHEFFE' TEST OF POST-HOC COMPARISON

Analysis of variance was followed by ***Post-hoc Comparison*** between the pairs of different levels of select Independent Variables on the means of Achievement in Biology (Objective wise and Total score). This will be attempted for the Independent Variables which yielded significant F-ratios in the Three-way ANOVA.

For this purpose, Scheffe's Test for Post-hoc Comparison was applied to compare the relevant categories of the Independent Variables in relation to the mean score on ***Achievement in Biology*** (Objective wise and Total

score). This was employed separately for Total sample and sub samples based on gender, locale and type of management.

The F-ratio between pairs of means is calculated using the within group variance. The values of ***F*** were compared with value of ***F'*** at the 0.05 level and 0.01 level. A significant difference between the pairs of means is judged at the required levels only when the value of ***F*** is equal to or greater than F' (Ferguson, 1976).

3.7.4. CLASSIFICATION SCHEMES

Classification of Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation into different levels using Three-way ANOVA is based on the following formula.

Mean ± 1SD

Three levels of ***Learning Style*** identified are : Highly Preferred Learning Style (HPLS); Moderately Preferred Learning Style (MPLS) and Less Preferred Learning Style (LPLS).

Three levels of ***Approaches to Studying*** include Highly Desirable Approaches to Studying (HDAS), Moderately Desirable Approaches to Studying (MDAS) and Less Desirable Approaches to Studying (LDAS).

Three levels of ***Achievement Motivation*** include High Achievement Motivation (HAM), Average Achievement Motivation (AAM) and Low Achievement Motivation (LAM).

Based on the scores of the Independent Variables, each subject's position was identified in the following 27combinations stated as follows.

1. Highly Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
2. Highly Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
3. Highly Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
4. Moderately Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
5. Moderately Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
6. Moderately Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
7. Less Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
8. Less Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
9. Less Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
10. Highly Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
11. Highly Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
12. Highly Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.

13. Moderately Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
14. Moderately Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
15. Moderately Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.
16. Less Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
17. Less Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
18. Less Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.
19. Highly Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
20. Highly Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
21. Highly Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.
22. Moderately Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
23. Moderately Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
24. Moderately Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.

25. Less Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
26. Less Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
27. Less Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.

3.7.5. MULTIPLE REGRESSION ANALYSIS - STEP WISE

Multiple Regression is a statistical device used for analysing the collective and separate contributions of two or more Independent Variables (Xi) to the variation of a Dependent Variable (Y). It can be used to check whether certain variables are caused or preceded by others to derive a functional relationship between the two sets.

This statistical technique helps to ***predict*** a criterion or Dependent Variable from a set of ***predictor*** or Independent Variables (Tacq, 1997). The predictor variables are entered one by one to find out the influence of each variable in predicting the criterion variable. First, the Predictor Variable having the highest correlation with the criterion variable is entered and then calculate the measures like F, R, R^2, adjusted R^2, Partial Regression Coefficients B, the Intercept B_0, Beta weights and Significance of t etc.

Using the F value obtained, it is possible to check whether the regressor (predictor variable entered) is significant or not. If the F-value exceeds the tabled value of F for a particular level of significance for appropriate degree of freedom, the regressor is significant. The investigator can then prepare the equation to the regression line using these quantities.

In step II the Predictor Variable having the next largest correlation is entered. If the percentage variance contributed by the two variables is considerably higher than the percentage variance contributed by the first variable, then it can be assumed that this variable is also a significant predictor. Along with this, the equation to the regression line and R can be calculated from the regression weights computed. If the R also has increased considerably from the previous R, this is an evidence that the Predictor Variable second entered is also significant in predicting the criterion variable.

The general regression equation for any number of variables is given as follows:

Y - Dependent Variable

X - Independent Variable

$Y' = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots\ldots B_KX_K$

B_0 - The slope (intercept), the value of Y when X_1 is equal to zero

B_1 - Regression coefficient for the Independent Variable X_1 – The change in Y per unit increase in X_1

X_1 - First Predictor Variable

B_2X_2 - Coefficient and variable for the second Predictor Variable X_2

B_KX_K - Coefficient and variable for the 'K^{th}' Predictor Variable – X_K.

To determine the predictive strength of the relationship we have to compute a static referred to as Multiple R. This static is just the Pearsons correlation (r) between the subjects real Y score and the Y' (predictive) based on the equation $Y' = B_0 + X_1B_1 + X_2B_2 \ldots X_KB_K$. Thus

Multiple $R = r_{y,y'}$

If the R is high, then the equation predicts the real scores well. Multiple Regression analysis will throw light upon the following issues:

1. Does the equation right?
2. What variable should there be in the equation?
3. How should test them?
4. How good is the equation?

Objectives of the Technique

1. To look for a function $Y_1 = B_0 + B_1X_1 + B_2X_2 .... + B_KX_K$ which represents the linear relationship between X_1 and Y better than among other equations. This comes down to the calculation of Regression Coefficient B_1 and the intercept B_0.
2. To investigate the magnitude of relationship between X_1 and Y and to predict which part of the variance of Y is explained by the variance of X_1. This comes down to the calculation of the correlation coefficient $r_{y'}$ and its square $r^2_{y'}$ respectively.
3. To investigate whether the relationship between X_1 and Y that is found in the sample can be generalised to the population. This comes down to the application of a significance test of the relationship.

1. Calculation of the Standardised Partial Regression coefficient β & B_0

$$\beta_1 = \frac{\sum X_1 Y - n\bar{Y}\bar{X}_1}{\sum X_1^2 - n\bar{X}_1^2}$$

$$B_0 = \overline{Y} - B_{y'}\overline{X}_1$$

$\overline{X}, \overline{Y}$ - Mean values of X_1 and Y_1

Standard deviation is made equal to 1. Beta weights are most suitable to determine the relative importance of the predictors X_1 and X_2. ***Beta must not be greater than 1.***

If Beta greater than 1 is obtained, the reason is an excessively strong association between the causal factors X_1 and X_2 (Multicollinearity). Tolerance is used for dealing multicollinearity. When multicollinearity measured, tolerance will decrease, hence standard error will become greater, so that precision becomes smaller.

2. Strength of Association of the Relationship and the Explained Variance

R = the linear association between Y on the one hand and X_1 and X_2 on the other, by means of the multiple correlation coefficient R and the square of R is the multiple determination and represents the proportion of explained variance.

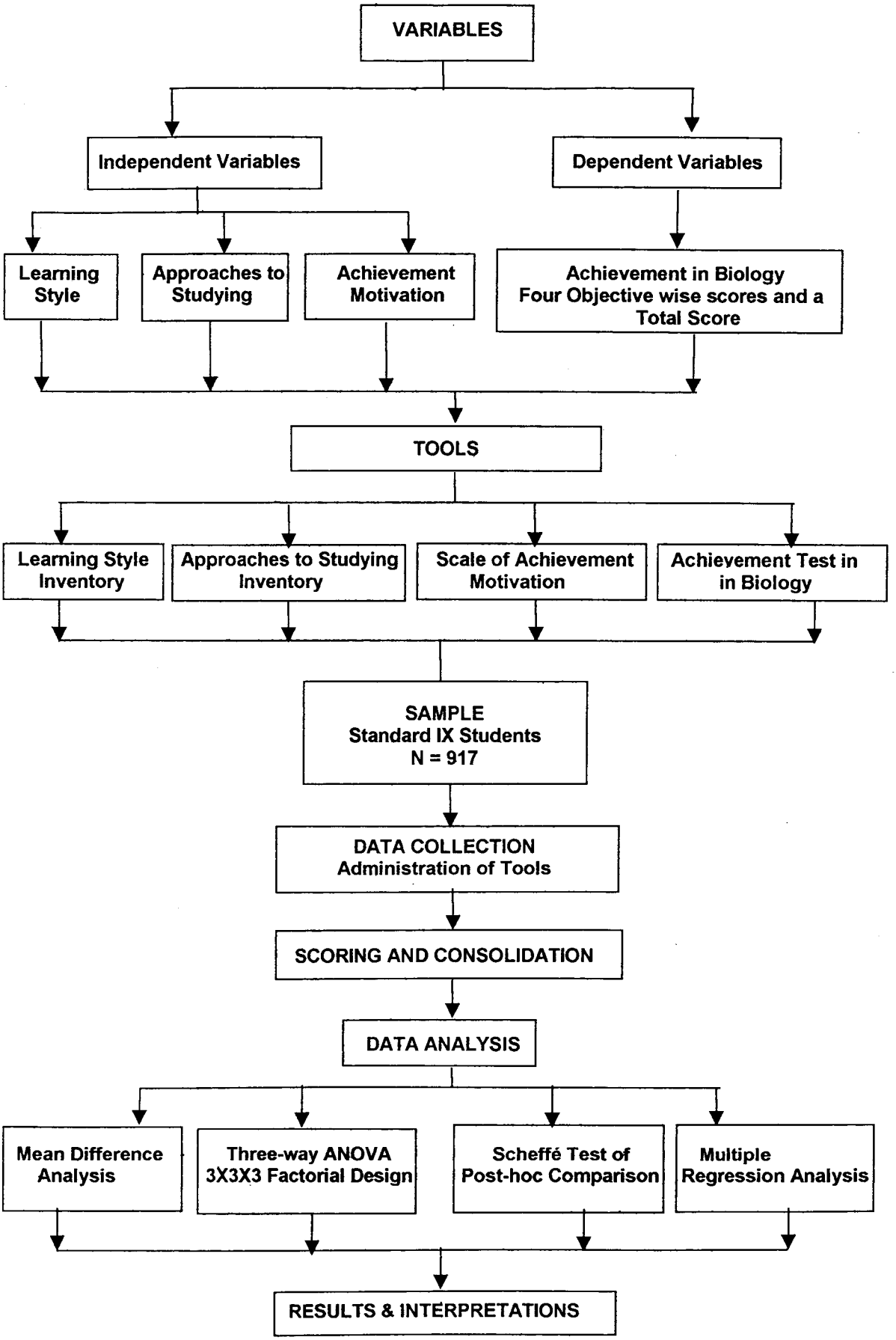
$$R = r_{y,y'}$$

t-tests for the significance of B_0, B_1 and B_2 terms are used to determine whether the term is to be included in the equation. If the term is not statistically significant then it really should not be used in the equation, despite its numerical value.

3.8. SUMMARY OF METHODOLOGY

The methodology used in the present research programme is summarised in the following Flowchart for clarity and easy reference.

Flow Chart Showing the Summary of Methodology



METHODOLOGY

Hassan koya M.P. “Influence of learning style approaches to studying and achievement motivation on achievement in biology of secondary school pupils” Thesis. Department of Education, University of Calicut, 2002

Chapter

Three

METHODOLOGY

CHAPTER 3 METHODOLOGY

This chapter deals with the techniques and methods adopted to complete the procedure of investigation. A master plan is prepared beforehand to carry out the investigation in a scientific manner. It helped the investigator to utilize time and effort in an economic way. In this chapter the details of the methodology adopted during the different phases of investigation is explained in the order of hierarchy.

3.1. VARIABLES

3.2. OBJECTIVES

3.3. HYPOTHESES

3.4. TOOLS USED FOR MEASUREMENT

3.5. SAMPLE FOR THE STUDY

3.6. MODE OF DATA COLLECTION SCORING AND CONSOLIDATION OF DATA

3.7. STATISTICAL TECHNIQUES USED

3.8. SUMMARY OF METHODOLOGY

A detailed description of each of these follows.

3.1. VARIABLES

The study is intended to explain the main and ***interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology of Secondary school pupils.*** The main focus is to unveil whether there is any variation in Achievement in Biology of Secondary school pupils attributable to variation in their Learning Style,

Approaches to Studying and Achievement Motivation. Further, the study explores to predict the Achievement in Biology from a set of three predictor variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

For the present study ***Learning Style, Approaches to Studying*** and ***Achievement Motivation*** are treated as Independent Variables. Achievement in Biology (Total score and four Objective wise scores) are the Dependent variables.

The variables for this study have been selected on the basis of the following rationale.

3.1.1. SELECTION OF VARIABLES

First of all the investigator made an attempt to identify the variables or factors which exercise substantial influence on ***Achievement***. The variables related were located by reviewing the research studies conducted abroad and India. The selection of any variable as Independent Variables was based on the hypothesis that the variable might be related to student performance and Achievement. Moreover, it could be used as predictor of Achievement. An analysis of the research studies helped to categorise the variables as follows.

3.1.1.1. Cognitive Variables

Cognitive variables include Intelligence and information processing abilities like Spatial Ability, Numerical Ability, Critical thinking, Verbal Reasoning and Cognitive Style and the like. The studies show that these

variables individually or in combination influence the Achievement of pupils.

3.1.1.2. Personality Variables

Personality variables include factors of non-cognitive and affective nature. This category include variables such as Attitude, Interest, Achievement Motivation, Adjustment, Anxiety, Neuroticism and the like. There is ample research evidence showing relationship between these variables and Science Achievement.

3.1.1.3. Instructional Methods and Infra-structural Facilities

This include variables such as Methods of Teaching, Instructional Effectiveness, Evaluation Procedure, Classroom Climate, use of Audio-Visual materials and Text Book, Size of Classroom etc. A number of studies support the relation between these variables and achievement.

3.1.1.4. Cultural Variables

This include variables of social and familial origin. Parental Education, Profession and Income, Previous Social and Educational Experience, Family Integration, Rejection/Acceptance, Autocracy/ Democracy with family etc., comes under this category.

3.1.1.5. Student Specific Variables

Variables such as Study Habits, Approaches to Learning, Learning Style, Learning Strategies etc. are included in this category. Since these variables are relatively new, the empirical evidence showing the

relationship with achievement is not very clear. Inconsistent relationships were reported by previous researchers.

3.1.2. CRITERIA USED FOR SELECTION OF VARIABLES

From the pool of variables listed earlier the investigator selected few variables which are most relevant to student learning. The specific variables are selected based on the following criteria.

(i) Make sure that the factors fall under student specific variable and personality domain.

(ii) High degree of influence is shown by the selected factors with Achievement.

(iii) The factors selected can be objectively measured.

(iv) Standardised tests are readily available or could be developed to assess the variables.

Keeping these criteria the Independent Variables were selected. They are the following.

3.1.2.1. Independent Variables

The Independent Variables selected are:

a. Learning Style (Four Component wise and Total score)

They are: Environmental, Emotional, Sociological, Physical and Learning Style (Total)

b. Approaches to Studying (Four Orientations and Total score)

They are : Meaning Orientation, Reproducing Orientation, Achieving Orientation, Non-Academic Orientation and Approaches to Studying (Total).

c. Achievement Motivation (Total score only)

3.1.2.2. Dependent Variables

Achievement in Biology is treated as Dependent Variables (four Objective wise score and a Total score). Specific Dependent variables are, Achievement in the Objectives : Knowledge, Comprehension, Application, Higher Objectives and Achievement in Biology (Total).

3.2. OBJECTIVES

The objectives formulated for the presented study are described in this part.

3.2.1. To study whether there exists ***significant gender difference*** in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.2. To study whether there exists ***significant gender difference*** in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.3. To study whether there exists ***significant gender difference*** in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.4. To study whether there exists ***significant gender difference*** in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.2.5. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for the Total sample.

3.2.6. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Boys.

3.2.7. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Girls.

3.2.8. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Rural sample.

3.2.9. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Urban sample.

3.2.10. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Government sample.

3.2.11. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Private sample.

3.2.12. To find out the ***best predictor*** of Achievement in Biology from the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

3.2.13. To study whether there exist ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

3.3. HYPOTHESES

The hypotheses set for the present study follows.

3.3.1. There will be ***significant*** gender difference in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.2. There will be ***significant*** gender difference in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.3. There will be ***significant*** gender difference in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.4. There will be ***significant*** gender difference in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

3.3.5. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for the Total sample.

3.3.6. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Boys.

3.3.7. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Girls.

3.3.8. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology

(Objective wise and Total score) of Secondary school pupils will be significant for Rural sample.

3.3.9. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Urban sample.

3.3.10. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Government sample.

3.3.11. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Private sample.

3.3.12. Achievement in Biology can be ***predicted*** using the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

3.3.13. There will be ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

3.4. TOOLS USED FOR MEASUREMENT

In the present study the three Independent Variables and Dependent Variables were measured using standardised tools of proven psychometric properties. A brief description of the tools follows.

3.4.1. LEARNING STYLE INVENTORY - LSI (Kumar, *et al.*, 1996)

Learning Style of Secondary school pupils was measured through ***Learning Style Inventory*** (LSI) constructed and standardised by Kumar *et al.* (1996). This Learning Style Inventory is constructed on the theoretical framework of Dunn and Dunn Model of Learning Style (Dunn, *et. al.*, 1989), which depicts the Learning Style as multidimensional rather than bipolar (Harvey, 1994).

Five style areas viz., ***Environmental, Emotional, Sociological*** and ***Physical*** characterises the Inventory. Psychological style area is dropped owing to the fact that it is not tapped objectively through the items of the inventory.

A style area include a cluster of style elements. These are learner preferences to the factors in the learning situations. A self explanatory sketch of the style area and style elements follows in Table 3.1.

TABLE 3.1

Style Areas and Style Elements of Learning Style Inventory

Style area	Style element	Preference for
Environment	1. Noise Level	1. Sound vs. quiet
	2. Light	2. Bright vs. dim light
	3. Temperature	3. Warm vs. cool environment
	4. Design	4. Informal(sofa, floor) vs. formal (table, chair) seating arrangement
Emotional	5. Motivation	5. Desire to achieve
	6. Persistence	6. Engaging in a task until complete or 'take breaks'
	7. Responsibility	7. Conforming to expectations
	8. Structure	8. Specific direction vs. latitude
Sociological	9. Peers	9. Learning alone vs. with others (pairs, groups)
	10. Authority	10. Directions from 'expert'
	11. Several Ways	11. Variety of methodologies and/or ability to cope with same
Physical	12. Auditory	12. Learning by listening/hearing
	13. Visual	13. Learning by watching/reading
	14. Tactile	14. Learning by hand-on e.g. note taking
	15. Kinesthetic	15. Learning by active involvement e.g. direct experience
	16. Intake	16. Eating, drinking to help concentration
	17. Evening/Morning	17. Learning in the evening vs. morning
	18. Late Morning	18. Learning in the late morning
	19. Afternoon	19. Learning in the afternoon
	20. Mobility	20. 'Taking breaks' vs. able to sit still for long periods.

The Learning Style Inventory comprised of **45** items which is supposed to be answered within a time span of **25** minutes. Out of the total 45 items 31 items are positive while the remaining 16 being negative. The items required the pupils to respond on a three point scale as ***Always, Sometimes*** and ***Never.*** For a positive item in the Inventory a score of ***two*** was given to the response category - ***Always , One*** to the category ***Sometimes*** and ***Zero*** to the category ***Never.*** The scheme was reversed for the negative items. Scores of ***Zero, One,*** and ***two*** for ***Always, Sometimes*** and ***Never*** respectively. All items are in Malayalam with a maximum score of 90 and a minimum score of zero. The Learning Style Inventory, the response sheet and the corresponding English version are presented in Appendices I, IA, IB and IC respectively.

3.4.1.1. Validity

The Learning Style Inventory was revalidated by the investigator. Validity of the test was established through ***Pearson's Product Moment Correlation*** by correlating the scores on Learning Style inventory against those on Science Studying Approach Inventory as an external criteria. The two scales were administered on a sample of 50 secondary school students. Th corresponding index obtained was **0.62.**

3.4.1.2. Reliability

Reliability was re-established through ***test-retest*** method gave the reliability index ***0.64.*** It was worked out on a representative sample of 50 students. Two consecutive testing had an interval of three weeks between them. Eventhough, the test constructors had maintained the specified time

limit, the work of Dunn (1991) reported that Learning Style is ***largely resistant*** to ***Change.***

Inter-correlations among the scores of four style areas and with the total Learning Style score (Total sample) were employed to study the internal consistency of the Inventory. The correlation matrix is presented in the following.

Correlations	**Environmental**	**Emotional**	**Sociological**	**Physical**	**Total**
Environmental		0.139	0.088	0.155	.557**
Emotional			0.143	.0217	.607**
Sociological				0.144	.487**
					.726**

** P< 0.01

The validity and reliability indices of the Inventory shows that the inventory has successfully proven the criteria of a standardised test.

For an immediate reference, some of the illustrative items are presented.

a) **Style area** : **Environmental**

Style element : ***Noise level***

I am not disturbed by any sound in utmost concentration

Always	Sometimes	Never

b) Style area : Emotional

Style element : Structure

Often, I succeed in rising up to the expectations of my parent regarding my studies.

Always	Sometimes	Never

c) Style area : Sociological

Style element : Authority

I like to study in a way which is different from that of my peers.

Always	Sometimes	Never

d) Style area : Physical

Style element : Mobility

The short recesses during the study time boost up my enthusiasm to learn.

Always	Sometimes	Never

3.4.2. APPROACHES TO STUDYING INVENTORY - ASI (Kumar & Koya, 2001)

The Approaches to Studying Inventory developed and standardised by Kumar and Koya (2001) was used to measure the variable, Approaches

to Studying. The following steps were adopted in the construction and standardisation of the Inventory.

Planning

The investigator studied thoroughly the literature on Psychology of learning process to get a theoretical footing for the Inventory. Special attention was given to those kinds of literature dealing the process of learning in pupil's own perspective, because pupils have personal conceptions and motives about how their learning might be. To get an insight about this aspect, special emphasis was given to the work done by ***Watts (1810),Dewey (1910), Marton*** and ***Saljo (1976), Fransson (1977), Sevensson (1977), Entwistle, et al. (1979), Biggs (1979), Entwistle (1981), Entwistle (1987)*** and ***Biggs (1990)***.

The investigator searched for an appropriate inventory to measure the Approaches to Studying of the sample selected. Though such inventories were available, but were constructed and standardised in the foreign context. An **ASI** which was prepared in Indian context was also found available. But it has a limitation of being subject specific. Thus the investigator decided to construct a general Approaches to Studying Inventory which is ***culture free*** and standardised in Indian context.

The investigator reviewed a vast amount of literature and inventories relating to the Learning Style, Study Processes, Approaches to Studying etc. Previous factor analyses of the Approaches to Studying Inventories (Schmeck, *et al.*, 1977, Entwistle, *et al.*, 1979; Entwistle and Ramsden, 1983;

Biggs, 1987a; Pillai, *et al.*, 1992) were thoroughly reviewed and studied before preparing the new ASI.

This ASI was prepared in tune with the Approaches to Studying Inventory (Entwistle & Ramsden, 1983) which was a product of research on student learning. It included ***motivations*** and ***study methods*** as well as contrasting ***intention to understand*** with the ***intention to reproduce*** the information being processed. This inventory also attempted to measure differences in style or kind of learning, as described by Pask (1976) who identified two strategies: ***Comprehension learning*** and ***Operation learning;*** and two pathologies; ***Improvidence*** and ***Globetrotting*** (Pask, 1976). It also included the ideas of ***syllabus-boundness*** described by Hudson (1968) and strategic approach based on responding to contextual cues on what study behaviours are most rewarded by assessment system (Entwistle, *et al.*, 1979).

Preparation

The draft form of ASI developed comprised of four component scales with four sub scales each. The details of scales and subscales that constitute the ASI are given in Table 3.2.

TABLE 3.2

Scales and Sub-scales of Approaches to Studying Inventory

Scales	Subscales
Meaning Orientation	Deep approach Inter relating ideas Use of evidence Intrinsic motivation
Reproducing Orientation	Surface approach Syllabus-boundness Fear of failure Extrinsic motivation
Achieving Orientation	Strategic approach Disorganised study method Negative attitude to studying Achievement motivation
Non Academic Orientation	Comprehension learning Operation learning Globetrotting Improvidence

As per Table 3.2 the four component scales and their sub scales are the following.

1. ***Meaning Orientation***: It involves an intention to understand and give meaning and focussing on relations between parts of subject matter, the author's message in association with the evidence used to support it. The subscales of Meaning Orientation are:

    a. ***Deep Approach:-*** In deep approach the learner involves in active questioning while learning.

b. ***Inter Relating ideas:-*** Here the learner is trying to relate the content matter with other parts of the course.

c. ***Use of Evidence:-*** The learner uses evidence while concluding a learning material.

d. ***Intrinsic Motivation:-*** Here the learner is involved in active learning for learner's own sake.

2. ***Reproducing Orientation***: It involves minimalist engagement with the task, focussing on memorising or applying procedures unreflectively. The learner sees school learning as a mean towards some other end, such as obtaining a better job or just keeping out of trouble. The strategy is thus limited to the target of essentials and reproducing through rote learning. Its subscales are –

(a) **Surface Approach**:- The learner is preoccupied with memorisation for reproducing it when the need arises.

(b) **Syllabus Boundness:-** The learning process is centred around the syllabus and the learner is relying on staff to define the learning tasks.

(c) **Fear of Failure:-** The learner shows pessimism and anxiety about academic outcomes and the learning is guided by the goal of avoiding a failure.

(d) **Extrinsic Motivation:-** The student is interested in courses and studies for the qualifications and benefits they offer.

3. *Achieving Orientation:-* This is related to the competitive form of motivation called need for achievement (n'ach) or hope for success. It's related strategies are organising time, working space and syllabus coverage in most efficient way. It's subscales are:-

   (a) **Strategic Approach**:- In this subscale learners are aware of implications of academic demands made by staff.

   (b) **Disorganised Study Method**:- In this learning strategy learners are unable to work regularly and effectively.

   (c) **Negative Attitude to Studying**:- Pupils show a negative attitude to studying by lack of interest in content matter and in the application.

   (d) **Achievement Motivation**:- Learners are showing confidence and highly competitive.

4. *Non Academic Orientation:-* It involves broad strategies of Learning with logical sequences and overreliance on details. The techniques adopted for learning are ineffective and weak to achieve higher level of understanding. It's subscales are:-

   (a) **Comprehension Learning:-** The learners are ready to map out subject area and think divergently.

   (b) **Operation Learning:-** While learning the learners emphasize on facts and logical analysis.

   (c) **Globetrotting:-** The learners show a tendency to jump into conclusion without adequate factual basis.

(d) **Improvidence**:- It is a learning pathology characterised by overreliance on details and failure to develop overall understanding.

The investigator initially pooled 112 items falling equally in to the respective Approaches to Studying component Scales and Subscales. Each subscale consisted of seven items. Utmost care was taken to make the items ***clear, precise*** and ***comprehensive*** to the construct measured. Items were prepared by abiding to the rules of Attitude Scale Construction (Edwards, 1969). Four items from each subscale were selected and subjected to expert judgement. Based on the advice, some items were deleted and others modified. The draft form of ASI then comprised of 64 items.

Try out

The draft inventory was administered on a sample of 400 secondary school pupils who were randomly selected. Adequate weightage was given to each strata of sample like Sex, Locale and Type of Management of the schools. As per the instructions in the draft ASI, the pupils were required to respond on a three point scale as ***Always, Sometimes*** and ***Never.*** For a positive item in the inventory a score of ***two*** was given to the response ***Always, one*** to the response ***sometimes*** and ***zero*** to the response ***Never.*** For negative items the scoring scheme was reversed. All the items were presented in Malayalam with a maximum score of 128 and a minimum score of zero. The time required for the completion of all the items was found to be 35 minutes.

Item Analysis

For item analysis 400 response sheets, completed in all respects were selected. When the incomplete response sheets were rejected the number for item analysis reduced to 380. The item analysis was carried out using the method suggested by ***Edwards*** (1969). In order to facilitate computational procedures, 370 sheets out of 380 were randomly drawn and arranged in the descending order of scores. The upper 100 sheets (27%) and lower 100 sheets (27%) were treated as high and low groups respectively.

Under each group, for each item, the number of pupils making response to ***Always, Sometimes*** and ***Never*** were found out and presented in the form of a frequency table. Then the *t*-value for each item was calculated to find out the discriminating power. The *t*-value showed the extent to which the high group and the low group are differentiated on a given item in the inventory.

The following formula was used to calculate the *t* value.

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\Sigma(X_H-\bar{X}_H)^2+\Sigma(X_L-\bar{X}_L)^2}{n(n-1)}}}$$

where

$$\Sigma(X_H - \bar{X}_H)^2 = \Sigma X_H^2 - \frac{(\Sigma X_H)^2}{n}$$

and $\Sigma(X_L - \overline{X}_L)^2 = \Sigma X_L^2 - \frac{(\Sigma X_L)^2}{n}$

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

$\overline{X}_L$ = The mean score on the same item for the low group.

X_H = Score of high group

X_L = Score of low group

n = number of cases

Those items exceeding a *t* value of 1.88 were selected for the final inventory. The *t* values of items and the items selected are given in Table 3.3.

TABLE 3.3

Details of Item Analysis of Approaches to Studying Inventory

Item Number	Scales	Sub scales	Positive/ Negative	t-value	Items Selected/ Rejected
1.	Meaning Orientation	Deep Approach	Positive	1.41	Rejected
2.			Negative	3.90	Rejected
3.			Positive	4.49	Selected
4.			Negative	8.05	Selected
5.		Interrelating Ideas	Negative	3.58	Selected
6.			Positive	4.77	Rejected
7.			Positive	7.01	Selected
8.			Negative	2.73	Rejected
9.		Use of Evidence	Positive	3.52	Rejected
10.			Negative	3.06	Rejected
11.			Positive	4.33	Selected
12.			Negative	3.55	Selected
13.		Intrinsic Motivation	Positive	2.42	Rejected
14.			Negative	1.26	Rejected
15.			Positive	3.90	Selected
16.			Negative	3.14	Selected

contd.....

Item Number	Scales	Sub scales	Positive/ Negative	t-value	Items Selected/ Rejected
17.	Reproducing Orientation	Surface Approach	Positive	3.91	Selected
18.			Negative	3.42	Selected
19.			Positive	1.26	Rejected
20.			Negative	1.00	Rejected
21.		Syllabus Boundness	Negative	4.39	Selected
22.			Positive	7.01	Selected
23.			Positive	5.27	Rejected
24.			Negative	0.18	Rejected
25.		Fear of failure	Positive	0.00	Rejected
26.			Negative	5.11	Selected
27.			Positive	5.05	Rejected
28.			Negative	5.84	Selected
29.		Extrinsic Motivation	Positive	2.57	Selected
30.			Negative	4.51	Rejected
31.			Positive	1.87	Rejected
32.			Negative	5.9	Selected
33.	Achieving Orientation	Strategic Motivation	Negative	0.66	Rejected
34.			Positive	5.38	Selected
35.			Negative	1.08	Rejected
36.			Positive	1.88	Selected
37.		Disorganised Study method	Negative	7.15	Selected
38.			Negative	6.12	Rejected
39.			Positive	2.71	Selected
40.			Positive	0.90	Rejected
41.		Negative Attitude to studying	Negative	4.41	Selected
42.			Positive	7.62	Selected
43.			Positive	2.31	Rejected
44.			Negative	3.60	Rejected
45.		Achievement Motivation	Negative	1.88	Selected
46.			Positive	1.91	Rejected
47.			Negative	1.82	Rejected
48.			Positive	3.39	Selected
49.	Non Academic Orientation	Comprehension Learning	Positive	5.98	Selected
50.			Negative	1.31	Rejected
51.			Positive	5.91	Rejected
52.			Negative	3.05	Selected
53.		Operation Learning	Positive	6.74	Rejected
54.			Positive	7.81	Selected
55.			Negative	2.41	Rejected
56.			Negative	2.56	Selected
57.		Globetrotting	Negative	0.00	Rejected
58.			Positive	6.60	Selected
59.			Negative	0.99	Rejected
60.			Positive	6.32	Selected
61.		Improvidence	Positive	4.30	Selected
62.			Negative	4.29	Selected
63.			Positive	0.99	Rejected
64.			Negative	1.28	Rejected

The Final Approaches to Studying Inventory was thus comprised of 32 items of which 17 are positive and 15 are negative. Each scale contained ***eight*** items, with ***two*** items each from each sub scale. The time required to respond to the ASI was fixed to be 20 minutes. The inventory had a maximum score of **64** and a minimum score of ***zero***. All items were presented in Malayalam.

Validation

Criterion related validity of the Final ASI was established through Pearson's Product Moment Correlation by correlating the scores obtained by ASI with the scores of ***Science Studying Approach Inventory*** - SSAI (Pillai, *et al.*, 1992) which was used as a criterion and also meant to measure the same on a representative sample of 46 secondary school pupils. The validity index obtained was ***0.60***. Pearson's Product Moment Correlation was calculated by the following formula.

$$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2]\,[N\Sigma Y^2 - (\Sigma Y)^2]}}$$

Reliability:- The reliability of the Final ASI was established by the ***split-half*** method on a representative sample of 46 students. The items in the inventory were divided into two equal halves with 16 items each and the scores on the first half were correlated with the scores on the second half. The reliability index obtained after correcting with Spearmen – Brown formula was found to be 0.729. The Spearman – Brown formula used was the following.

$$r_{xx} = \frac{2r_{xx}}{1 + r_{hh}}$$

Where r_{xx} is the sample estimate of the reliability coefficient and r_{hh} is the reliability of a half test.

Further the ***intercorrelations*** among the scores of four scales of Approaches to Studying with the Total score of Approaches to Studying were employed to study the ***internal consistency*** of the test. The correlation matrix with their coefficients are given as follows.

Correlations	Meaning Orientation	Reproducing Orientation	Achieving Orientation	Non-Academic Orientation	Total
Meaning Orientation		0.288	0.200	0.279	0.648**
Reproducing Orientation			0.233	0.345	0.714**
Achieving Orientation				0.264	0.623**
Non-Academic Orientation					0.700**

** $P < 0.01$

The obtained ***validity*** and ***reliability*** indices of the **ASI** show that the inventory is a ***valid*** and ***reliable*** tool for measuring the approaches to Studying of Secondary School Pupils.

The draft inventory of **ASI**, and the response sheet are presented in Appendices II and IIA respectively and the final **ASI**, the response sheet,

the English version of final **ASI** and the response sheet of English version of final **ASI** are given in Appendices IIB, IIC, IID, and IIE respectively

Some illustrative items from the Final Inventory are given in the following.

a. Scale :Meaning Orientation

1. Subscale : Deep Approach

I conduct practically possible experiments and observations related to my lessons.

Always	Sometimes	Never

a. Scale: Meaning Orientation

2. Subscale :Inter-relating Ideas

While studying I do not check whether one subject is related with any other subject or not.

Always	Sometimes	Never

a. Scale : Meaning Orientation

3. Subscale :Use of Evidence

I evaluate the conclusions on the basis of observations and experiences.

Always	Sometimes	Never

a. Scale :Meaning Orientation

4. Subscale : Intrinsic Motivation

I do the exercises given with the lessons without a direction from my teacher.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

1. Subscale : Surface Approach

While studying I frequently check whether the learned facts are there in my mind or not.

Always	Sometimes	Never

b. Reproducing Orientation

2. Subscale : Syllabus boundness

I do not have the habit of reading the lessons as directed by the teacher.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

3. Subscale : Fear of failure

I am not afraid of examinations.

Always	Sometimes	Never

b. Scale : Reproducing Orientation

4. Subscale : Extrinsic Motivation

I study because of the compulsion of elders.

Always	Sometimes	Never

c. Scale : Achieving Orientation

1. Subscale : Strategic Approach

I study for applying the acquired knowledge in real life.

Always	Sometimes	Never

c. Scale : Achieving Orientation

2. Subscale : Disorganised study method

I do not have the habit of doing homework regularly.

Always	Sometimes	Never

c. Scale : Achieving Orientation

3. Subscale : Negative Attitude to Studying

I do not feel that studying is a tedious experience.

Always	Sometimes	Never

c. Scale : Achieving Orientation

4. Subscale : Achievement Motivation

I take passing the examination as a challenge.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

1. Subscale : Comprehension learning

I have the habit of recording the similar concepts in content material in a note book.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

2. Subscale : Operation Learning

I check the conclusions using empirical evidences.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

3. Subscale : Globetrotting

I arrive at conclusions only after cautious and detailed study.

Always	Sometimes	Never

d. Scale : Non Academic Orientation

4. Subscale : Improvidence

Before accepting concepts from study materials, I thoroughly check every details related to it.

Always	Sometimes	Never

3.4.3. SCALE OF ACHIEVEMENT MOTIVATION - SAM (Pillai & Kumar, 1993)

The Independent Variable, Achievement Motivation was measured using the ***Scale of Achievement Motivation*** standardised by Pillai and Kumar (1993) in Malayalam modelled after the Achievement Motivation Questionnaire (Cassidy & Lynn, 1989). It comprises seven factors viz., ***Work ethics, Acquisitiveness, Dominance, Excellence, Competitiveness, Status aspiration*** and ***Mastery.***

The factor work ethics comes from the Weberian concept of work ethic (Weber, 1904). Other factors were evolved from various other sources on Achievement Motivation. A brief description of each factor follows.

(i) Work Ethics

It means the desire to study hard and is based on the reinforcement in the performance itself. As a motivational attribute, it ***influences attitude, values*** and ***behaviour.***

Example: ***I like to avoid those lessons which I find difficult to study.***

ii) Persuit of Excellence

It is defined as a ***competition with a standard of excellence.*** It is the reward obtained by making the best performance in studies.

Example: ***I find satisfaction in doing work better than my earlier work even if I don't outperform others.***

iii) Status Aspiration

It incorporate the ***desire to be a dominant member or a leader among other students. It is reinforcement in climbing the social status hierarchy.***

Example: ***I want others to come to me for clearing their doubts.***

iv) Competitiveness

It is the ***Satisfaction obtained while competing with others.***

Example: ***If there is tough competition, my performance will be better.***

v) Acquisitiveness

This is motivation ***based on the reinforcement properties of position or possession attained by the individual.***

Example: ***There is continuous effort behind the success of my accomplishment in studies.***

vi) Mastery

It is the ***satisfaction obtained*** when succeeding in the study of difficult matters.

Example: ***I find satisfaction in studying material which require high Intellectual ability and skill.***

vii) Dominance

It includes the desire ***to lead or to take initiative*** or to become ***a dominant member of the group.***

Example: ***When we plan an activity I would like to direct it myself rather than someone else take the lead.***

The Scale of Achievement Motivation consists of ***50*** items both in positive and negative. Out of the ***50*** items, ***Eight*** items belong to Work Ethics, ***six*** items of Pursuit of Excellence, ***Ten*** items of Status Aspiration, ***six*** items of Competitiveness, ***six*** items of Acquisitiveness, ***Four*** items of Mastery and ***Ten*** items of Dominance.

The scale is a ***three point*** one demanding responses in the category ***Yes, Undecided*** and ***No.*** For a positive item, a score of ***two*** was given to the category ***Yes,*** score ***one*** to the category ***Undecided*** and ***zero*** to the category ***No.*** The scoring procedure was reversed for the Negative items - ***zero, one*** and ***two*** for ***Yes, Undecided*** and ***No*** respectively. ***Sum*** of the obtained scores for individual items indicate the Achievement Motivation

score of the subject. The maximum score is ***100*** and the minimum score is ***zero.*** The scale of Achievement Motivation, the response sheet and the corresponding English version are presented in the Appendices III, IIIA, IIIB and IIIC respectively.

3.4.3.1. Validity of the Scale

The scale was modelled after the well known scale, Cassidy – Lynn Achievement Motivation Questionnaire (1989). The scale was re-validated by the investigator against a popular scale used for many research purpose in Kerala viz., The Kerala Scale of Achievement Motivation (Nair, 1980). The two scales were administered on a sample of 50 secondary school students and the scores were correlated using Pearson's Product Moment Correlation. The validity coefficient is found to be ***0.70.***

3.4.3.2. Reliability of the scale

Reliability of the scale was also re-established by estimating the internal consistency of the items. For this purpose Cronbach's reliability coefficient ***alpha*** was calculated by the investigator using the formula.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\Sigma \text{var}(i)}{\text{Var } X}\right) \qquad \text{(Cronbach, 1971)}$$

Cronbach's reliability coefficient ***alpha*** estimate for the Achievement Motivation factors for a representative sample of 100 secondary school pupils selected at random is presented in Table 3.4.

TABLE 3.4

Cronbach's Reliability Coefficient *alpha* for the Achievement Motivation Factors

	Factor	Alpha Coefficient
i)	Work ethic	0.71
ii)	Persuit of Excellence	0.66
iii)	Status aspiration	0.82
iv)	Competitiveness	0.64
v)	Aquisitiveness	0.67
vi)	Mastery	0.60
vii)	Dominance	0.68

The obtained ***validity*** and ***reliability*** indices of the scale shows that this scale is a valid and reliable tool for measuring Achievement Motivation of Secondary School Pupils.

3.4.4. Achievement Test in Biology - A T B (Koya, 2001)

Achievement in Biology of the sample was estimated using an Achievement Test developed by the investigator (Koya, 2001). The test consist of 40 multiple choice items which can be attempted within a maximum time of 40 minutes.

The procedure followed and technique used in the construction and standardisation of Achievement Test in Biology is given in the following.

Preparation of the Test

The science curricula of the secondary school in Kerala especially the syllabus for standard IX was analysed carefully. Text books, reference materials, Question Banks and Question papers and other standardised tests of science Achievement were utilised as sources for framing items. The special literature used for developing item format are:

1. ***Science Education in Nineteen countries*** - An Empirical study (Comber & Keeves, 1973)

2. ***Science Teaching and Testing*** (Nadalsky, 1965).

3. ***Preparing Objective Examinations***: A Hand book for Teachers (Harper & Harper, 1990).

Based on the objectives of Bloom's (1979) Taxonomy of cognitive domain the items were prepared. The objectives considered were ***Knowledge, Comprehension, Application, Analysis, Synthesis*** and ***Evaluation***. The objectives Analysis, Synthesis and Evaluation were clubbed and labelled as ***Higher Objectives***.

Weightage to the Content

Due weightage was given to the important units in Biology syllabus of standard IX in the secondary schools of Kerala. A blue print was prepared to ensure the weightage assigned to different objectives and content units. Since the items are of multiple choice format, objective scoring can be employed which ensure economy of time and effort.

Blue Print

The objectives and content areas were scrutinised by the experts in the field of test construction and science education. A blue print ensuring the content coverage of the test with respect to the weightages given for various objectives was prepared.

Accepting this as a skeleton, the investigator initially pooled 60 multiple choice items. The item formats of reputed standardised tests in science achievement were referred for developing items for the test. The prepared items were scrutinized by a team of experts in the field of tests construction and evaluation. Some items were deleted and re-edited in the light of expert criticism. Thus a draft test comprising ***60*** items in Biology was pooled. These items were arranged objective wise according to Bloom's Taxonomy of Cognitive Domain viz., Knowledge, Comprehension, Application and Higher Objectives (Analysis, Synthesis and Evaluation). The Knowledge items come at the beginning and those of the Higher Objectives at the end of the test. Items 1-17 measuring the out-put in knowledge level, items 18-35 Comprehension, items 36-50 Application, items 51-54 Analysis, items 55-57 Synthesis and items 58-60 Evaluation level. The draft test was used as a pilot test for the present study. The blue print specifying the weightage to Objectives and content area for the final test is presented in Table 3.5.

TABLE 3.5

Blue Print of Achievement Test in Biology

Sl. No.	Name of the Topic	Objectives						Total
		Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	
1	Meaning and Scope of Biology	3	1					4
2	Structure and function of cell, structure, organisation of living beings	2	4					6
3	Movement of particles in the cell, chemical basis of life	1	2			1	1	5
4	Physiology of plant and Animals	4	2	4	1	1		12
5.	Transportation of particles in plant and animals	1	2	1	1		1	6
6.	Health Science	1	2	4				7
		12	13	9	2	2	2	40

Direction for Test administration, time limit, scoring scheme and separate answer sheets were developed in consultation with the experts. The ***conventional procedure*** for the test construction were strictly followed.

Try-out

The draft-test was tried out on a representative sample of 450 students who have completed the course in standard IX. Students from six schools were randomly selected for the pilot testing.

Item Analysis

Item analysis was done using the method suggested by Ebel (1972). The answer sheets of 450 students were scored. Incomplete answer sheets were rejected. For a correct response one score was alloted and for an incorrect answer no score was given. 395 answer sheets were obtained for analysis. The number was again reduced to 370 by random rejection of 25 answer sheets to facilitate computational procedures. The answer sheets were arranged from highest score to the lowest score to get two extreme groups. From this the upper 100 (27 per cent of the total group) answer sheets having highest scores and the lower 100 having lowest score were selected.

Adopting the procedure suggested by Ebel (1972) the test was item analysed by computing the indices of ***item difficulty*** and ***discrimination power***. This was done using the following formula.

$$\text{Index of item difficulty} = \frac{U+L}{2N} \times 100$$

$$\text{Index of Discrimination Power} = \frac{U - L}{N} \times 100$$

Where, U = Number of correct responses in the upper group.

L = Number of correct response in the lower group.

N = Number of subjects in both the group.

Items having the difficulty index ranging between 0.60 and 0.40 with discrimination power 0.30 and above were readily selected. But few items having of difficulty index 0.30 and the discrimination power between 0.20 and .30 were also chosen so as to comply with the Blue print. 40 items were thus selected for including in the final test. All the items were arranged on the basis of increasing order of difficulty. A list of the selected items were given in the following.

Achievement Test in Biology – Item Analysis Data

Sl. No.	DI	DP
*1	.80	.30
*2	.30	.33
*3	.42	.37
*4	.63	.32
5	.12	.08
*6	.60	.41
*7	.49	.33
8	.22	.14
9	.68	.17
10	.38	.16
*11	.79	.39
*12	.56	.20
13	.58	.11
*14	.57	.40
*15	.76	.54
*16	.78	.20
*17	.28	.21
*18	.50	.38
19	.61	.13
*20	.31	.59
21	.44	.05
*22	.47	.37
*23	.38	.13
24	.38	.22
*25	.33	.21
*26	.31	.12
27	.73	.32
*28	-31	.24
*29	.71	.32
*30	.67	.31

Sl.No.	DI	DP
31*	.74	.30
32*	.31	.20
33	.37	.17
34*	.54	.35
35*	.47	.29
36	.19	.16
67*	.47	.27
38*	.70	.41
39*	.39	.33
40*	.87	.15
41	.57	.10
42	.22	.27
43	.28	.10
44	.05	-.03
45*	.59	.27
46*	.48	.54
47	.39	.24
48*	.72	.29
49*	.39	.25
50*	.46	.35
51	.33	.25
52	.33	.25
53*	.51	.33
54*	.53	.30
55	.26	.21
56*	.58	.40
57*	.43	.27
58	.36	.28
59*	.40	.42
60*	.68	.42

* Items selected for the final test.

DI – Difficulty Index; DP- Discrimination Power.

The final test includes items relating to various objectives namely, ***Knowledge, Comprehension, Application and Higher Objectives.*** The Objectives - Analysis, Synthesis and Evaluation were grouped together in ***Higher Objectives*** category. The test comprised of ***40*** multiple choice items in Malayalam with a time span of ***40*** minutes. A score of ***one*** was given to the correct answer and ***zero*** to wrong answers. Maximum and the minimum scores being ***40*** and ***zero*** respectively. The Achievement Test in Biology (Draft) and the response sheet are presented in Appendices IV and IVA respectively. Achievement Test in Biology (Final), response sheet, corresponding English versions and scoring key are presented in Appendices, IVB, IVC, IVD, IVE and IVF respectively.

Some of illustrative items are presented in following.

a) Knowledge

Name the branch of science dealing with hereditary characteristics?

A. Biology B. Zoology C. Botany D. Genetics

A	B	C	D✓

b) Comprehension

Which is the pigment that gives red colour to the red blood corpuscles?

A. Plasma B. Albumin C. Platelets D. Haemoglobin

A	B	C	D✓

c) Application

When marine fishes are included in the diet of a Goiter patient, the disease is seen gradually cured. Which of the following elements accounts for this?

A. Sodium B. Cholorine C. Iodine D. Calcium

A	B	C✓	D

d) Higher Objectives

The ratio of Hydrogen and Oxygen in a chemical compound is 2:1 as in water. There are 6 carbon atoms, 12 hydrogen atoms and 6 oxygen atoms in it. Which of the following is the best conclusion.

A. It is hydrocarbon B. It is $C_6 H_{12} O_6$ carbohydrate

C. It contains six water molecules D. It is an amino acid

A	B✓	C	D

3.4.4. 1. Validity and Reliability of the Test.

Estimation of the validity of the Achievement Test in Biology was done by correlating against the annual examination marks of standard IX students in Biology. ***The correlation coefficient obtained is 0.86.***

The ***split half reliability of the test was*** worked on a representative sample of 50 students and the index after correction using Spearman-Brown Formula was ***found to be o.77.*** the objective wise inter-correlation with the

Total Achievement Score was also employed to study the ***internal consistency*** of the test. The coefficients were reasonably high and the correlation matrix for the intercorrelation follows.

	Know-ledge	Compreh-ension	Applicat-ion	Higher objectives	Achievement in Biology (Total)
Knowledge	1.000	0.5036	0.4436	0.2653	0.7888**
Comprehension		1.000	0.4552	0.3147	0.8146**
Application			1.000	0.3328	0.7379**
Higher objectives				1.000	0.5780**

** $P < 0.01$

The indices of ***validity*** and ***reliability*** indicate that the Achievement Test has acceptable psychometric properties to measure the Achievement in Biology of standard IX students of Secondary schools in Kerala.

3.5. SAMPLE FOR THE STUDY

The study is carried out on a representative sample of ***1000*** pupils studying in class IX of Secondary school of Kerala state. Students of standard IX were given preferences on the assumption that these pupils form a ***true representative*** sample of the Secondary school population comprising of standard VIII, IX and X.

3.5.1. SAMPLING TECHNIQUE

More important than the size ***is the care with which the sample is selected.*** It is advisible to ***sub divide the*** population into ***smaller homogenous groups*** to get more accurate representation. This method results in stratified sampling. Therefore, in the present study, the technique adopted is ***proportionate stratified sampling technique.*** Due representations was given to the factors like sex, locale, management and efficiency of the schools.

3.5.1.1. Factors Represented in the Sample

For the present study the investigator considered the following factors as strata from which the necessary sample was drawn.

(i) *Gender of the subject*
(ii) *Locale of the school (Rural/urban)*
(iii) *Type of management of school (Government/private)*
(iv) *Efficiency of school*
(v) *Geographical distribution of school*

A description of each strata follows.

(i) Gender

It is a well established fact that Instructional efficiency depends on the gender of the subject. The environmental conditions and instructional pattern may be different in Boys and Girls schools. Hence equal consideration to either group is given during selection of the sample (Boys and Girls in the ratio ***1:1***).

(ii) Locale

It is noted that the location of the schools (***Rural/Urban***) influence the students performance to a considerable extend. Though greater propotions of the school belongs to Rural areas, greater efficiency is found associated with Urban schools. The students of Urban schools hails from socio-economically affluent families, while students of Rural schools mostly belongs to socio-economically backward families. Therefore, in the present sample, the consideration were given to Rural and Urban in the Ratio *3:2*.

(iii) Management

In Kerala state more than sixty per cent of the schools are run by private sector. The private school on comparison to government schools are found to be more efficient. Due weightage is given to both Private and Government in the ratio *2:1*.

(iv) Instructional Efficiency

Based on the result of the S.S.L.C. examinations of three preceeding Academic years (98-99, 99-2000, 2000-2001) schools were classified as above Average, Average and Below Average. Schools with 60% and above were given the Above Average Status. Schools with 40-60 per cent results were grouped into Average and schools which record 40 per cent and below belongs to Below Average group. While selecting the sample equal representation were given to all three groups.

3.5.2. SAMPLE SIZE

Considering all relevant factors, the size of the sample was initially fixed to be ***1000***. This ideal sample is large enough to serve as adequate representation of the population about which the investigator wishes to generalize.

A break up of the initial sample is given in the following.

Break up of the Initial Sample

Sex of the sample	Rural		Urban		Total
	Government	Private	Government	Private	
Boys	111	222	56	111	500
Girls	111	222	56	111	500
Total	222	444	112	224	
	666		334		
	1000				1000

3.6. MODE OF DATA COLLECTION SCORING AND CONSOLIDATION OF DATA

The procedure adopted for data collection follows.

3.6.1. MODE OF DATA COLLECTION

Once the sample was finalized, the next step was to prepare a list of schools. Schools were selected by strictly adhering to the all factors mentioned. Before administering the tests, the permission from concerned

Heads were ensured. Two days visit to each school required to conduct the tests. At a time the test were conducted on a single division selected randomly. Each test took it's own time schedule.

The students were supplied printed form of test materials and response sheets. Prior to the administration of tests, the students were requested to read the instructions carefully and the doubts were cleared immediately. To the level best, the students were given ideal testing conditions.

3.6.2. SCORING AND CONSOLIDATION OF DATA

Scoring was done as per the schemes of various tests. The response sheets which are not duly filled were excluded. All the obtained data were consolidated and recorded for computer processing.

Though the initial sample is 1000, a number of incomplete response sheets were deleted and the size of final sample is reduced to 917. A break-up of the final sample follows.

Break up of the Final Sample

<table>
<tr><th rowspan="2">Sex of the sample</th><th colspan="2">Rural</th><th colspan="2">Urban</th><th rowspan="2">Total</th></tr>
<tr><th>Government</th><th>Private</th><th>Government</th><th>Private</th></tr>
<tr><td>Boys</td><td>98</td><td>178</td><td>57</td><td>109</td><td>442</td></tr>
<tr><td>Girls</td><td>108</td><td>227</td><td>51</td><td>89</td><td>475</td></tr>
<tr><td rowspan="3">Total</td><td>206</td><td>405</td><td>108</td><td>198</td><td rowspan="2"></td></tr>
<tr><td colspan="2">611</td><td colspan="2">306</td></tr>
<tr><td colspan="4">917</td><td>917</td></tr>
</table>

The final sample comprises *917* students from 20 schools belongs to four districts of Kerala viz., Calicut, Malappuram, Kannur, and Kasragode. The details of the schools and number of students from each school is presented in Table 3.6.

TABLE 3.6

Details of the Final Sample

Sl. No.	Name of school	Locale (Rural/ Urban)	Manage-ment (Govt./ Private)	Type (Boys/Girls/ Co-Edn)	Sex	
					Boys	Girls
1.	C.H.M.K.S. Govt. H.S.S. Mattool	R	Govt.	Co.Edn.	16	19
2.	Moothedath High School, Thaliparamba	U	Pvt.	Co.Edn.	42	39
3.	Puthiyangadi Jama-ath H.S. Madai	R	Pvt.	Co.Edn.	21	21
4.	Iqbal High School, Kanhagad	U	Pvt.	Co.Edn.	24	13
5.	N.S.S. Higher Secondary School,Alakkode	R	Pvt.	Co.Edn.	15	24
6.	Govt. High School, Kadannapalli	R	Govt.	Co.Edn.	17	21
7.	Govt. High School, Kunhimangalam	R	Govt.	Co.Edn.	18	18
8.	Chatanchal H.S.S. Chattanad	R	Pvt.	Co.Edn.	17	19
9.	Rajas H.S. Neelaswaram	R	Pvt.	Co.Edn.	17	21
10.	Govt. Higher Sec. School, Vellur	U	Govt.	Co.Edn.	35	29
11.	M.K.S.H.S., Kuttamath	R	Pvt.	Co.Edn.	17	21

Sl. No.	Name of school	Locale (Rural/ Urban)	Manage-ment (Govt./ Private)	Type (Boys/Girls/ Co-Edn)	Sex	
					Boys	Girls
12.	Farooque Higher Sec. School	R	Pvt.	Co.Edn.	25	25
13.	V.P.K. High School, Pallikkal, Malappuram	R	Pvt.	Co.Edn.	19	20
14.	St. Joseph's High Sec. School, Calicut	U	Pvt.	Boys	43	-
15.	Calicut Girls School, Calicut	U	Pvt.	Girls	-	37
16.	Chackalakkal High School, Calicut	R	Pvt.	Co.Edn.	23	19
17.	M.C.C High School, Medical College	U	Govt.	Co.Edn.	22	22
18.	Govt. High School Koduvally	R	Govt.	Co.Edn.	47	50
19.	S.O.S. High School, Arecode	R	Pvt.	Co.Edn.	24	19
20.	Kunnamangalam High School, Calicut	R	Pvt.	Girls	-	38
	TOTAL				442	475
					917	

3.7. STATISTICAL TECHNIQUES USED

The statistical techniques used for Preliminary analysis and Major analysis include - Test of Significance of Difference between Means, Three-way ANOVA with 3x3x3 factorial design, Scheffe' Test of Post-hoc Comparison and Multiple Regression (Step-wise) analysis. A brief discussion of each of these follows:

3.7.1. TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS

It is used to identify the gender difference among Independent and Dependent variables. The Boys and Girls may show difference in Learning Style (Component wise and Total score), Approaches to Studying (Component wise and Total score), Achievement Motivation (Total score) and Achievement in Biology (Objective wise and Total score). To identify this difference, means of Independent and Dependent variables obtained for Boys and Girls were subjected to two-tailed test of significance of difference. Test of Significance of Difference between Means is also used to study the difference in Styles and Approaches between the High and Low achievers in secondary school Biology.

3.7.2. THREE WAY ANALYSIS OF VARIANCE (ANOVA)

Three-way analysis of variance (ANOVA) was used with 3x3x3 ***factorial design*** to determine the ***main*** and ***interaction effects*** of the select Independent Variables on Dependent Variables.

Analysis of variance employing three Independent Variables involving three-way classification is the Three-way ANOVA, which involves **R** levels of one factor, **C** levels of second factor and **L** levels of a third factor, the number of treatment combinations **RCL**.

Three levels of Learning Style (Highly Preferred, Moderately Preferred and Less Preferred), three levels of Approaches to Studying (Highly Desirable, Moderately Desirable and Less Desirable Approaches to Studying) and three levels of Achievement Motivation (High, Average and Low Achievement Motivation) are adopted for the 3x3x3 ***factorial design.***

ANOVA was employed separately for Achievement in Biology Total score and Objective wise scores such as Knowledge, Comprehension, Application, and Higher Objectives (Analysis, Synthesis and Evaluation clubbed) for the Total sample and the sub samples based on the Gender, Locale and Management. A model of Three-way ANOVA follows in Table 3.7.

TABLE 3.7

Three-way Model ANOVA

A	a – 1	$SS_A = nbc\ \Sigma_i\alpha_i^2$
B	b – 1	$SS_b = nct\ \Sigma_i\beta_i^2$
C	a – 1	$SS_a = nbt\ \Sigma_k\chi k^2$
A*B	(a-1) (b-1)	$SS_{A+B} = nc\ \Sigma_{ij}\ (\alpha\beta)_{ij}^2$
A*C	(a-1) c-1)	$SS_{A+C} = nb\ \Sigma_{ik}\ (\alpha\chi^2)_{ik}$
B*C	(b-1) (c-1)	$SS_{B+C} = nb\ \Sigma_{jk}\ (\beta\chi)_{jk}^2$
A*B*C	(a-1) (b-1) (c-1)	$SS_{A+B+C} = n\Sigma_{ijk}\ (\alpha\beta\chi)_{ij}^2$
error	abc (n-1)	$SS_{ERROR} = \Sigma_{ijkl}\ (\chi_{ijkl} - L_{ijk})^2$

3.7.3. SCHEFFE' TEST OF POST-HOC COMPARISON

Analysis of variance was followed by ***Post-hoc Comparison*** between the pairs of different levels of select Independent Variables on the means of Achievement in Biology (Objective wise and Total score). This will be attempted for the Independent Variables which yielded significant F-ratios in the Three-way ANOVA.

For this purpose, Scheffe's Test for Post-hoc Comparison was applied to compare the relevant categories of the Independent Variables in relation to the mean score on ***Achievement in Biology*** (Objective wise and Total

score). This was employed separately for Total sample and sub samples based on gender, locale and type of management.

The F-ratio between pairs of means is calculated using the within group variance. The values of ***F*** were compared with value of ***F'*** at the 0.05 level and 0.01 level. A significant difference between the pairs of means is judged at the required levels only when the value of ***F*** is equal to or greater than F' (Ferguson, 1976).

3.7.4. CLASSIFICATION SCHEMES

Classification of Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation into different levels using Three-way ANOVA is based on the following formula.

Mean ± 1SD

Three levels of ***Learning Style*** identified are : Highly Preferred Learning Style (HPLS); Moderately Preferred Learning Style (MPLS) and Less Preferred Learning Style (LPLS).

Three levels of ***Approaches to Studying*** include Highly Desirable Approaches to Studying (HDAS), Moderately Desirable Approaches to Studying (MDAS) and Less Desirable Approaches to Studying (LDAS).

Three levels of ***Achievement Motivation*** include High Achievement Motivation (HAM), Average Achievement Motivation (AAM) and Low Achievement Motivation (LAM).

Based on the scores of the Independent Variables, each subject's position was identified in the following 27combinations stated as follows.

1. Highly Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
2. Highly Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
3. Highly Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
4. Moderately Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
5. Moderately Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
6. Moderately Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
7. Less Preferred Learning Style with High Achievement Motivation and Highly Desirable Approaches to Studying.
8. Less Preferred Learning Style with Average Achievement Motivation and Highly Desirable Approaches to Studying.
9. Less Preferred Learning Style with Low Achievement Motivation and Highly Desirable Approaches to Studying.
10. Highly Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
11. Highly Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
12. Highly Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.

13. Moderately Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
14. Moderately Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
15. Moderately Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.
16. Less Preferred Learning Style with High Achievement Motivation and Moderately Desirable Approaches to Studying.
17. Less Preferred Learning Style with Average Achievement Motivation and Moderately Desirable Approaches to Studying.
18. Less Preferred Learning Style with Low Achievement Motivation and Moderately Desirable Approaches to Studying.
19. Highly Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
20. Highly Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
21. Highly Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.
22. Moderately Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
23. Moderately Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
24. Moderately Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.

25. Less Preferred Learning Style with High Achievement Motivation and Less Desirable Approaches to Studying.
26. Less Preferred Learning Style with Average Achievement Motivation and Less Desirable Approaches to Studying.
27. Less Preferred Learning Style with Low Achievement Motivation and Less Desirable Approaches to Studying.

3.7.5. MULTIPLE REGRESSION ANALYSIS - STEP WISE

Multiple Regression is a statistical device used for analysing the collective and separate contributions of two or more Independent Variables (Xi) to the variation of a Dependent Variable (Y). It can be used to check whether certain variables are caused or preceded by others to derive a functional relationship between the two sets.

This statistical technique helps to ***predict*** a criterion or Dependent Variable from a set of ***predictor*** or Independent Variables (Tacq, 1997). The predictor variables are entered one by one to find out the influence of each variable in predicting the criterion variable. First, the Predictor Variable having the highest correlation with the criterion variable is entered and then calculate the measures like F, R, R^2, adjusted R^2, Partial Regression Coefficients B, the Intercept B_0, Beta weights and Significance of t etc.

Using the F value obtained, it is possible to check whether the regressor (predictor variable entered) is significant or not. If the F-value exceeds the tabled value of F for a particular level of significance for appropriate degree of freedom, the regressor is significant. The investigator can then prepare the equation to the regression line using these quantities.

In step II the Predictor Variable having the next largest correlation is entered. If the percentage variance contributed by the two variables is considerably higher than the percentage variance contributed by the first variable, then it can be assumed that this variable is also a significant predictor. Along with this, the equation to the regression line and R can be calculated from the regression weights computed. If the R also has increased considerably from the previous R, this is an evidence that the Predictor Variable second entered is also significant in predicting the criterion variable.

The general regression equation for any number of variables is given as follows:

Y - Dependent Variable

X - Independent Variable

$Y' = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots\ldots B_KX_K$

B_0 - The slope (intercept), the value of Y when X_1 is equal to zero

B_1 - Regression coefficient for the Independent Variable X_1 – The change in Y per unit increase in X_1

X_1 - First Predictor Variable

B_2X_2 - Coefficient and variable for the second Predictor Variable X_2

B_KX_K - Coefficient and variable for the 'K^{th}' Predictor Variable – X_K.

To determine the predictive strength of the relationship we have to compute a static referred to as Multiple R. This static is just the Pearsons correlation (r) between the subjects real Y score and the Y' (predictive) based on the equation $Y' = B_0 + X_1B_1 + X_2B_2 \ldots X_KB_K$. Thus

Multiple $R = r_{y,y'}$

If the R is high, then the equation predicts the real scores well. Multiple Regression analysis will throw light upon the following issues:

1. Does the equation right?
2. What variable should there be in the equation?
3. How should test them?
4. How good is the equation?

Objectives of the Technique

1. To look for a function $Y_1 = B_0 + B_1X_1 + B_2X_2 .... + B_KX_K$ which represents the linear relationship between X_1 and Y better than among other equations. This comes down to the calculation of Regression Coefficient B_1 and the intercept B_0.
2. To investigate the magnitude of relationship between X_1 and Y and to predict which part of the variance of Y is explained by the variance of X_1. This comes down to the calculation of the correlation coefficient $r_{y'}$ and its square $r^2_{y'}$ respectively.
3. To investigate whether the relationship between X_1 and Y that is found in the sample can be generalised to the population. This comes down to the application of a significance test of the relationship.

1. Calculation of the Standardised Partial Regression coefficient β & B_0

$$\beta_1 = \frac{\sum X_1 Y - n\bar{Y}\bar{X}_1}{\sum X_1^2 - n\bar{X}_1^2}$$

$$B_0 = \overline{Y} - B_{y'}\overline{X}_1$$

$\overline{X}, \overline{Y}$ - Mean values of X_1 and Y_1

Standard deviation is made equal to 1. Beta weights are most suitable to determine the relative importance of the predictors X_1 and X_2. ***Beta must not be greater than 1.***

If Beta greater than 1 is obtained, the reason is an excessively strong association between the causal factors X_1 and X_2 (Multicollinearity). Tolerance is used for dealing multicollinearity. When multicollinearity measured, tolerance will decrease, hence standard error will become greater, so that precision becomes smaller.

2. Strength of Association of the Relationship and the Explained Variance

R = the linear association between Y on the one hand and X_1 and X_2 on the other, by means of the multiple correlation coefficient R and the square of R is the multiple determination and represents the proportion of explained variance.

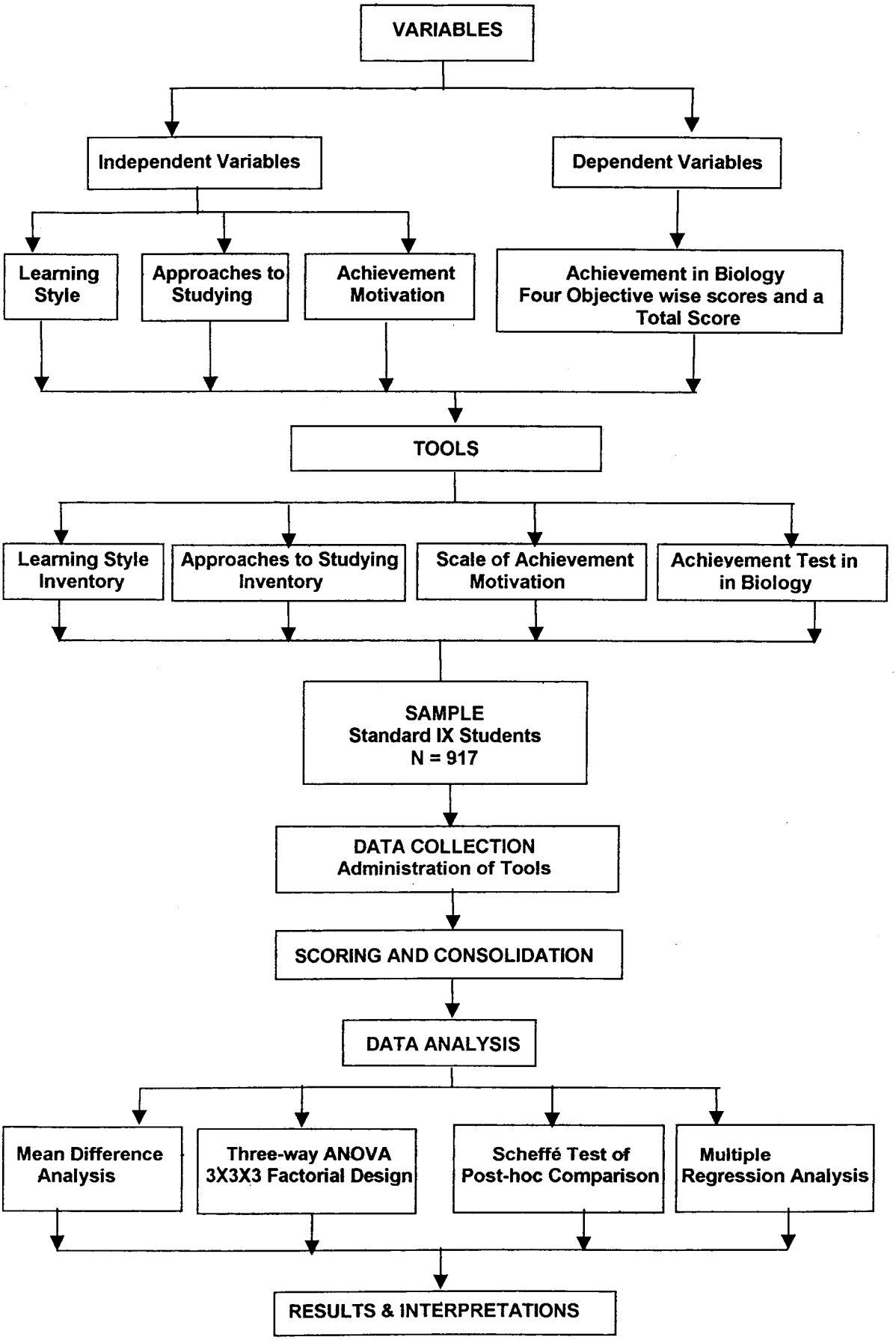
$$R = r_{y,y'}$$

t-tests for the significance of B_0, B_1 and B_2 terms are used to determine whether the term is to be included in the equation. If the term is not statistically significant then it really should not be used in the equation, despite its numerical value.

3.8. SUMMARY OF METHODOLOGY

The methodology used in the present research programme is summarised in the following Flowchart for clarity and easy reference.

Flow Chart Showing the Summary of Methodology



SUMMARY OF PROCEDURE FINDINGS AND IMPLICATIONS

Hassan koya M.P. “Influence of learning style approaches to studying and achievement motivation on achievement in biology of secondary school pupils” Thesis. Department of Education, University of Calicut, 2002

Chapter

Five

SUMMARY OF PROCEDURE FINDINGS AND IMPLICATIONS

CHAPTER 5

SUMMARY OF PROCEDURE FINDINGS AND IMPLICATIONS

The investigation is carried out on a sample of 917 Secondary school pupils across four districts of Kerala state. The target of the study was to determine the ***main*** and ***interaction*** effects of ***Learning Style, Approaches to Studying*** and ***Achievement Motivation*** on Achievement in Biology (Objective wise and Total score) of Secondary school pupils. The study is also focused to examine Gender difference in the Independent Variables and Dependent Variables, Identification of preferred Learning Style and Approaches to Studying, and how Learning Style and Approaches to Studying differentiate the High and Low Biology achievers. Sorting out of the best Predictor Variable from a set of Independent Variables to predict Achievement in Biology was another phase of the study. The results of the study are reliable and can be generalized to a great extent primarily because, the study was conducted at grass root level encompassing the Total sample and all possible sub samples.

The procedure of the investigation was completed in different phases. For convenience, the important aspect of each phase, findings drawn and their educational implications and suggestions for further research are highlighted in this chapter.

5.1. STUDY IN RETROSPECT

The various aspects in the different stage of the present investigation like the problem, the variables, objectives, hypotheses and methodology used are reviewed retrospectively.

5.1.1 STATEMENT OF THE PROBLEM

The study was entitled as **INFLUENCE OF LEARNING STYLE APPROACHES TO STUDYING AND ACHIEVEMENT MOTIVATION ON ACHIEVEMENT IN BIOLOGY OF SECONDARY SCHOOL PUPILS.**

5.1.2. VARIABLES SELECTED FOR THE STUDY

The variables selected for the study were the following.

5.1.2.1. Independent Variables

The Independent Variables selected are:

a. Learning Style (Four component wise and Total score)

They are: Environmental, Emotional, Sociological, Physical and Learning Style (Total)

b. Approaches to Studying (Four Orientations and Total score)

They are : Meaning Orientation, Reproducing Orientation, Achieving Orientation, Non-Academic Orientation and Approaches to Studying (Total)

c. Achievement Motivation

5.1.2.2. Dependent Variables

Achievement in Biology is treated as Dependent Variables (four Objective wise scores and a Total score). Specific Dependent Variables are, Achievement in the Objectives: Knowledge, Comprehension, Application, Higher Objectives and Achievement in Biology (Total).

5.1.3. OBJECTIVES

The objectives formulated for the presented study are described in this part.

5.1.3.1. To study whether there exists ***significant gender difference*** in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.3.2. To study whether there exists ***significant gender difference*** in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.3.3. To study whether there exists ***significant gender difference*** in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.3.4. To study whether there exists ***significant gender difference*** in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.3.5. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for the Total sample.

5.1.3.6. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total Score) of Secondary school pupils for Boys.

5.1.3.7. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Girls.

5.1.3.8. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Rural sample.

5.1.3.9. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Urban sample.

5.1.3.10. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Government sample.

5.1.3.11. To study the ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils for Private sample.

5.1.3.12. To find out the ***best predictor*** of Achievement in Biology from the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

5.1.3.13. To study whether there exist ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

5.1.4. HYPOTHESES

The hypotheses set for the present study follows.

5.1.4.1. There will be ***significant*** gender difference in Learning Style (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.4.2. There will be ***significant*** gender difference in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.4.3. There will be ***significant*** gender difference in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.4.4. There will be ***significant*** gender difference in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.

5.1.4.5. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for the Total sample.

5.1.4.6. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Boys.

5.1.4.7. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Girls.

5.1.4.8. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Rural sample.

5.1.4.9. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Urban sample.

5.1.4.10. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Government sample.

5.1.4.11. The ***main*** and ***interaction effects*** of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Private sample.

5.1.4.12. Achievement in Biology can be ***predicted*** using the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.

5.1.4.13. There will be ***significant difference*** in Learning Style and Approaches to Studying between the High and Low achievers in Secondary school Biology.

5.1.5. METHODOLOGY

In this part, the details of the methodology used for conducting the investigation is presented. It includes matters related to selection of sample, tools used for the study and statistical techniques. A brief description of each of these follows.

5.1.5.1. Sample for the Study

The study was conducted on a representative sample of 917 students of Standard IX of secondary schools from four districts of Kerala state viz., Calicut, Malappuram, Kannur and Kasaragode. Due representation to ***gender, locale*** and ***type of management*** of schools were given through proportionate stratified sampling technique.

5.1.5.2. Tools Used for the Study

The tools used for collecting the needed data were the following.

Learning Style Inventory - LSI (Kumar, *et al.*, 1996).

Approaches to Studying Inventory - ASI (Kumar, & Koya, 2001)

Scale of Achievement Motivation - SAM (Pillai & Kumar, 1993).

Achievement Test in Biology -ATB (Koya, 2001).

5.1.5.3. Statistical Techniques Used for the Analysis of Data

The following were the statistical procedures used to analyse the data.

Test of Significance of Difference Between Means

To study the gender difference in Independent and Dependent Variables and to study whether Learning Style and Approaches to Studying differentiating High and Low achievers in Secondary school Biology, this statistical technique was used.

Three-way ANOVA with 3x3x3 Factorial Design

Three way ANOVA was used to find out the ***main*** and ***interaction effects*** of Independent Variables on the Dependent Variables.

Scheffe' Test of Post-hoc Comparison

Scheffe' Test of Post-hoc Comparison is used to identify the groups which differ significantly in the mean achievement score. It is a follow up procedure of ANOVA.

Step-wise Multiple Regression Analysis

This technique was used to predict Criterion / Dependent Variables from a set of three predictor variables, Learning Style, Approaches to Studying and Achievement Motivation.

5.2. MAJOR FINDINGS OF THE STUDY

The major findings of the investigation in a crystallized from is given in this section. The focus of this chapter is given to the results of the investigation of gender difference in Independent Variables and Dependent Variables, Identification of the pupil's preference for Learning Style and Approaches to Studying, Main and Interaction effects of Independent Variables on Dependent Variables, Multiple Regression analysis and Style and Approach difference in High and Low Biology Achievers.

5.2.1. GENDER DIFFERENCE IN INDEPENDENT AND DEPENDENT VARIABLES

The details of results of Test of Significance of Difference between Means to study the gender difference on the Independent and Dependent Variables are given in the following:

5.2.1.1. Gender Difference in Learning Style

Regarding the Independent Variable Learning Style, significant gender difference could be observed in the components ***Emotional Style*** area (Government sample), ***Social Style*** area (Total and Urban samples) and ***Physical Style*** area (Total, Rural and Private samples). The significant t-values showing gender difference are presented as follows in the decreasing order of magnitude.

Variable	Sample	t-value	Level of significance
Physical	Rural	2.60	0.01
Physical	Private	2.60	0.01
Social	Total	2.57	0.01
Physical	Total	2.32	0.05
Social	Urban	2.28	0.05
Emotional	Government	2.06	0.05

However, no significant gender difference could be observed in all samples for Environmental Style area, in Rural, Government and Private samples for Social Style area, in Urban and Government samples for Physical Style area and in all samples for Learning Style (Total score).

5.2.1.2. Gender Difference in Approaches to Studying

The investigation results indicate that significant gender difference was noticed for the variable Approaches to Studying (Componentwise and Total score). Gender difference is found for ***Meaning Orientation*** in Private sample, ***Non-Academic Orientation*** in Total sample and Private sample and ***Approaches to Studying (Total)*** in Rural sample. The significant t-values are given in the following in the descending order of magnitude.

Variable	Sample	t-value	Level of significance
Meaning Orientation	Private	2.52	0.05
Non-Academic Orientation	Total	2.06	0.05
Non-Academic Orientation	Private	2.04	0.05
Approaches to Studying (Total)	Rural	1.99	0.05

It is also noted that, the components ***Reproducing Orientation*** and ***Achieving Orientation*** in all samples yielded no gender difference. Similarly Meaning Orientation in Total, Rural, Urban and Government samples and Non-Academic Orientation in Rural, Urban and Government samples. Approaches to Studying (Total score) in Total, Urban, Government and Private sample do not yield gender difference.

5.2.1.3. Gender Difference in Achievement Motivation

The result of 't' test conducted for the variable Achievement Motivation indicate that there exist no gender difference. Boys and Girls in the Total sample and Sub samples are ***identical*** with respect to their Achievement Motivation.

5.2.1.4. Gender Difference in Achievement in Biology

For the Dependent Variable, Achievement in Biology all the Objectives and Total score except Objective Comprehension show gender difference. Objective Application is showing gender difference in Total,

Rural, Urban and Government samples. Dependent variable Higher Objectives yield gender difference in Total, Private and Urban samples. Likewise Boys and Girls show significantly different scores for the Objective Knowledge in Urban, Government and Private samples. Achievement in Biology (Total score) show gender difference in two samples, viz., Government and Private. The significant t-values obtained are listed as follows in the decreasing order of magnitude.

Dependent Variable	Sample	t-value	Level of significance
Application	Government	4.68	0.01
Higher Objectives	Urban	3.26	0.01
Application	Total	2.91	0.01
Knowledge	Private	2.81	0.01
Higher Objectives	Total	2.66	0.01
Application	Urban	2.57	0.05
Achievement in Biology (Total)	Government	2.42	0.05
Knowledge	Urban	2.23	0.05
Higher Objectives	Private	2.18	0.05
Knowledge	Government	2.13	0.05
Achievement in Biology (Total)	Private	1.97	0.05
Application	Rural	1.96	0.05

Meanwhile, ***no gender difference*** is noticed for the Objective Knowledge in Total sample and Rural sample. The variable Application do not yield gender difference in Private sample. Higher Objectives show no gender difference in Rural and Government sample. It could be observed

that no gender difference is noticed for Achievement in Biology (Total) in Rural, Urban and Total sample.

5.2.2. IDENTIFICATION OF LEARNING STYLE PREFERENCES

An attempt was made by the investigator to identify the Learning Style preferences of pupils (Total and all Sub samples). For this the mean and standard deviations obtained for Learning Style (Component wise) were studied. It revealed that the most preferred Learning Style component was ***Physical Style,*** which was followed by ***Emotional Style*** and ***Environmental Style.*** The least preferred style was found associated with ***Social Style*** area.

5.2.3. IDENTIFICATION OF STUDY APPROACHES

The results of the Component wise identification of study approaches of pupils (Total and all sub samples) revealed that the highly preferred study approach was ***Achieving Orientation.*** It was followed immediately by ***Reproducing Orientation*** and next by ***Non-Academic Orientation.*** The least preferred study approach was ***Meaning Orientation.***

5.2.4. RESULTS OF THREE-WAY ANOVA FOR ACHIEVEMENT IN BIOLOGY

This is the core analysis which explains the main and interaction effects of Independent Variables on Achievement in Biology (Objective wise and Total score). This is done with the help of Statistical technique Three-way ANOVA with 3x3x3 factorial design.

5.2.4.1. Main Effect of Independent Variables

The main effect of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) are discussed in this part.

Main Effect of Learning Style

The results of Three-way ANOVA show that Learning Style is found to have significant main effect on Achievement in Biology (Objective wise and Total score) in ***five*** ANOVA. Main effect is noticed for the samples Rural (Knowledge and Achievement in Biology – Total score), Government (Comprehension) and Private (Comprehension and Achievement in Biology – Total). Details of the significant F-values are presented as follows in the decreasing order of magnitude.

Sl. No.	Sample	N	Dependent Variable	F-values
1	Rural	611	Knowledge	5.23**
2	Rural	611	Achievement in Biology (Total)	4.27*
3	Private	603	Achievement in Biology (Total)	3.44*
4	Private	603	Comprehension	3.36*
5	Government	314	Comprehension	3.11*

** $P < 0.01$
* $P < 0.05$

Main Effect of Approaches to Studying

Approaches to Studying yielded significant main effect in ***four*** ANOVA distributed in Total sample (Knowledge), Boys (Knowledge and Achievement in Biology - Total score) and Private sample (Comprehension). The significant F-values are given in the descending order of preference in the following.

Sl. No.	Sample	N	Dependent Variable	F-values
1	Boys	442	Knowledge	6.37**
2	Private	603	Comprehension	4.52*
3	Boys	442	Achievement in Biology (Total)	3.87*
4	Total	917	Knowledge	3.47*

** $P < 0.01$
* $P < 0.05$

Main Effects of Achievement Motivation

For the Independent Variable Achievement Motivation significant main effect was found to exist in *two* ANOVA. The main effect was noticed in the Total sample on the Objective wise Achievement in Biology in Knowledge and Higher Objectives. The significant F-values showing main effect are presented as follows:

Sl. No.	Sample	N	Dependent Variable	F-values
1	Total	917	Knowledge	3.26*
2	Total	917	Higher Objectives	3.08*

* $P < 0.05$

5.2.4.2. Interaction Effects of Independent Variables

Under this headline the results of two-way interaction effects and three-way interaction effect are described briefly.

Two-way Interactions

There are three type of two-way interaction viz., Learning Style x Approaches to Studying, Learning Style x Achievement Motivation and Approaches to Studying x Achievement Motivation.

For the combined effect of ***Learning Style x Approaches to Studying*** one ANOVA in ***Private sample is turned out to be significant.*** The interaction effect of Learning Style x Approaches to Studying is found on the Achievement in Biology Objective Comprehension. From the graphs of Private sample, it is clear that ***Moderately preferred Learning Style interact with Highly Desirable Approaches to Studying*** to produce high Achievement in Biology, Objective Comprehension.

The significant F-ratio for the two-way interaction of Learning Style x Approaches to Studying follows:

Sl. No.	Sample	N	Dependent Variable	F-value Learning Style x Approaches to Studying
1.	Private	603	Comprehension	2.60*

*P < 0.05

The interaction of ***Learning Style x Achievement Motivation*** yield ***six*** significant F-values. ***Of the six significant F-values three falls in Private sample, (Knowledge, Application and Achievement in Biology Total score), two in Rural sample (Knowledge and Achievement in Biology Total score) and one is in the sub sample Girls (Knowledge).*** Therefore, it is evident that the ***combined effect of Learning style x Achievement Motivation causes variation in Achievement in Biology (Objective wise and Total score).*** The findings is substantiated by the graphs of Private, Rural and Girls. In all these, the ***High Achievement Motivation groups coupled with Moderately preferred Learning Style produced high Achievement in Biology (Objective wise and Total score).*** The significant F-ratios of two-way interactions for Learning Style x Achievement Motivation are presented as follows in decreasing order of magnitude.

Sl. No.	Sample	N	Dependent Variable	F-value Learning Style x Achievement Motivation
1	Private	603	Knowledge	3.24*
2	Private	603	Achievement in Biology (Total)	3.19*
3	Rural	611	Knowledge	3.14*
4	Private	603	Application	2.75*
5	Rural	611	Achievement in Biology (Total)	2.45*
6	Girls	475	Knowledge	2.38*

*P < 0.05

Three way Interaction

The result of three-way Interaction of Learning Style x Approaches to Studying x Achievement Motivation revealed that it is not significant on the Dependent Variable Achievement in Biology (Objective wise and Total score). The F-ratios obtained for the Total sample, Boys, Girls, Rural, Urban, Government and Private are turned out to be not significant.

5.2.5. GROUP DIFFERENCE IN MEAN ACHIEVEMENT IN BIOLOGY (OBJECTIVE WISE AND TOTAL SCORE)

Identification of the Group difference in mean Achievement in Biology (Objective wise and Total score) for relevant groups based on Learning Style, Approaches to Studying and Achievement Motivation was made through Scheffe' test of Post-hoc Comparison. Comparison were carried out whenever significant main effects were noticed.

5.2.5.1. Group Difference in Mean Achievement in Biology (Objective wise and Total score) Based on Learning Style

The result of Three-way ANOVA undertaken for Rural, Government and Private sample, yield significant main effect for Learning style. As a follow-up procedure Post-hoc Comparison was made through Scheffe' test to identify the groups which differ significantly. The F-values obtained in Scheffe' test are arranged in the decreasing order of magnitude in case of each sample and presented in the following.

Sample	N	Dependent Variable	Groups compared	F-value	Level of signifi-cance
Rural	611	Knowledge	MPLS - LPLS HPLS - LPLS HPLS - MPLS	8.85 3.16 0.54	0.05 NS NS
Rural	611	Achievement in Biology (Total)	MPLS - LPLS HPLS - LPLS HPLS - MPLS	6.46 4.51 0.26	0.05 NS NS
Government	314	Comprehension	HPLS - LPLS HPLS - MPLS MPLS - LPLS	8.41 4.55 2.51	0.05 NS NS
Private	603	Comprehension	HPLS - MPLS HPLS - LPLS MPLS - LPLS	6.99 6.46 3.35	0.05 0.05 NS
Private	603	Achievement in Biology (Total)	HPLS - LPLS MPLS - LPLS HPLS - MPLS	6.87 3.75 1.07	0.05 NS NS

HPLS - Highly Preferred Learning Style
MPLS - Moderately Preferred Learning Style
LPLS - Less Preferred Learning Style
NS - Not Significant.

Results of the Post-hoc Comparison of three groups formed on the basis of Learning Style, viz., HPLS, MPLS and LPLS revealed the following:

1. Significant differences in mean achievement score is found in *six* out of 15 groups compared.
2. Significant difference exist between all the three groups compared (HPLS - LPLS; HPLS - MPLS and MPL - LPLS).
3. In most of the cases, it is observed that highest mean score is associated with ***HPLS***, when comparison is made between HPLS - LPLS and HPLS - MPLS.

When compared MPLS - LPLS group, high mean achievement score is found linked with MPLS. In short, comparison of mean Achievement scores in Biology, showed the ***superiority of High groups for higher achievement benefits.***

5.2.5.2. Group Difference in Achievement in Biology (Objective wise and Total score) Based on Approaches to Studying

Approaches to Studying is found to have main effect on Achievement in Biology (Objective wise and Total score) for Total sample, Boys and Private sample. To identify the groups which yield significant differences in mean achievement scores, Scheffe' test was applied. The F-values obtained in the Scheffe' test are arranged in the decreasing order of magnitude in each sample is presented as follows.

Sample	N	Dependent Variable	Groups compared	F-value	Level of significance
Total	917	Knowledge	HDAS - LDAS MDAS - LDAS HDAS - MDAS	6.05 5.57 0.7	0.05 NS NS
Boys	442	Knowledge	MDAS - LDAS HDAS - MDAS HDAS - LDAS	7.16 2.14 0.9	0.05 NS NS
Boys	442	Achievement in Biology (Total)	HDAS - LDAS HDAS - MDAS MDAS - LDAS	13.18 8.08 2.48	0.01 0.05 NS
Private	603	Comprehension	HDAS - LDAS HDAS - MDAS MDAS - LDAS	8.87 2.94 0.569	0.05 NS NS

HDAS - Highly Desirable Approaches to Studying
MDAS - Moderately Desirable Approaches to Studying
LDAS - Less Desirable Approaches to Studying
NS - Not Significant.

Results of Post-hoc Comparison of three groups, formed on the basis of Approaches to Studying (HDAS, MDAS and LDAS) showed the following:

1. Significant differences in mean achievement score in ***five*** out of 12 groups compared.

2. All the three groups compared namely HDAS - MDAS, HDAS - LDAS and MDAS - LDAS show significant difference.

3. When comparison is made between HDAS-MADS and HDAS-LDAS, ***highest mean achievement score is found associated with HDAS.*** Similarly MDAS attain high mean achievement score when paired with LDAS.

The results confirm that the three groups - HDAS, MDAS and LDAS are dissimilar in their performance and their achievement in Biology varies with regard to the three groups based on Approaches to Studying (HDAS - MDAS, HDAS - LDAS and MDAS - LDAS).

5.2.5.3 Difference in Mean Achievement in Biology (Objective wise and Total score) Based on Achievement Motivation

Achievement Motivation is found to have significant main effect on Achievement in Biology (Objective wise - Achievement in Knowledge and Higher Objectives) for the Total sample. To identify the groups which yield significant differences in mean achievement scores, Scheffe' test of Post-hoc Comparison was applied. The F-values obtained in the Scheffe' test are arranged in the decreasing order of magnitude in the following.

Sample	N	Dependent Variable	Groups compared	F-value	Level of significance
Total	917	Knowledge	HAM - AAM HAM - LAM AAM - LAM	15.39 9.64 3.60	0.01 0.01 NS
Total	917	Higher Objectives	HAM - LAM HAM - AAM AAM - LAM	20.26 15.58 3.18	0.01 0.01 NS

HAM - High Achievement Motivation
AAM - Average Achievement Motivation
LAM - Low Achievement Motivation
NS - Not Significant.

Results of the Post-hoc Comparison reveal the following:

1. Significant differences in mean achievement score is obtained in ***four*** out of ***six*** groups compared.

2. Only two-groups - HAM-AAM and HAM-LAM yield significant difference.

3. ***High mean achievement score in associated with HAM in group comparisons*** - HAM-AAM and HAM-LAM.

4. Comparison of mean achievement score in Biology (objective wise) showed the superiority of the HAM group.

Since the comparison AAM-LAM do not yield any significant difference, it can be concluded that only the group HAM causes enhanced achievement in Biology (Objective wise) for the Total sample.

5.2.6. RESULTS OF MULTIPLE REGRESSION ANALYSIS - STEP WISE

Multiple Regression Analysis - Step-wise revealed that from the set of three Independent Variables, viz., Learning Style, Approaches to Studying and Achievement Motivation, the best predictor variable of Achievement in Biology was found to be Achievement Motivation and second predictor variable was Approaches to Studying with high percentage variance Beta weights and t-values. The shared variance, increment in percentage variance and t-values obtained in two steps are presented as follows:

Step No.	Predictor Variable	Shared variance	Increment in Percentage variance	Beta Weights	t-value	Signi-ficance of 't'
1	Achievement Motivation	2.41	--	0.126	3.760	0.01
2	Approaches to Studying	3.51	1.10	0.108	3.22	0.01

5.2.7. RESULTS OF STYLE AND APPROACH DIFFERENTIATION IN HIGH AND LOW BIOLOGY ACHIEVERS

The details of the t-test conducted to differentiate Style and Approach in High and Low Biology Achievers follows.

5.2.7.1. Learning Style Differentiation in High and Low Biology Achievers

The result of t-test conducted to differentiate Style preference indicate that there exist no difference in Style preference between High and Low Biology achievers. The High Biology achievers and Low Biology achievers are ***identical*** with respect to their Style preference.

5.2.7.2. Approach Differentiation in High and Low Biology Achievers

The result of Test of Significance of Difference between means of Approaches to Studying of High Achievers and Low Achievers indicate the existence of significant difference in their Approaches to Studying.

Reproducing Orientation, Achieving Orientation, Non-Academic Orientation and Approaches to Studying (Total) show significant difference between High and Low Biology Achievers. The significant t-values are given in the following in the order of decreasing magnitude.

Variable	t-value	Level of significance
Reproducing Orientation	5.60	0.01
Approaches to Studying (Total)	4.16	0.01
Achieving Orientation	2.62	0.01
Non-Academic Orientation	2.16	0.05

5.3. TENABILITY OF HYPOTHESES

Based on the major findings, the tenability of the hypotheses set for the present study is examined as follows:

5.3.1. The first hypothesis was that ***there will be significant gender difference in Learning Style (Component wise and Total score) for the Total Sample and Sub samples based on Locale and Type of management of school.***

Among the 25 t-values studied to understand gender difference in Learning Style for Total sample and Sub samples based on Locale and Type of management of school in ***six*** comparisons, significant gender difference was noted. So this hypothesis is substantiated to a lesser extent.

5.3.2. The second hypotheses was that ***there will be significant gender difference in Approaches to Studying (Component wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.***

Out of the 25 t-values studied to examine the gender difference in Approaches to Studying (Componentwise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school ***four*** were found significant. Hence, this hypothesis is substantiated to a lesser extent.

5.3.3. The third hypothesis was that ***there will be significant gender difference in Achievement Motivation (Total score) for the Total sample and Sub samples based on Locale and Type of management of school.***

All the t-values studied to examine gender difference in Total sample and sub samples were found to be not significant. Therefore, this hypothesis is rejected.

5.3.4. The fourth hypothesis was that ***there will be significant gender difference in Achievement in Biology (Objective wise and Total score) for the Total sample and Sub samples based on Locale and Type of management of school.***

In Achievement in Biology (Objectivewise and Total score) significant gender difference was found in *12* out of 25 comparisons (***four*** for the Objective Application, ***three*** for Knowledge, ***three*** for Higher Objectives and ***two*** for Achievement in Biology - Total score). This result shows that there exist significant gender difference in Achievement in Biology (Objective wise and Total score) for Total sample and Sub samples. Hence this hypothesis is partially accepted.

5.3.5. The fifth hypothesis was ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for the Total sample.***

For the main effect of Learning Style on Achievement in Biology (Objective wise and Total score) none of the F-value is found to be significant. ***Approaches to Studying is found to have significant main effect in one ANOVA on Dependent Variable, Knowledge.*** But the main effect of Approaches to Studying on other Objectives and Achievement in Biology (Total) is not significant. ***Achievement Motivation yielded two significant F-values out of five ANOVA undertaken*** for the main effect on Achievement in Biology (Objectives - Knowledge and Higher Objectives). Altogether in Total sample ***three*** F-values were found significant out of five ANOVA undertaken. However, the results of two-way interactions and

three-way interactions for the Total sample do not yield any significant F-values. Hence the Hypothesis is rejected.

5.3.6. The sixth hypothesis stated that ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Boys.***

The F-values obtained for the main effect of Learning Style and Achievement Motivation is found not significant. For Approaches to Studying significant main effect is observed in ***two*** ANOVA for the Objective Knowledge and Achievement in Biology (Total score). Out of the five ANOVA employed, only in ***two*** ANOVA significant F-values were obtained.

No two-way interactions namely Learning Style x Approaches to Studying, Learning Style x Achievement Motivation and Approaches to Studying x Achievement Motivation produced significant interaction effect. Likewise the three-way interaction is also found not significant.

Therefore the sixth hypothesis is rejected.

5.3.7. The seventh hypothesis stated that ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Girls.***

The results of the Three-way ANOVA for Girls show that all the three independent variables yielded no significant F-values. In other words, the

main effect of Learning Style, Approaches to Studying and Achievement Motivation is not found significant.

Moreover, the results of two-way interactions - Learning Style x Approaches to Studying and Approaches to Studying x Achievement Motivation - do not produce any significant interaction effect. However, Learning Style x Achievement Motivation is found to be significant for the objective Knowledge. Similarly the F-value obtained for three way interaction - Learning Style x Approaches to Studying x Achievement Motivation - also turned out to be not significant. Out of the five ANOVA undertaken for Girls only one F-value is found significant. Hence, hypothesis seven is rejected.

5.3.8. Hypotheses eight was ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Rural sample.***

The ***main effect*** of Learning style is found to have ***significant on two Dependent Variables***. The F-value obtained for Knowledge and Achievement in Biology (Total score) were found to be significant. On the contrary, for the Dependent Variables, Comprehension, Application and Higher Objectives the main effect is not significant. Approaches to Studying and Achievement Motivation yielded no significant F-values for the main effect. Altogether in Rural sample ***two*** F-values were found significant for the main effect out of five ANOVA.

For the interaction effects Learning Style x Approaches to Studying and Approaches to Studying x Achievement Motivation fail to produce any significant interaction effect on Dependent Variables. ***But the combination Learning Style x Ahievement Motivation yielded significant interaction effect on Achievement in Biology (Total score) and in the Objective Knowledge.*** Out of the five ANOVA two F-values were found significant for the interaction effect. And therefore this hypothesis is partially accepted.

5.3.9. Hypothesis nine stated that ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Urban sample.***

Throughout five ANOVA undertaken for the Urban sample, no F-value is turned out to be significant. All the main effects, two-way interaction and three-way interactions were found to be not significant. So the nineth hypothesis is rejected.

5.3.10.The tenth hypothesis was ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Government sample.***

Out of the *five* ANOVA, main effect of Learning Style (for the category Comprehension) is found to be significant. Approaches to

Studying and Achievement Motivation yielded no significant main effect for Achievement in Biology (Objective wise and Total score).

All the two-way interactions fail to produce significant F-values. Besides, the three-way interaction namely Learning Style x Approaches to Studying x Achievement Motivation is also turned to be not significant. Out of five ANOVA only ***one*** F-value for the main effect is found significant for Government sample. In this context, the hypothesis set for the Government sample is rejected.

5.3.11.The eleventh hypothesis stated that ***the main and interaction effects of Learning Style, Approaches to Studying and Achievement Motivation on Achievement in Biology (Objective wise and Total score) of Secondary school pupils will be significant for Private sample.***

The main effect of Learning Style on Achievement in Biology (Objective wise and Total sore) was found to be significant in ***two out of five ANOVA undertaken.*** Approaches to Studying yield only ***one*** significant main effect out of the five ANOVA, the remaining four ANOVA undertaken were found to be not significant. Altogether in Rural Sample ***three*** F-values were found significant for the main effect out of five ANOVA.

In the case of two-way interaction ***Learning Style x Achievement Motivation*** yielded significant ***interaction effect*** for Knowledge, Application and Achievement in Biology (Total). The interaction of ***Learning Style x Approaches to Studying*** yield significant ***interaction effect***

for ***one*** Dependent Variable Comprehension. Altogether four F-values were found to be significant out of five ANOVA for the interaction effect. While Approaches to Studying x Achievement Motivation do not yield any significant interaction effect. Similarly three-way interaction of Learning Style x Approaches to Studying x Achievement Motivation also yielded no significant F-values. ***Hence this hypothesis is substantiated to a lesser extent.***

5.3.12.The twelfth hypothesis was that ***Achievement in Biology can be predicted using the set of three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation.***

Out of the three Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation used for predicting Achievement in Biology, ***Achievement Motivation*** was found to be the best predictor of achievement. The second Predictor Variable found was Approaches to Studying. Hence this hypothesis is accepted.

5.4.13.The thirteenth hypothesis was that ***there will be significant difference in Learning Styles and Approaches to Studying between High and Low Achievers in Secondary School Biology.***

The result of t-test conducted to differentiate Style preference between High and Low Biology Achievers yielded no significant t-values. For ***Approaches to Studying, among five t-values, four of them yielded significant difference between High and Low Biology Achievers.*** Hence this hypothesis is partially accepted.

5.4. IMPLICATIONS OF THE STUDY

The present study highlight the fact that the thrust of educators ***to explore student specific variables*** to enhance academic achievement ***is promising***. The findings are of paramount importance as it ***support*** a number of relevant studies which exhorts that students' attainments depend to a quite considerable extend on the experiences he/she has enjoyed (Campbell, 1978). Educational attainment can be enhanced by identifying and strengthening their own style of learning (Entwistle, 1981). On the basis of the results of the present investigation, ***the following alterations in practice of teaching and learning are suggested for improving secondary school education.***

5.4.1. RECONSTRUCT LEARNING ENVIRONMENT

In the light of the major findings, it is clear that the changes in the Independent Variables viz., Learning Style, Approaches to Studying and Achievement Motivation ***independently*** and in ***combination*** influenced Achievement in Biology to a lesser extend. The weak effect may be due to several intervening variables that are beyond the control of the investigator. Learning is a process which depends upon a large number of facilitating and debilitating factors such as pupils' aptitude, socio-familial background, instructional method, motivation, Style of Learning and Approaches to Studying.

The study revealed that the main effect of Learning Style on Achievement in Biology (Objective wise and Total score) is found to be significant to a lesser extent. It implies that the variation in Learning Style

preferences of pupils influence their Achievement in Biology mildly. The present findings are substantiated by a number of former studies, which considers Learning Style preference as a determinant factor in Achievement. Students with Preferred Learning Style perform better (Mathews, 1995). Learning Style is found to have significant main effect on Achievement (Rehna, 1996; Kumar, 1997). Results of the studies conducted by Kumar (1997a) further clarifies that there is significant differences between High and Low Achievers based on their Learning Style. Result of studies conducted by Burns, *et al.* (1998) show that significant overall differences were found between average and above average achieving students in Learning Style preferences.

Although the single effect of Learning Style on Achievement in Biology is weak, the study revealed that the two-way interaction of ***Learning Style x Achievement Motivation*** is significant to a considerable extent. It implies that to enhance achievement educators may give attention to ***combining Learning Style preferences along with Achievement Motivation.*** The study of graphical representation further clarifies that High Achievement Motivation group adopting Moderately Preferred Learning Style attain high academic achievement. Therefore, there is a necessity to ***reconstruct*** learning environment around students' Learning Style preferences.

5.4.2. IDENTIFY AND MATCH THE STYLE

Earlier research studies show that match between educational structures and conceptual level of students calls special attention (Hunt, 1971). It emphasise the relationship of teaching strategies to the learner

requirements. Hence teacher may adopt teaching style that is likely to accommodate the preferences of students' learning styles. Learning Style - Teaching Style Congruency (Matching of Styles) is directly related to academic performance (Charkins, 1984; Ferris, 1984; Cooper and Miller, 1992; Cleverly, 1995). It helps the students to understand the ***subject matter in an easiest way, develop inquiry skills, a desire to utilize their repertoire to the maximum and to master the concepts, principles and theories***. This would definitely lead to a highly productive outcome. Thus the learning structures become ***joyful and less restrictive*** which is badly needed in secondary school grades. Above all, the participation of teaching learning process becomes an exciting experience. Helping the students to identify their own style of learning, make it possible to train them to capitalise on their repertoires of learning strategies (Entwistle, 1981).

Therefore, to improve the academic achievement, it is necessary to identify students' Learning Style preferences. As the ***students of secondary school are minor, they depend much on their teachers for guidance in this concern.*** Teacher can categorise the students according to their style preferences. The style preferences in the four areas viz., Environmental, Emotional, Sociological and Physical are equally important. But identification of Learning Style preference of pupils unveil that ***Physical Style area*** is most preferred. Hence the teachers' role is to ***help the students to stick on to the unique style preferences in these areas.*** For instance, in the physical area some students adopt Tactile(Note-taking) style preference. The instruction given to this category students must provide opportunity to note-making habit. To enhance this style preference, instead of dictating notes, allow students to prepare notes based on study material and

classroom teaching. This strategy may lead to a better learning through hands-on.

In the Emotional Style area the ***persistence*** shown by students varies. Certain students are more determinant, i.e., they decide to ***take break only after completing a solid piece of work***. They some how manage to engage in the given work until it is completed or a particular phase of the task is finished. This style preference is characterised by avoiding ***taking breaks*** in between. The teacher can foster this style preference by ***assigning more responsible work with time limit.*** Here the break enjoyed after the completion of the work act as a reinforcement.

As far as Environmental component is considered, it is related to the instructional setting. One of the major drawback of the present education system is that only in school the students are provided with a permanent design (table, chair). But the ***face-to-face teaching or teacher-student interaction time is minimum.*** After the class hours and in Holidays the students are spending their time at home. Here most of the students lack a permanent instructional setting. To those students who prefer formal seating arrangement (table, chair), it is necessary to arrange such environmental condition with all facilities. ***Unfortunately most of the students lack such a design of their style preference at home and school.*** For the optimum use of the time and resources of the students ***attention must be focussed equally on learning environmental conditions.***

Similarly in the Sociological style area certain students prefer learning with peers while others prefer to learn alone. For the former group instruction based on project work will cater their learning preference.

The latter group will be happy to go along with instruction which demand assignment which give opportunity for self-pace.

5.4.3. IDENTIFY THE STUDY APPROACHES

It is a well established fact that learning is ***individualistic,*** that is there occurs qualitative difference in ways pupil express their understanding (Entwistle, 1987). Put it in other words, individual's Approach to Learning material differs. Their intentions and motivations are varying. However, the present investigation looks ahead to see whether the differences in their Approach are crucial enough to be of considerable educational importance. The result available are supporting this hypothesis. The ***study revealed that the main effect of Approaches to Studying on Achievement in Biology is significant to a certain extent.*** The present findings indicate ***that students differ in their Approaches and is reflected in their Achievement to a considerable level.***

The findings is a major breakthrough in the research area of Approaches to Studying as it substantiate a series of recent research findings. Significant main effect of Approaches to Studying on Achievement is reported by Anilkumar (1997), Pillai (1995) and Kumar (1998). Significant difference exist between High and Low Achievers based on their Approaches to Studying (Kumar, 1997a). The results of group difference indicate that superiority in Achievement is associated with Highly Desirable Approaches to Studying. Moreover the results of two-way interaction ***Learning Style x Approaches to Studying is also found significant.*** From the interaction graphs it is clear that Highly Desirable Approaches to Studying (HDAS) along with Moderately Preferred

Learning Style induce high achievement. All these indicate the ***importance of identifying the Study Approaches***.

It implies that the instruction given in secondary schools may cater ***the preferred Approaches to Studying***. The present results support pioneer research findings. ***Meaning Orientation*** provide commitment to inquiry, conceptual understanding, higher grades and qualitatively superior learning outcomes in secondary education (Marton, *et al.*, 1984; Biggs, 1987; Ramsden & Entwistle, 1981). It is evident that Meaning Orientation make use of independence in learning, Analytic thinking, Academic motivation, Meaningful learning and Internality which are essential in the Science Curriculum of secondary education.

To develop Deep Approach in students the teaching-learning activity may include enough chances to ***conduct experiments and observation***. On contrary, if the instruction is centred around merely on theoretical aspects, it help only to develop a Surface Approach. Moreover, the students should try to integrate the subject matter with other life experiences. The ***instruction should focus on rich experiences of the students*** and attempt should be done from the part of the teacher to exploit it.

Science classes often encounter with facts, principles and concepts. Instead of ***mere rote learning, the students should seek evidences and clarifications***. This will help to anchor the principles and theories in more meaningful way. Likewise the instruction should cater ***intrinsic motivation***. The best method is to provide opportunities to do the exercises independently. The reinforcement during this training certainly motivate the student to go ahead with his studies. More important is the study

material or text book which are clearly and logically organized. The contents which include facts, concepts, principles and theories to be presented in the order of hierarchy. This would help to integrate the matter in a meaningful way. An instruction which incorporate all these suggestions will probably develop a Highly Desirable Approaches to Studying which in turn will ***improve academic achievement.***

5.4.4. DEVELOP NEED FOR ACHIEVEMENT

Researchers in the field of education give prime importance to the ***inherent force, Achievement Motivation*** to enhance Academic Achievement. Properly motivated students have shown high performance in their Academic Achievement (Waxman, 1997; Simons, *et al.*, 1999). The presence of a striving force for Achievement and Apprehensiveness as the base of consistent achievement (Grote & James, 1991). Educational attainment was influenced by Achievement Motivation (Cassidy & Lynn, 1991).

The present investigation result indicate that the main effect of Achievement Motivation on Achievement in Biology (Objective wise and Total score) is found significant to a lesser extent. This finding support and substantiate the former research results. Achievement Motivation was affecting Achievement in Biology to a lesser extent only (Kumar, 1994). Apart from this, many studies indicate the positive and significant effect of Achievement Motivation on Achievement. Achievement Motivation has significant, positive effect on Achievement (Reynold & Herbert, 1992; Preetha, 1996). Cassidy and Lynn (1991) claims that Educational attainment was influenced by Achievement Motivation. Research evidences revealed

that motivation was the powerful discriminating factor between the high, average and low achieving groups (Gopinathan, 1981; Haynes, *et al.*, 1998).

However, the two-way interaction effect of ***Learning Style*** x ***Achievement Motivation*** is ***found to be significant.*** This implies that the role of Achievement Motivation in determining the achievement is still relevant. The graphical representation indicate that ***High Achievement Motivation group yield better achievement in most of the combinations especially with Moderately Preferred Learning Style.*** Hence, deliberate attempt from the part of educators is expected to develop a conducive environment to foster High Achievement Motivation.

Besides, the results of Multiple Regression Analysis - Step wise revealed that out of the three predictor variables ***Achievement Motivation*** emerged to be the best predictor of achievement. This once again underline the importance of Achievement Motivation in improving achievement. To cater Achievement Motivation students with ***outstanding performance*** in curricular and co-curricular activities are to be ***acknowledged.*** This recognition of their performance act as a reinforcement because it is a pleasant effect. Teachers with high academic profile and experience could become a ***Motivating Power.*** Therefore while recruiting teachers, candidates with good teaching skills and having ***global vision*** are to be given priority. The ***team-work*** of teachers of different faculties can formulate strategies to motivate students.

This could be possible by helping the students to become ***self reliant and independent*** at the Secondary school level. Contemporary practises followed in the school force the students to depend on their teachers for

every activities. For a change, students may be assigned ***intermediate task*** to begin with and they may allow to choose progressively ***greater difficulty whenever the individual experience success***. To develop High achievement motivation a shift in the evaluation procedure is necessary. The evaluation procedure adopted in secondary school focuses on the quantity of learning, rather than quality. The ***qualitative aspects of the work done is not often appreciated.*** Therefore introducing ***grade system in school*** may provide opportunity to evaluate the qualitative aspects and thereby develop a ***desire in students for a better performance.*** The students may develop a healthy competitive spirit which helps for ***a productive outcome***.

For the three-way interactions, though not significantly high, interaction is noticed in the graphical sketches. High Achievement Motivation group coupled with Highly Desirable Approaches to Studying and Moderately Preferred Learning Style (HAM-HDAS-MPLS) is found to yield better academic achievement. This indicate that student ***personality in general and Achievement Motivation in particular have a substantial influence on their Approaches to Studying*** and to the level of knowledge processing (Abouserie, 1995). It implies that students with High Achievement Motivation exhibit Highly Desirable Approaches. Obviously High Achievement Motivation create a drive in the students for greater achievement. To yield this achievement they are obliged to develop a more Meaning Oriented Approach along with Moderately Preferred Learning Style. As a consequence the subject matter becomes integrated and inter-related thereby resulting a better academic output.

5.4.5. TO BOOST ACHIEVEMENT

Over the years researchers in the field of education are making constant efforts to improve academic achievement. The present study revealed that High Biology achievers and Low Biology achievers significantly differ in their study approaches. High achievers obtained high mean score in Approaches to Studying (Component wise and Total sore) except for Meaning Orientation. The result indicates the faulty method adopted in secondary school science teaching. The present teaching learning process do not help the students to develop a Meaning Oriented approach. This is because the goals of education are viewed as temporary and directed externally such as obtaining grades. To obtain this students depend on ***capsule informations given through commercially available Guides***. The knowledge obtained through this method do not help to integrate the content properly. It means that the acquired ***informations remains isolated bits*** and the student fails to interconnect it.

This emphasises the necessity to bring a steady shift in the Learning Approach of Low achievers. To develop a healthy approach teaching must be based on study materials which are written by experts in the concerned area. Therefore to boost achievement among Low achievers attention mustbe given to improve their study approaches. The goals of education should be diversified considering the future requirements rather than the present to encourage pupils to adopt a more desirable approach. The investigative and scientific temperament of pupils may be utilized for this.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

Based on the present study the investigator suggest the following areas for further research.

1. The same study can be extended to Central schools and Higher Secondary schools.

2. Study can be conducted in subjects like Physics and Chemistry.

3. Interaction of Learning Style and select cultural variables on Achievement.

4. Influence of Creativity, Approaches to Studying and Learning Style on process outcome.

5. Exploration of various factors affecting Approaches to Studying and Learning Style.

6. Relationship of child rearing practises and Achievement Motivation in Affluent families and Non-affluent families.

7. A factor analytic study of Learning Style with Achievement in different school subjects.

8. Study which explores the relationship and role of parents in developing Approaches to Studying.

9. Effect of Instructional design (Environmental Component) on Achievement in Various subjects.

10. Style identification and match-mismatch of pupils' learning style with teching style in different curricular areas.

11. Relationship of Learning Style and science temperament of higher secondary students.

12. Relationship of Approaches to Studying components with Achievement of school and college students.

13. A study using Multiple Regression Analysis to find out the best predictor variable in different academic subject incorporating the components and Total scores of Learning Style, and different Orientations and Approaches to Studying (Total score) and Achievement Motivation.

14. A path analytic study using the components of Learning Style and Approaches to Studying.

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APPENDICES

Appendix I

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
LEARNING STYLE INVENTORY

Dr. P.K. Sudheesh kumar
Prectha. S., Rehna E.T., & sathy. P.

നിർദ്ദേശങ്ങൾ: താഴെ കൊടുത്തിരിക്കുന്ന ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിക്കുക. ഓരോ പ്രസ്താവനക്കും 3 വീതം പ്രതികരണങ്ങൾ കൊടുത്തിരിക്കുന്നു. 1. എല്ലായ്പ്പോഴും 2. ചിലപ്പോൾ മാത്രം 3. ഒരിക്കലുമില്ല. എന്നിങ്ങനെ ഓരോ പ്രസ്താവനയിലും പറയുന്ന കാര്യം നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം യഥാർത്ഥത്തിൽ എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. ആ പ്രതികരണമാണ് രേഖപ്പെടുത്തേണ്ടത്. ഉത്തരക്കടലാസ് പ്രത്യേകം തന്നിട്ടുണ്ട്. തന്നിരിക്കുന്ന ഉത്തരക്കടലാസിൽ അതത് പ്രസ്താവനകളും നമ്പറിനെതിരെ നിങ്ങളുടെ ശരിയായ പ്രതികരണത്തിന് ചുവടെയുള്ള വൃത്തത്തിൽ 'X' ചിഹ്നം രേഖപ്പെടുത്തുക. പ്രസ്താവനകളുടെ ക്രമനമ്പർ നോക്കി ഉത്തരക്കടലാസിലെ അതേ നമ്പറിന് നേരെയുള്ള വൃത്തത്തിൽ വേണം 'X' ചിഹ്നം രേഖപ്പെടുത്താൻ. എല്ലാ പ്രസ്താവനകൾക്കും പ്രതികരണം രേഖപ്പെടുത്താൻ പ്രത്യേകം ശ്രദ്ധിക്കുമല്ലൊ.

1. നിശബ്ദമായ ഒരു സ്ഥലത്തിരുന്ന് പഠിക്കുമ്പോൾ എനിക്ക് ഉറക്കം വരാറുണ്ട്.
2. നിശബ്ദമായ അന്തരീക്ഷത്തിൽ വളരെ പെട്ടെന്ന് പഠിക്കാൻ എനിക്ക് കഴിയുന്നുണ്ട്.
3. മങ്ങിയ പ്രകാശത്തിൽ പഠിക്കുമ്പോൾ ദീർഘനേരം പഠിക്കാൻ എനിക്ക് കഴിയാറില്ല.
4. ഫലപ്രദമായി പഠിക്കുവാൻ കസേരയിലിരുന്ന് പഠിക്കുന്നതിലാണ് എനിക്ക് താല്പര്യം.
5. പകൽ സമയത്ത് പഠിക്കുമ്പോൾ പഠനമുറിയുടെ കതകും ജനൽവാതിലുകളും ഞാൻ തുറന്നിടാറില്ല.
6. ചാരുകസേരയിൽ കിടന്ന് എനിക്ക് പഠിക്കാൻ കഴിയാറുണ്ട്.
7. നല്ല തണുപ്പുള്ള സമയങ്ങളിൽ പഠിക്കാൻ എനിക്ക് മടി അനുഭവപ്പെടാറുണ്ട്.
8. വേനൽകാലത്തെ ചൂടിനേക്കാൾ മഴക്കാലത്തെ തണുപ്പാണ് പഠിക്കാനുള്ള നല്ല കാലാവസ്ഥയായി എനിക്ക് അനുഭവപ്പെടുന്നത്.
9. ശ്രദ്ധിച്ച് പഠിക്കുമ്പോൾ മറ്റൊരു ശബ്ദവും എനിക്ക് ശല്യമാകാറില്ല.
10. പകൽ സമയത്ത് അടഞ്ഞ മുറിക്കുള്ളിൽ ഇരുന്ന് പഠിക്കുന്നതിനേക്കാൾ തുറസ്സായ സ്ഥലത്തിരുന്ന് പഠിക്കാനാണ് എനിക്കിഷ്ടം.

11. വെയിലിന് ചൂടു കൂടുമ്പോൾ പകൽ സമയത്തുള്ള എന്റെ പഠനം ഫലപ്രദ മാകാറില്ല.
12. അന്നന്നു പഠിച്ചു തീർക്കാനുള്ള പാഠ്യ ഭാഗങ്ങൾ മുഴുവൻ പഠിച്ചു തീർക്കാതെ ഞാൻ എഴുന്നേൽക്കാറില്ല.
13. മറ്റുള്ളവർ നിർബന്ധിക്കുന്നതുകൊണ്ടാണ് ഞാൻ പഠിക്കുന്നത്.
14. ഒറ്റയിരുപ്പിന് പാഠങ്ങൾ പഠിച്ചു തീർക്കാൻ എനിക്ക് ബുദ്ധിമുട്ടാണ്.
15. അദ്ധ്യാപകർ ഏൽപിക്കുന്ന പഠനകാര്യങ്ങൾ ഉദ്ദേശിച്ച നിലവാരത്തിൽ ചെയ്തു തീർക്കാൻ എനിക്ക് കഴിയാറുണ്ട്.
16. കഴിഞ്ഞ പരീക്ഷകളിൽ കിട്ടിയ മാർക്കിനേക്കാൾ കൂടുതൽ മാർക്ക് ലഭിക്കുവാനായി ഞാൻ നന്നായി പഠിക്കാറുണ്ട്.
17. പഠന സമയത്ത് ബുദ്ധിമുട്ടായി തോന്നുന്ന പാഠഭാഗങ്ങൾ ഞാൻ ഒഴിവാക്കാറുണ്ട്.
18. പഠനകാര്യങ്ങളിൽ അദ്ധ്യാപകരുടെ നിർദ്ദേശങ്ങൾ അക്ഷരംപ്രതി പാലിക്കണമെന്ന് എനിക്ക് നിർബന്ധമുണ്ട്.
19. ക്ലാസ്സിൽ ഓരോ ദിവസവും പഠിപ്പിക്കുന്ന കാര്യങ്ങൾ അന്നുതന്നെ പഠിക്കണമെന്ന് അദ്ധ്യാപകർ പറയുമെങ്കിലും ഞാൻ അത് ചെയ്യാറില്ല.
20. നന്നായി പഠിക്കണമെന്ന മാതാപിതാക്കളുടെ ആഗ്രഹത്തിനൊത്ത് എനിക്ക് ഉയരാൻ കഴിയാറുണ്ട്.
21. പുതിയ പാഠ്യഭാഗങ്ങൾ പഠിക്കാനായി അദ്ധ്യാപകർ നൽകുന്ന നിർദ്ദേശങ്ങൾ എനിക്ക് സ്വീകാര്യമല്ല.
22. പഠനത്തിനിടക്ക് വരുന്ന ഇടവേളകൾ ആദ്യം പഠിച്ച കാര്യങ്ങൾ മറക്കാൻ ഇടയാക്കു മെന്നാണ് എന്റെ അനുഭവം.
23. ഗഹനമായ ഒരു പാഠ്യപ്രശ്നത്തിന് പരിഹാരം കണ്ടെത്തേണ്ടിവരുമ്പോൾ എന്റെ കാഴ്ചപ്പാടാണ് എനിക്ക് പ്രധാനം.
24. നിത്യജീവിതത്തിലെ വസ്തുതകളും, സംഭവങ്ങളുമായി പാഠഭാഗങ്ങൾ ബന്ധിപ്പി ച്ചാണ് ഞാൻ പഠിക്കാറുള്ളത്.
25. ചർച്ചകളിലൂടെയും പ്രവൃത്തികളിലൂടെയുമുള്ള പഠനരീതി എന്റെ പഠനസമയം നഷ്ടപ്പെടുത്താതെ ഉതകു.
26. പഠനകാര്യത്തിൽ മറ്റുള്ളവരുടെ പഠനശൈലി അനുകരിക്കുന്നതിനേക്കാൾ സ്വന്തം ശൈലി ഉപയോഗിക്കാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
27. സുഹൃത്തുമായിരുന്നു ചർച്ച ചെയ്ത് പഠിക്കുമ്പോൾ എളുപ്പത്തിൽ പഠിക്കാൻ എനിക്ക് കഴിയുന്നുണ്ട്.
28. പഠനത്തിൽ മിടുക്കരായ കുട്ടികളുടെ പഠനക്രമങ്ങൾ എന്നെ സ്വാധീനിക്കാറുണ്ട്.
29. സുഹൃത്തുക്കളുടെ പഠനരീതിയിൽ നിന്നും വ്യത്യസ്ഥമായ ഒരു ശൈലിയിൽ പഠി ക്കാനാണ് എനിക്കു താല്പര്യം.

30. സുഹൃത്തുക്കളുമായി ഒരുമിച്ചിരുന്നു പഠിക്കുമ്പോൾ എന്റെ പഠനരീതിയിലുള്ള കുറവുകൾ ഞാൻ മനസ്സിലാക്കുന്നു.
31. റേഡിയോ, ടി.വി. എന്നിവയിലെ വിദ്യാഭ്യാസ പരിപാടികളിൽ എനിക്ക് ഉപയുക്തമായവ ഉണ്ടെന്ന് തോന്നിയിട്ടില്ല.
32. അതിരാവിലെയുള്ള പഠനം മറ്റു സമയങ്ങളിലുള്ള പഠനത്തേക്കാൾ എനിക്കു ഫലപ്രദമായി അനുഭവപ്പെടാറുണ്ട്.
33. പാഠ്യവിഷയങ്ങളോട് ബന്ധപ്പെട്ട ചിത്രപ്രദർശനങ്ങൾ, പരീക്ഷണങ്ങൾ എന്നിവ നിരീക്ഷിച്ചാലും എന്റെ പഠനം എളുപ്പമാകാറില്ല.
34. ലഘുപരീക്ഷണങ്ങൾ സ്വയം ചെയ്തുനോക്കുന്നത് ശാസ്ത്ര തത്വങ്ങൾ മനസ്സിലാക്കാൻ എനിക്കു സഹായകരമാകാറുണ്ട്.
35. പഠനത്തിനിടയിലുള്ള ചെറു ഇടവേളകൾ പഠിക്കാൻ ഉൻമേഷം നൽകാറുണ്ട്.
36. പഠനത്തിനിടയ്ക്കു കുറച്ചുസമയം വിശ്രമിക്കുന്നത് എന്റെ പഠനത്തെ ഫലപ്രദമാക്കാറുണ്ട്.
37. പഠനത്തിനിടയിൽ ഭക്ഷണം കഴിക്കുന്നത് എന്റെ ശ്രദ്ധ തടസ്സപ്പെടുത്താറുണ്ട്.
38. രാവിലെയുള്ള പഠനം പാഠ്യഭാഗത്തെ വളരെവേഗം മനസ്സിലാക്കുന്നതിന് എന്നെ സഹായിക്കാറുണ്ട്.
39. വിശപ്പറിയാതെയുള്ള എന്റെ പഠനം ദീർഘനേരം നിലനിൽക്കാറുണ്ട്.
40. ശാസ്ത്രപാഠങ്ങളിൽ നിർദ്ദേശിച്ചിട്ടുള്ള പരീക്ഷണങ്ങൾ ഞാൻ ചെയ്തുനോക്കി പഠിക്കാറുണ്ട്.
41. പ്രഭാഷണങ്ങളും ചർച്ചകളും ശ്രദ്ധിച്ചു കേൾക്കുന്നത് എന്റെ പഠനം ഫലപ്രദമാക്കുന്നു.
42. അദ്ധ്യാപകൻ ക്ലാസിൽ കാണിച്ചു തരുന്ന പരീക്ഷണങ്ങൾ നിരീക്ഷിക്കുമെങ്കിലും അവ വിവരിച്ചു തരുന്നതാണ് എന്റെ പഠനത്തെ സഹായിക്കുന്നത്.
43. പുസ്തകത്തിൽ പാഠഭാഗങ്ങൾ വായിക്കുന്നതിനേക്കാൾ അദ്ധ്യാപകൻ ക്ലാസിൽ അവതരിപ്പിക്കുന്നത് കേട്ട് മനസ്സിലാക്കുന്നതാണ് എനിക്ക് കൂടുതൽ എളുപ്പം.
44. അദ്ധ്യാപകൻ പറഞ്ഞുതരുന്ന നോട്ടുകളെ ആധാരമാക്കി സ്വന്തമായി തയ്യാറാക്കുന്ന കുറിപ്പുകൾ പഠിക്കുന്നതാണ് എന്റെ പഠനരീതി.
45. മറ്റു പുസ്തകങ്ങൾ വായിച്ച് സ്വയം നോട്ടുകൾ തയ്യാറാക്കുന്നത് ആയാസകരമായി എനിക്ക് തോന്നാറുണ്ട്.

Appendix - I A

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LEARNING STYLE INVENTORY
RESPONSE SHEET

വിദ്യാർത്ഥിയുടെ പേര് ..... വയസ്സ്.....

ക്ലാസ്..... ക്ലാസ് നമ്പർ..... ആൺകുട്ടി/പെൺകുട്ടി

No.	എല്ലായ്പോഴും	ചിലപ്പോൾമാത്രം	ഒരിക്കലുമില്ല
1	O	O	O
2	O	O	O
3	O	O	O
4	O	O	O
5	O	O	O
6	O	O	O
7	O	O	O
8	O	O	O
9	O	O	O
10	O	O	O
11	O	O	O
12	O	O	O
13	O	O	O
14	O	O	O
15	O	O	O

No.	എല്ലായ്പോഴും	ചിലപ്പോൾമാത്രം	ഒരിക്കലുമില്ല
16	O	O	O
17	O	O	O
18	O	O	O
19	O	O	O
20	O	O	O
21	O	O	O
22	O	O	O
23	O	O	O
24	O	O	O
25	O	O	O
26	O	O	O
27	O	O	O
28	O	O	O
29	O	O	O
30	O	O	O

No.	എല്ലായ്പോഴും	ചിലപ്പോൾമാത്രം	ഒരിക്കലുമില്ല
31	O	O	O
32	O	O	O
33	O	O	O
34	O	O	O
35	O	O	O
36	O	O	O
37	O	O	O
38	O	O	O
39	O	O	O
40	O	O	O
41	O	O	O
42	O	O	O
43	O	O	O
44	O	O	O
45	O	O	O

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Appendix I B

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LEARNING STYLE INVENTORY

Dr. P.K. Sudheesh Kumar,
Preetha, S., Rehna E.T. & Sathy, P.

Instructions: Read carefully each of the following statements. For each statement three types of responses are given: (1) Always (2) Sometimes (3) Never. Decide carefully your response and it has to be marked in a separate answer sheet provided, by putting 'X' in the relevant circle. Special care should be taken to mark response for every statement.

1. I feel sleepy while studying in a quiet place.
2. I can study quickly in a quiet atmosphere .
3. I cannot carry on with my studies for long, in dim vision.
4. For effective learning, I like to sit in a chair.
5. While studying during daytime, I do not keep the windows and doors of my study room open.
6. I can learn, while sitting in an easy chair.
7. I feel lazy in studying during cold seasons.
8. The chilly rainy atmosphere is preferable to the warm summer atmosphere for my studies.
9. I am not disturbed by any sound in utmost concentration.
10. I prefer studying in an open place, to studying in an enclosed room during day time.
11. My learning will not turn effective when the atmospheric temperature shoots up.
12. I study the daily portions that I am expected to cover for that day.

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13. I learn on the compulsion of others.

14. I find it difficult to complete my studies at a stretch.

15. I can do the assigned works given by teachers in the expected standards.

16. I study well for achieving better marks than my previous ones.

17. I avoid difficult portions while studying.

18. I strictly abide by the instructions of my teachers in study matters.

19. Eventhough our teachers insist on our being up-to-date in studies, I seldom do so.

20. Often I succeed in rising upto the expectations of my parents regarding my studies.

21. I will not accept the instructions given by teachers for studying new portions.

22. The interval between the study periods is found to blur my memory of the things already studied.

23. When I have to find the solution for a serious academic problem, I go by my choice.

24. I learn by linking my lessons with things and incidents of daily life.

25. Learning through discussions and activities only robs my study time.

26. In studies I prefer my own style to that of others.

27. I can learn with ease, if I discuss matters with my friends.

28. The study methods of toppers influence me.

29. I like to study in a way which is different from that of my peers.

30. When I study in the company of my friends, I understand the defects in my study process.

31. Among the various educational programmes in radio and television, I could not find anyone to be of worth to me.

32. Studies in the early morning is found to be very effective for me than studies at other times of the day.

33. Observing the exhibitions and experiments related to the academic subjects will not facilitate my learning.

34. Conducting minor experiments by myself enables me to understand the scientific principles.

35. The short recesses during the study time boost up my enthusiasm to learn.

36. Taking rest for sometime during studies is found to be effective for my studies.

37. Eating while studying interrupts my concentration.

38. Studies in the morning is found to be effective for me.

39. I can study for long, if I am not haunted by hunger.

40. I learn by doing the experiments suggested in Science lessons.

41. Listening to talks and discussions make my studies effective.

42. Explanations given to the experiments help me to learn better than merely observing the experiments.

43. It is more easy for me to comprehend the lectures rather than reading the books.

44. My way of studying involves internalising the prepared short notes based on the notes given by the teacher.

45. It is difficult for me to prepare notes by reading other books.

Appendix I C

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

LEARNING STYLE INVENTORY
RESPONSE SHEET

Name of the Student: ..... Age: .....

Class : ..... Class. No: ..... Boy/Girl

No	Always	Sometimes	Never
1	O	O	O
2	O	O	O
3	O	O	O
4	O	O	O
5	O	O	O
6	O	O	O
7	O	O	O
8	O	O	O
9	O	O	O
10	O	O	O
11	O	O	O
12	O	O	O
13	O	O	O
14	O	O	O
15	O	O	O

No	Always	Sometimes	Never
16	O	O	O
17	O	O	O
18	O	O	O
19	O	O	O
20	O	O	O
21	O	O	O
22	O	O	O
23	O	O	O
24	O	O	O
25	O	O	O
26	O	O	O
27	O	O	O
28	O	O	O
29	O	O	O
30	O	O	O

No	Always	Sometimes	Never
31	O	O	O
32	O	O	O
33	O	O	O
34	O	O	O
35	O	O	O
36	O	O	O
37	O	O	O
38	O	O	O
39	O	O	O
40	O	O	O
41	O	O	O
42	O	O	O
43	O	O	O
44	O	O	O
45	O	O	O

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Appendix II

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

APPROACHES TO STUDYING INVENTORY

(Draft)

Dr. P. K. Sudheesh Kumar
&
Hassan Koya. M. P

നിർദ്ദേശങ്ങൾ :

താഴെ കൊടുത്തിരിക്കുന്ന ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിക്കുക. ഓരോ പ്രസ്താവനയ്ക്കും 1. എല്ലായ്പ്പോഴും. 2. ചിലപ്പോൾ മാത്രം. 3. ഒരിക്കലുമില്ല എന്നിങ്ങനെ മൂന്ന് വീതം പ്രതികരണങ്ങൾ കൊടുത്തിരിക്കുന്നു. ഓരോ പ്രസ്താവനയും നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. ആ പ്രതികരണം പ്രത്യേകം തന്നിരിക്കുന്ന കടലാസിൽ ഓരോ പ്രസ്താവനയുടേയും നമ്പറിനുനേരെയുള്ള കോളത്തിൽ 'X' ചിഹ്നമിട്ട് രേഖപ്പെടുത്തുക. നിങ്ങൾ അടയാളപ്പെടുത്തിയ 'X' ചിഹ്നം തെറ്റായ സ്ഥാനത്താണെങ്കിൽ അതിനുചുറ്റും ഒരു വൃത്തം വരയ്ക്കുകയും (X) പുതിയ സ്ഥാനത്ത് 'X' ചിഹ്നം രേഖപ്പെടുത്തുകയും ചെയ്യുക. എല്ലാ പ്രസ്താവനകൾക്കും പ്രതികരണം രേഖപ്പെടുത്താൻ മറക്കരുത്.

മാതൃക:
ഞാൻ പതിവായി സ്വമേധയാ പഠനം നടത്തുന്നു.

എല്ലായ്പ്പോഴും	ചിലപ്പോൾ മാത്രം	ഒരിക്കലുമില്ല
	X	

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1. പഠിക്കുമ്പോൾ എന്റെ മനസ്സിലുള്ള ചോദ്യങ്ങൾക്ക് ഉത്തരം കണ്ടെത്താനാണ് ഞാൻ ശ്രമിക്കുന്നത്.
2. പഠിക്കുന്ന കാര്യങ്ങൾ യഥാർഥജീവിതത്തിൽ പ്രാവർത്തികമാണോ എന്നറിയാൻ എനിക്ക് താൽപര്യമില്ല.
3. പഠിക്കുന്ന വസ്തുതകളുടെ നിജസ്ഥിതി മനസ്സിലാക്കാൻ ഞാൻ സാധ്യമായ പരീക്ഷണങ്ങളും നിരീക്ഷണങ്ങളും നടത്താറുണ്ട്.
4. പഠിക്കുമ്പോൾ പാഠ്യവസ്തുവിന്റെ അടിസ്ഥാനം എന്താണെന്ന് മനസ്സിലാക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.
5. പഠിക്കുമ്പോൾ ഒരു വിഷയത്തിന് മറ്റു വിഷയങ്ങളുമായി എന്തെങ്കിലും ബന്ധമുണ്ടോ എന്ന് ഞാൻ പരിശോധിക്കാറില്ല.
6. ഒരു സിദ്ധാന്തമോ നിയമമോ പഠിക്കുമ്പോൾ അതിന് അത്തരത്തിലുള്ള മറ്റ് സിദ്ധാന്തങ്ങളും നിയമങ്ങളുമായുള്ള ബന്ധം കണ്ടെത്താൻ ഞാൻ ശ്രമിക്കാറുണ്ട്.
7. പഠിക്കുമ്പോൾ കണ്ടെത്തുന്ന വസ്തുതകളെ പരീക്ഷണ നിരീക്ഷണങ്ങളുടെ ഫലങ്ങളുമായി ഞാൻ താരതമ്യം ചെയ്തു നോക്കാറുണ്ട്.
8. നോട്ട് തയ്യാറാക്കുമ്പോൾ ഒരു പാഠ്യ വസ്തുവിന് മറ്റൊരു പാഠ്യവസ്തുവുമായി എന്തെങ്കിലും ബന്ധം കണ്ടെത്തിയാൽ അത് പ്രത്യേകം രേഖപ്പെടുത്താറില്ല.
9. ലഭ്യമായിരിക്കുന്ന തെളിവുകൾ ഉപയോഗിച്ച് തന്നിരിക്കുന്ന നിഗമനങ്ങൾ ശരിയാണോ എന്ന് ഞാൻ പരിശോധിക്കാറുണ്ട്.
10. നിഗമനങ്ങളുടെ സത്യാവസ്ഥ മനസ്സിലാക്കാൻ സാധ്യമായ പരീക്ഷണങ്ങൾ ചെയ്തു നോക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.

11. നിരീക്ഷണങ്ങളുടെയും ജീവിതാനുഭവങ്ങളുടെയും അടിസ്ഥാനത്തിൽ തന്നിരിക്കുന്ന നിഗമനങ്ങളെ ഞാൻ വിലയിരുത്തുന്നു.
12. തന്നിരിക്കുന്ന നിഗമനങ്ങൾ ശരിയാണോ എന്നറിയുന്നതിനാവശ്യമായ തെളിവുകൾ ശേഖരിക്കുന്ന പതിവ് എനിക്കില്ല.
13. ഞാൻ പതിവായി സ്വമേധയാ പഠനം നടത്തുന്നു.
14. പാഠഭാഗങ്ങൾ അദ്ധ്യാപകൻ ക്ലാസ്സിൽ പഠിപ്പിക്കുന്നതിന് മുമ്പ് ഞാൻ വായിക്കാറില്ല.
15. പാഠത്തോടൊപ്പം കൊടുത്തിരിക്കുന്ന മിക്ക അഭ്യാസങ്ങളും അദ്ധ്യാപകന്റെ നിർദ്ദേശമില്ലാതെ തന്നെ ഞാൻ ചെയ്യാറുണ്ട്.
16. പാഠങ്ങൾ കൂടുതലായി മനസ്സിലാക്കുന്നതിന് അതുമായി ബന്ധപ്പെട്ട മറ്റ് പുസ്തകങ്ങളും പ്രസിദ്ധീകരണങ്ങളും ഞാൻ വായിക്കാറില്ല.
17. പഠിച്ചുകൊണ്ടിരിക്കുമ്പോൾ പഠിച്ച കാര്യങ്ങൾ ഓർമ്മയിലുണ്ടോ എന്ന് ഞാൻ ഇടയ്ക്കിടെ പരിശോധിക്കാറുണ്ട്.
18. പഠിക്കാനിരിക്കുമ്പോൾ പരീക്ഷയിൽ ജയിക്കാനാവശ്യമായ വിവരങ്ങൾ മനസ്സിലാക്കുക മാത്രമാണ് എന്റെ ലക്ഷ്യം
19. ഞാൻ റിവിഷൻ നടത്തുന്നത് മറന്ന കാര്യങ്ങൾ വീണ്ടും ഓർമ്മിക്കുന്നതിനാണ്.
20. വായിക്കുന്ന കാര്യങ്ങൾ ഓർമ്മിച്ചു വെയ്ക്കുന്നതിനായി ഞാൻ ചില സൂത്രങ്ങൾ ഉപയോഗിക്കാറുണ്ട്.
21. അദ്ധ്യാപകർ ആവശ്യപ്പെടുന്ന പാഠഭാഗങ്ങൾ പതിവായി വായിക്കുന്ന ശീലം എനിക്കില്ല.
22. പാഠഭാഗത്തെക്കുറിച്ച് എനിക്കുണ്ടാകുന്ന സംശയങ്ങൾ അദ്ധ്യാപകരോട് ചോദിച്ച് നിവാരണം നടത്താറുണ്ട്.
23. പാഠഭാഗത്തെ ചോദ്യങ്ങളുടെ ഉത്തരങ്ങൾ തയ്യാറാക്കി ഞാൻ അദ്ധ്യാപകരെ കാണിക്കാറുണ്ട്.
24. പഠിക്കാൻ ബുദ്ധിമുട്ടുള്ള പാഠഭാഗങ്ങൾ ഒരിക്കൽക്കൂടി പഠിപ്പിക്കാൻ ഞാൻ അദ്ധ്യാപകരോട് ആവശ്യപ്പെടാറില്ല.
25. പരീക്ഷകളെ ഞാൻ പൊതുവെ ഭയപ്പെടാറില്ല.
26. എത്ര നന്നായി പഠിച്ചാലും പരീക്ഷയിൽ ഉയർന്ന മാർക്ക് കിട്ടില്ല എന്ന തോന്നൽ എനിക്കുണ്ട്.
27. പാഠഭാഗങ്ങൾ പൊതുവെ കടുപ്പമുള്ളതും പഠിക്കാൻ വിഷമമുള്ളതുമായി എനിക്ക് അനുഭവപ്പെടാറില്ല.
28. പരീക്ഷകളിൽ ഉയർന്ന മാർക്ക് വാങ്ങിയാലും നല്ല ഒരു ഭാവി ഉണ്ടാവില്ല എന്ന ഞാൻ കരുതുന്നു.
29. പഠിക്കുമ്പോൾ പരീക്ഷയിൽ ജയിക്കുക എന്ന ലക്ഷ്യം മാത്രമല്ല എന്റെ മനസ്സിലുണ്ടാവുക.
30. പരീക്ഷയിൽ തോൽക്കുമ്പോഴുണ്ടാകുന്ന അപമാനം ഒഴിവാക്കുന്നതിനുവേണ്ടിയാണ് ഞാൻ പഠിക്കുന്നത്.
31. പാഠ്യവിഷയങ്ങളിൽ പരമാവധി അറിവുനേടാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
32. മുതിർന്നവർ നിർബ്ബന്ധിക്കുമ്പോഴാണ് ഞാൻ പഠിക്കുന്നത്.
33. നല്ല ഒരു ജോലി നേടിയെടുക്കുന്നതിനുവേണ്ടിയാണ് ഞാൻ പഠിക്കുന്നത്.
34. പഠിച്ച കാര്യങ്ങൾ നിത്യജീവിതത്തിൽ പകർത്തുക എന്ന ലക്ഷ്യത്തോടെയാണ് ഞാൻ പഠിക്കുന്നത്.
35. രാഷ്ട്രപുരോഗതിക്കുവേണ്ടി പ്രവർത്തിക്കാൻ മികച്ച വിദ്യാഭ്യാസം ആവശ്യമാണെന്ന് ഞാൻ കരുതുന്നില്ല.
36. ഒരു വ്യക്തിക്ക് സമൂഹത്തിൽ ലഭിക്കുന്ന അംഗീകാരത്തിന് അയാളുടെ വിദ്യാഭ്യാസ നിലവാരവും കാരണമാണെന്ന് ഞാൻ വിശ്വസിക്കുന്നു.
37. പതിവായി ഹോം വർക്ക് ചെയ്യുന്ന ശീലം എനിക്കില്ല.
38. ക്ലാസ്സിൽ പഠിപ്പിക്കുന്ന പാഠഭാഗങ്ങൾ അതാതു ദിവസങ്ങളിൽ തന്നെ പഠിക്കുന്നതിനോട് എനിക്ക് യോജിപ്പില്ല.
39. ഒരു ടൈംടേബിൾ തയ്യാറാക്കി അതിനനുസരിച്ച് പഠിക്കുന്നത് നല്ലതാണെങ്കിലും എനിക്കതിനു കഴിയാറില്ല.
40. ഓരോ ദിവസത്തെയും പഠനപ്രവർത്തനങ്ങൾ നിശ്ചയിച്ച പ്രകാരം ഞാൻ പൂർത്തിയാക്കാറില്ല.
41. പഠിക്കാനുപയോഗിക്കുന്ന സമയം കൂടി കളിക്കാനാണ് എനിക്ക് താൽപര്യം.
42. പഠനം ഒരു മടുപ്പിക്കുന്ന അനുഭവമായി എനിക്ക് തോന്നാറില്ല.
43. എത്ര പഠിച്ചാലും പ്രയോജനമില്ലെന്ന് ഞാൻ കരുതുന്നില്ല.
44. പഠിക്കാതിരുന്നാലുള്ള പ്രശ്നങ്ങൾ ഒഴിവാക്കുന്നതിനു വേണ്ടിയാണ് ഞാൻ പഠിക്കുന്നത്.
45. പരീക്ഷകളിൽ ജയിക്കുക എന്നത് ഒരു വാശിയായിട്ടാണ് ഞാൻ കാണുന്നത്.
46. ക്ലാസ്സിലെ ഉയർന്ന റേങ്ക് നേടിയെടുക്കുക എന്ന ലക്ഷ്യത്തോടെയല്ല ഞാൻ പഠിക്കുന്നത്.
47. സമൂഹത്തിലെ ഉന്നത സ്ഥാനങ്ങൾ ലക്ഷ്യമാക്കിയാണ് ഞാൻ പഠിക്കുന്നത്.
48. ആത്മാർത്ഥമായി പരിശ്രമിച്ചാൽ ജീവിതത്തിൽ എന്തും നേടിയെടുക്കാം എന്ന വിശ്വാസമാണ് എന്നെ നയിക്കുന്നത്.
49. പാഠഭാഗത്തിലെ സമാന ആശയങ്ങളെ ഞാൻ നോട്ടുബുക്കിൽ പ്രത്യേകം രേഖപ്പെടുത്താറുണ്ട്.
50. പാഠഭാഗത്തിലെ ആശയങ്ങൾ ഉൾക്കൊള്ളിച്ചുകൊണ്ട് കഥകളോ കവിതകളോ ഉണ്ടാക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.

51. പാഠഭാഗത്തിന്റെ ആശയങ്ങളുടെ പ്രത്യേകതകൾ നിരീക്ഷിച്ച് അവയുടെ വിശദാംശങ്ങൾ ഞാൻ ശേഖരിക്കാറുണ്ട്.
52. പാഠ്യവസ്തുവിന്റെ ഗുണദോഷങ്ങളുടെ അടിസ്ഥാനത്തിൽ അവയെ വിലയിരുത്താൻ ഞാൻ ശ്രമിക്കാറില്ല.
53. പാഠഭാഗത്തിലെ പ്രധാന വസ്തുതകളുടെ ഒരു കുറിപ്പ് ഞാൻ തയ്യാറാക്കാറുണ്ട്.
54. നിഗമനങ്ങളെ വസ്തുതാപരമായ തെളിവുകൾ ഉപയോഗിച്ച് ഞാൻ പരിശോധിക്കാറുണ്ട്.
55. ആശയങ്ങളെ ഉൾക്കൊള്ളുന്നതിന് മുൻപ് അതിനാവശ്യമായ മുഴുവൻ വസ്തുതകളും ശേഖരിക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.
56. പാഠ്യവസ്തുവിലെ ആശങ്ങളുടെ വിശദമായ അർത്ഥവും വ്യാപ്തിയും മനസ്സിലാക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.
57. പഠനം ആരംഭിച്ചാൽ എത്രയും പെട്ടെന്ന് നിഗമനങ്ങളിൽ എത്തിച്ചേരാൻ ഞാൻ ശ്രമിക്കുന്നു.
58. നിഗമനങ്ങളിൽ എത്തിച്ചേരുന്നതിനു മുൻപ് അതിനാവശ്യമായ വസ്തുതകൾ ഞാൻ വിശദമായി പരിശോധിക്കാറുണ്ട്.
59. പഠിക്കുമ്പോൾ ചില ഭാഗങ്ങൾ വിട്ടു കളഞ്ഞാലും നിഗമനങ്ങൾക്ക് ഞാൻ പ്രാധാന്യം കൊടുക്കുന്നു.
60. ശ്രദ്ധാപൂർവ്വവും വിശദവുമായ പഠനത്തിനു ശേഷമാണ് ഞാൻ നിഗമനങ്ങളിലേക്ക് കടക്കുന്നത്.
61. പാഠഭാഗത്തുനിന്നും ആശയങ്ങൾ ശേഖരിക്കുന്നതിനുമുൻപ് മുഴുവൻ വിശദാംശങ്ങളും ഞാൻ പരിശോധിക്കാറുണ്ട്.
62. ഒരു പാഠം പഠിക്കുന്നതിന് മറ്റുള്ളവർക്ക് ആവശ്യമുള്ളതിൽ കൂടുതൽ സമയം എനിക്കാവശ്യമാണ്.
63. ആശയങ്ങളും വസ്തുതകളും സ്വായത്തമാക്കുന്നതിനു മുൻപ് അതിന്റെ വിശദാംശങ്ങൾക്കു വേണ്ടി ഏറെ സമയം ഞാൻ ചെലവഴിക്കാറില്ല.
64. നിഗമനങ്ങളിൽ എത്തിച്ചേരുന്നതിനു മുൻപ് അതിന്റെ വിശദാംശങ്ങൾ വളരെയേറെ സമയം ഞാൻ വായിക്കാറുണ്ട്.

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Appendix - II A

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

APPROACHES TO STUDYING INVENTORY
(DRAFT)

RESPONSE SHEET

വിദ്യാർത്ഥിയുടെ പേര് ..... വയസ്സ്.....

ക്ലാസ്..... ക്ലാസ് നമ്പർ..... ആൺകുട്ടി/പെൺകുട്ടി

Sl. No.	എല്ലായ്പോഴും	ചിലപ്പോഴൊക്കെ	ഒരിക്കലുമില്ല	Sl. No.	എല്ലായ്പോഴും	ചിലപ്പോഴൊക്കെ	ഒരിക്കലുമില്ല	Sl. No.	എല്ലായ്പോഴും	ചിലപ്പോഴൊക്കെ	ഒരിക്കലുമില്ല
1				22				43			
2				23				44			
3				24				45			
4				25				46			
5				26				47			
6				27				48			
7				28				49			
8				29				50			
9				30				51			
10				31				52			
11				32				53			
12				33				54			
13				34				55			
14				35				56			
15				36				57			
16				37				58			
17				38				59			
18				39				60			
19				40				61			
20				41				62			
21				42				63			
								64			

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Appendix II B

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION
APPROACHESTO STUDYING INVENTORY (FINAL)
Dr. P. K. Sudheesh Kumar & Hassan Koya. M. P

നിർദ്ദേശങ്ങൾ :

താഴെ കൊടുത്തിരിക്കുന്ന ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിക്കുക. ഓരോ പ്രസ്താവനയ്ക്കും 1. എല്ലായ്പ്പോഴും. 2. ചിലപ്പോൾ മാത്രം. 3. ഒരിക്കലുമില്ല എന്നിങ്ങനെ മൂന്ന് വീതം പ്രതികരണങ്ങൾ കൊടുത്തിരിക്കുന്നു. ഓരോ പ്രസ്താവനയും നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. ആ പ്രതികരണം പ്രത്യേകം തന്നിരിക്കുന്ന കടലാസിൽ ഓരോ പ്രസ്താവനയുടേയും നമ്പറിനുനേരെയുള്ള കോളത്തിൽ 'X' ചിഹ്നമിട്ട് രേഖപ്പെടുത്തുക. നിങ്ങൾ അടയാളപ്പെടുത്തിയ 'X' ചിഹ്നം തെറ്റായ സ്ഥാനത്താണെങ്കിൽ അതിനുചുറ്റും ഒരു വൃത്തം വരയ്ക്കുകയും (X) പുതിയ സ്ഥാനത്ത് 'X' ചിഹ്നം രേഖപ്പെടുത്തുകയും ചെയ്യുക. എല്ലാ പ്രസ്താവനകൾക്കും പ്രതികരണം രേഖപ്പെടുത്താൻ മറക്കരുത്.

മാതൃക:

ഞാൻ പതിവായി സ്വമേധയാ പഠനം നടത്തുന്നു.

എല്ലായ്പ്പോഴും	ചിലപ്പോൾ മാത്രം	ഒരിക്കലുമില്ല
	X	

1. പഠിക്കുന്ന വസ്തുതകളുടെ നിജസ്ഥിതി മനസ്സിലാക്കാൻ ഞാൻ സാധ്യമായ പരീക്ഷണങ്ങളും നിരീക്ഷണങ്ങളും നടത്താറുണ്ട്.
2. പഠിക്കുമ്പോൾ പാഠ്യവസ്തുവിന്റെ അടിസ്ഥാനം എന്താണെന്ന് മനസ്സിലാക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.
3. പഠിക്കുമ്പോൾ ഒരു വിഷയത്തിന് മറ്റു വിഷയങ്ങളുമായി എന്തെങ്കിലും ബന്ധമുണ്ടോ എന്ന് ഞാൻ പരിശോധിക്കാറില്ല.
4. പഠിക്കുമ്പോൾ കണ്ടെത്തുന്ന വസ്തുതകളെ പരീക്ഷണ നിരീക്ഷണങ്ങളുടെ ഫലങ്ങളുമായി ഞാൻ താരതമ്യം ചെയ്തു നോക്കാറുണ്ട്.
5. നിരീക്ഷണങ്ങളുടെയും ജീവിതാനുഭവങ്ങളുടെയും അടിസ്ഥാനത്തിൽ തന്നിരിക്കുന്ന നിഗമനങ്ങളെ ഞാൻ വിലയിരുത്തുന്നു.
6. തന്നിരിക്കുന്ന നിഗമനങ്ങൾ ശരിയാണോ എന്നറിയുന്നതിനാവശ്യമായ തെളിവുകൾ ശേഖരിക്കുന്ന പതിവ് എനിക്കില്ല.
7. പാഠത്തോടൊപ്പം കൊടുത്തിരിക്കുന്ന മിക്ക അഭ്യാസങ്ങളും അദ്ധ്യാപകന്റെ നിർദ്ദേശമില്ലാതെ തന്നെ ഞാൻ ചെയ്യാറുണ്ട്.
8. പാഠങ്ങൾ കൂടുതലായി മനസ്സിലാക്കുന്നതിന് അതുമായി ബന്ധപ്പെട്ട മറ്റ് പുസ്തകങ്ങളും പ്രസിദ്ധീകരണങ്ങളും ഞാൻ വായിക്കാറില്ല.
9. പഠിച്ചുകൊണ്ടിരിക്കുമ്പോൾ പഠിച്ച കാര്യങ്ങൾ ഓർമ്മയിലുണ്ടോ എന്ന് ഞാൻ ഇടയ്ക്കിടെ പരിശോധിക്കാറുണ്ട്.
10. പഠിക്കാനിരിക്കുമ്പോൾ പരീക്ഷയിൽ ജയിക്കാനാവശ്യമായ വിവരങ്ങൾ മനസ്സിലാക്കുക മാത്രമാണ് എന്റെ ലക്ഷ്യം
11. അദ്ധ്യാപകർ ആവശ്യപ്പെടുന്ന പാഠഭാഗങ്ങൾ പതിവായി വായിക്കുന്ന ശീലം എനിക്കില്ല.
12. പാഠഭാഗത്തെക്കുറിച്ച് എനിക്കുണ്ടാകുന്ന സംശയങ്ങൾ അദ്ധ്യാപകരോട് ചോദിച്ച് നിവാരണം നടത്താറുണ്ട്.
13. എത്ര നന്നായി പഠിച്ചാലും പരീക്ഷയിൽ ഉയർന്ന മാർക്ക് കിട്ടില്ല എന്ന തോന്നൽ എനിക്കുണ്ട്.
14. പരീക്ഷകളിൽ ഉയർന്ന മാർക്ക് വാങ്ങിയാലും നല്ല ഒരു ഭാവി ഉണ്ടാവില്ല എന്ന ഞാൻ കരുതുന്നു.
15. പഠിക്കുമ്പോൾ പരീക്ഷയിൽ ജയിക്കുക എന്ന ലക്ഷ്യം മാത്രമല്ല എന്റെ മനസ്സിലുണ്ടാവുക.
16. മുതിർന്നവർ നിർബ്ബന്ധിക്കുമ്പോഴാണ് ഞാൻ പഠിക്കുന്നത്.
17. പഠിച്ച കാര്യങ്ങൾ നിത്യജീവിതത്തിൽ പകർത്തുക എന്ന ലക്ഷ്യത്തോടെയാണ് ഞാൻ പഠിക്കുന്നത്.
18. ഒരു വ്യക്തിക്ക് സമൂഹത്തിൽ ലഭിക്കുന്ന അംഗീകാരത്തിന് അയാളുടെ വിദ്യാഭ്യാസ നിലവാരവും കാരണമാണെന്ന് ഞാൻ വിശ്വസിക്കുന്നു.

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19. പതിവായി ഹോം വർക്ക് ചെയ്യുന്ന ശീലം എനിക്കില്ല.
20. ഒരു ടൈംടേബിൾ തയ്യാറാക്കി അതിനനുസരിച്ച് പഠിക്കുന്നത് നല്ലതാണെങ്കിലും എനിക്കതിനു കഴിയാറില്ല.
21. പഠിക്കാനുപയോഗിക്കുന്ന സമയം കൂടി കളിക്കാനാണ് എനിക്ക് താൽപര്യം.
22. പഠനം ഒരു മടുപ്പിക്കുന്ന അനുഭവമായി എനിക്ക് തോന്നാറില്ല.
23. പരീക്ഷകളിൽ ജയിക്കുക എന്നത് ഒരു വാശിയായിട്ടാണ് ഞാൻ കാണുന്നത്.
24. ആത്മാർത്ഥമായി പരിശ്രമിച്ചാൽ ജീവിതത്തിൽ എന്തും നേടിയെടുക്കാം എന്ന വിശ്വാസമാണ് എന്നെ നയിക്കുന്നത്.
25. പാഠഭാഗത്തിലെ സമാന ആശയങ്ങളെ ഞാൻ നോട്ടുബുക്കിൽ പ്രത്യേകം രേഖപ്പെടുത്താറുണ്ട്.
26. പാഠ്യവസ്തുവിന്റെ ഗുണദോഷങ്ങളുടെ അടിസ്ഥാനത്തിൽ അവയെ വിലയിരുത്താൻ ഞാൻ ശ്രമിക്കാറില്ല.
27. നിഗമനങ്ങളെ വസ്തുതാപരമായ തെളിവുകൾ ഉപയോഗിച്ച് ഞാൻ പരിശോധിക്കാറുണ്ട്.
28. പാഠ്യവസ്തുവിലെ ആശങ്ങളുടെ വിശദമായ അർത്ഥവും വ്യാപ്തിയും മനസ്സിലാക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.
29. നിഗമനങ്ങളിൽ എത്തിച്ചേരുന്നതിനു മുൻപ് അതിനാവശ്യമായ വസ്തുതകൾ ഞാൻ വിശദമായി പരിശോധിക്കാറുണ്ട്.
30. ശ്രദ്ധാപൂർവ്വവും വിശദവുമായ പഠനത്തിനു ശേഷമാണ് ഞാൻ നിഗമനങ്ങളിലേക്ക് കടക്കുന്നത്.
31. പാഠഭാഗത്തുനിന്നും ആശയങ്ങൾ ശേഖരിക്കുന്നതിനുമുൻപ് മുഴുവൻ വിശദാംശങ്ങളും ഞാൻ പരിശോധിക്കാറുണ്ട്.
32. ഒരു പാഠം പഠിക്കുന്നതിന് മന്ദബുദ്ധികളായവർക്ക് ആവശ്യമുള്ളതിൽ കൂടുതൽ സമയം എനിക്കാവശ്യമാണ്.

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Appendix II C

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

APPROACHES TO STUDYING INVENTORY

(Final)

RESPONSE SHEET

വിദ്യാർത്ഥിയുടെ പേര് .... വയസ്സ് ....

ക്ലാസ്സ് .... ക്ലാസ് നമ്പർ .... ആൺകുട്ടി/പെൺകുട്ടി

SI No.	എല്ലായ്പ്പോഴും	ചിലപ്പോഴൊക്കെ	ഒരിക്കലുമില്ല	SI No.	എല്ലായ്പ്പോഴും	ചിലപ്പോഴൊക്കെ	ഒരിക്കലുമില്ല
1				17			
2				18			
3				19			
4				20			
5				21			
6				22			
7				23			
8				24			
9				25			
10				26			
11				27			
12				28			
13				29			
14				30			
15				31			
16				32			

Appendix II D

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

APPROACHES TO STUDYING INVENTORY (FINAL)

Dr. P. K. Sudheesh Kumar
&
Hassan Koya. M. P

Instructions: Read carefully each of the following statements. Three types of responses are given for each statement: (1) *Always* (2) *Sometimes* (3) *Never.* Decide your response to each statement and mark it in a separate response sheet provided by putting X in the relevant column. If you marked incorrectly put a circle around it (X) and mark X at the right place. Please mark your response for every statement.

Example :

1. Usually I study by myself

Always	Sometimes	Never
	X	

---

1. I conduct practically possible experiments and observations related to my lessons.
2. While studying I do not try to understand the basis of content matter.
3. While studying I do not check whether one subject is related with any other subjects or not.
4. The facts that I find out while studying is compared with the results of experiments and observations.
5. I evaluate the conclusions on the basis of observations and experiences.
6. I do not have the habit of collecting evidences to check the validity of conclusions.
7. I do the exercises given with the lessons without a direction from my teacher.
8. I do not read the other related books and publications to study more about my lessons.

9. While studying I frequently check whether the learned facts are there in my mind or not.
10. When I study my intention is to collect the information required for a pass in the examination.
11. I do not have the habit of reading the lessons as directed by the teacher.
12. I clear my doubts about the lessons by asking teachers.
13. I am not hopeful of scoring high marks even if studied well.
14. Even if I scored high marks in the examinations I am not hopeful of a good future.
15. While studying, my goal is not simply to pass the examination.
16. I study because of the compulsion of elders.
17. I study for applying the acquired knowledge in real life.
18. I believe that education is also responsible for one's recognition in society.
19. I do not have the habit of doing home work regularly.
20. Eventhough it is good to learn according to a timetable, I cannot to do so.
21. I like to play even during the time meant for studying.
22. I do not feel that studying is a tedious experience.
23. I take passing the examinations as a challenge.
24. I am directed by the belief that anything can be achieved by a sincere effort.
25. I have the habit of recording the similar concepts in content material in a note book.
26. I do not try to evaluate the content matter on the basis of their merits and demerits.
27. I check the conclusions using empirical evidences.
28. I do not try to understand the detailed meaning and scope of concepts in content matter.
29. Before arriving at conclusions I thoroughly check the facts required for it.
30. I arrive at conclusions only after cautious and detailed study.
31. Before accepting concepts from study materials I thoroughly check every details related to it.
32. To study a lesson I need more time than others.

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

APPROACHES TO STUDYING INVENTORY

(Final)

RESPONSE SHEET

Name of Student ..... Age .....

Class ..... Class No. ..... Boy / Girl

SI No.	Always	Sometimes	Never	SI No.	Always	Sometimes	Never
1				17			
2				18			
3				19			
4				20			
5				21			
6				22			
7				23			
8				24			
9				25			
10				26			
11				27			
12				28			
13				29			
14				30			
15				31			
16				32			

40

Appendix III

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

SCALE OF ACHIEVEMENT MOTIVATION

Dr. Kamala S. Pillai and Salimkumar C

നിർദ്ദേശങ്ങൾ: താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകളും ശ്രദ്ധാപൂർവ്വം വായിക്കുക. ഓരോ പ്രസ്താവനക്കും നിങ്ങളുടെ പ്രതികരണമനുസരിച്ചുള്ള ഉത്തരം കൊടുത്തിരിക്കുന്നു. 'Y' അതെ (Yes) എന്നതിനേയും 'U' തീച്ചയില്ല (Undecided) എന്നതിനേയും 'N' അല്ല (No) എന്നതിനേയും സൂചിപ്പിക്കുന്നു. ഓരോ പ്രസ്താവനക്കും നിങ്ങളുടെ പ്രതികരണം രേഖപ്പെടുത്തിയിരിക്കുന്ന ഉത്തരക്കടലാസിൽ അതായത് പ്രസ്താവനകളുടെ നമ്പരിനെതിരെ നിങ്ങളുടെ ശരിയായ പ്രതികരണമനുസരിച്ച് (Y, U, N) ഏതെങ്കിലുമുള്ള വൃത്തത്തിൽ 'X' ചിഹ്നം കൊണ്ട് രേഖപ്പെടുത്തുക. എല്ലാ പ്രസ്താവനകൾക്കും പ്രതികരണം രേഖപ്പെടുത്താൻ പ്രത്യേകം ശ്രദ്ധിക്കുക.

1. പഠിക്കാൻ ബുദ്ധിമുട്ട് തോന്നുന്ന പാഠഭാഗങ്ങളും ഞാൻ ഒഴിവാക്കാൻ ഇഷ്ടപ്പെടുന്നു.
2. ഏത് പ്രവർത്തിയിലും എന്റെ കഴിവിന്റെ പരമാവധി ഞാൻ ഉപയോഗപ്പെടുത്താൻ ശ്രമിക്കാറുണ്ട്.
3. ഓരോ ദിവസവും പഠിപ്പിക്കുന്ന പാഠഭാഗങ്ങളും ഞാൻ അതാതു ദിവസംതന്നെ പഠിക്കാറുണ്ട്.
4. ഞാനൊരു മടിയനാണെന്ന തോന്നൽ എനിക്കുണ്ട്.
5. ഇന്നു ചെയ്യേണ്ടതിനുശേഷമാണെന്നറിയാവുന്ന പലകാര്യങ്ങളും ഞാൻ പിന്നീട് ചെയ്യാൻ മാറ്റിവയ്ക്കാറുണ്ട്.
6. കൂടുതൽ അദ്ധ്വാനം ഞാൻ ഇഷ്ടപ്പെടുന്നു.
7. എനിക്ക് ചെയ്യാൻ കഴിയുന്നതിലും വളരെ കുറച്ച് ജോലി മാത്രമെ ഞാൻ ചെയ്യാറുള്ളൂ.
8. വിഷമമുള്ള പാഠഭാഗങ്ങളും പഠിക്കാൻ ഞാൻ കൂടുതൽ സമയം ചെലവഴിക്കാറുണ്ട്.
9. പഠനപ്രവർത്തനങ്ങളും നന്നായി ചെയ്യാൻ കഴിയുന്നതിൽ എനിക്ക് സംതൃപ്തിയുണ്ട്.
10. എന്നെപ്പോലെ നന്നായി പഠിക്കുന്നവരോട് കൂട്ടുകൂടാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
11. കഴിഞ്ഞ പരീക്ഷയേക്കാളും കൂടുതൽ മാർക്ക് വാങ്ങാൻ ഞാൻ ഓരോ തവണയും ശ്രമിക്കാറുണ്ട്.
12. ഒരു പ്രവൃത്തി നല്ല രീതിയിൽ ചെയ്തു തീർക്കുമ്പോൾ സംതൃപ്തിയുണ്ടാകുന്നു.
13. മറ്റുള്ളവർ ചെയ്യുന്നതിനേക്കാളും നന്നായിട്ടില്ലെങ്കിലും എന്റെ മുൻ പ്രവർത്തനങ്ങളേക്കാളും നന്നായി ചെയ്യാൻ കഴിഞ്ഞാൽ എനിക്ക് സംതൃപ്തിയുണ്ടാകുന്നു.
14. പഠനകാര്യങ്ങളും ഏറ്റവും നന്നായി ചെയ്തു തീർക്കാൻ എനിക്ക് കഴിയാറുണ്ട്.
15. മറ്റുള്ളവർ എന്നെ മാതൃകയാക്കാവുന്ന തരത്തിലുള്ള പ്രവർത്തനം കാഴ്ചവയ്ക്കാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
16. എന്റെ ക്ലാസ്സിലെ എല്ലാവരും ഇഷ്ടപ്പെടുന്ന വ്യക്തിയാകാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
17. സംശയ നിവാരണത്തിനായി മറ്റു കുട്ടികൾ എന്റെ അടുത്ത് വരണമെന്ന് ഞാൻ ആഗ്രഹിക്കുന്നു.
18. എല്ലാവരും എന്റെ കഴിവിനെ അംഗീകരിക്കുവാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
19. എന്റെ അഭിപ്രായങ്ങളും ഏറ്റവും വിലപ്പെട്ടതാകുവാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
20. എല്ലാവരാലും ശ്രദ്ധിക്കപ്പെടുവാൻ ഞാൻ ആഗ്രഹിക്കുന്നില്ല.
21. തീരുമാനങ്ങളും എന്റേതാകുവാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
22. ഉന്നത വ്യക്തികളുമായി ഇടപഴകുവാൻ ഞാൻ ആഗ്രഹിക്കുന്നു.
23. എന്റെ നല്ല രീതിയിലുള്ള പ്രവർത്തനത്തെ എല്ലാവരും അഭിനന്ദിക്കണമെന്ന് ഞാൻ ആഗ്രഹിക്കുന്നു.
24. പഠനത്തിൽ ഞാൻ ഏറ്റവും മുൻപന്തിയിലാണെങ്കിലും പഠനം തുടരാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
25. മത്സരങ്ങളിൽ മറ്റുള്ളവരേക്കാളും മുൻപന്തിയിലെത്താൻ ഞാൻ കഠിനമായി പ്രയത്നിക്കാറുണ്ട്.
26. വെറും നേട്ടത്തേക്കാളുപരി എന്റെ പ്രവർത്തിയുടെ ഫലത്തെ ഞാൻ വിലയിരുത്തുന്നത് അത് മറ്റുള്ളവർ ചെയ്യുന്നതിനേക്കാളും നല്ലതാണോ എന്ന് നോക്കിയാണ്.

27. ഒരു പ്രവൃത്തി മറ്റുള്ളവരേക്കാളും നന്നായി ചെയ്യണമെന്നതിൽ എനിക്ക് നിഷ്കർഷയുണ്ട്.
28. ക്ലാസിൽ ഒന്നാംസ്ഥാനം ലഭിക്കണമെന്ന ആഗ്രഹത്തോടെ ഞാൻ പഠിക്കാറുണ്ട്.
29. വിജയം എനിക്കുതന്നെയാണെന്ന് ഉറപ്പുള്ള കാര്യങ്ങളും ചെയ്യുവാൻ എനിക്ക് ഉൽസാഹം ഉണ്ട്.
30. എതിരാളികളും ശക്തരാണെങ്കിൽ എന്റെ പ്രവർത്തനം ഏറ്റവും മെച്ചമായിരിക്കും.
31. പഠിത്തത്തിൽ നേട്ടമുണ്ടാക്കാനുള്ള ഏതവസരവും ഞാൻ കളയാറില്ല.
32. മറ്റുള്ളവർ നേരംപോക്കിനായ് സമയം ചെലവഴിക്കുമ്പോഴും കൂടുതൽ നേട്ടങ്ങളും ഉണ്ടാക്കുവാൻ ഞാൻ ശ്രമിക്കുന്നു.
33. പഠിത്തത്തിൽ ഉയർച്ചയുണ്ടായതിന്റെ പിന്നിൽ നേട്ടങ്ങളുടെ ഒരു ചരിത്രം എനിക്കുണ്ട്.
34. കൂടുതൽ നേട്ടങ്ങളും ഉണ്ടാകുന്നതുകൊണ്ടാണ് എനിക്ക് നന്നായി പഠിക്കാൻ കഴിയുന്നത്.
35. പഠനത്തിന് പ്രാധാന്യം കൊടുക്കുന്നത് അതിൽ നിന്നും ഉണ്ടാകുന്ന ഉയർച്ചയെ അടിസ്ഥാനമാക്കിയാണ്.
36. പഠനകാര്യങ്ങളും നന്നായി ചെയ്യുന്നതിനുള്ള സമ്മാനങ്ങളും എന്നും എനിക്കുതന്നെയാണ് ലഭിക്കാറുള്ളത്.
37. സാങ്കേതികജ്ഞാനം കൂടുതൽ ആവശ്യമുള്ള പ്രവർത്തികളും ചെയ്യുവാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
38. ഉയർന്ന ബുദ്ധിശക്തിയും നിപുണതയും ആവശ്യമായ പഠനപ്രവർത്തികളും ചെയ്യാൻ ഞാൻ ഇഷ്ടപ്പെടുന്നു.
39. ഒരു പ്രവർത്തി ശരിയായി ചെയ്യാൻ കഴിയാതെ വരുമ്പോൾ അതു് ഉപേക്ഷിക്കാൻ എനിക്ക് തോന്നാറുണ്ട്.
40. ലക്ഷ്യത്തിലെത്തിച്ചേരാൻ സഹായകമാണോ എന്റെ പഠനരീതി എന്ന് എനിക്ക് സംശയം തോന്നാറുണ്ട്.
41. എല്ലാവരേക്കാളും ഉപരിയായി പഠനകാര്യങ്ങളും നന്നായി ചെയ്യുവാൻ എനിക്ക് കഴിയും.
42. പഠനപരമായ എല്ലാ പ്രവർത്തനങ്ങളിലും ആദ്യം അഭിപ്രായം പറയുന്നത് ഞാനാണ്.
43. പഠനകാര്യങ്ങളും സഹപാഠികളോട് ചർച്ച ചെയ്യാൻ ഞാൻ മുൻകൈയ്യെടുക്കാറുണ്ട്.
44. സഹപാഠികളിൽ സ്വാധീനം ചെലുത്താൻ കഴിയുന്നത് എനിക്ക് സന്തോഷമുള്ള കാര്യമാണ്.
45. അവസരം കിട്ടിയാൽ സഹപാഠികളുടെ ഇടയിൽ ഞാൻ ഒരു നല്ല നേതാവാകും.
46. ഞാൻ പറയുന്നത് എന്റെ സഹപാഠികളും എല്ലാവരും ശ്രദ്ധിക്കാറുണ്ട്.
47. എന്റെ സംഘത്തിലെ നേതാവാണ് ഞാൻ എന്ന് എനിക്ക് എപ്പോഴും തോന്നാറുണ്ട്.
48. സഹപാഠികളും എന്ത് ചെയ്യണമെന്ന് തീരുമാനിക്കുന്നതിലും അത് നടപ്പിലാക്കുന്നതിനും മുൻകൈയ്യെടുക്കുന്നതാണ് എനിക്ക് സന്തോഷം.
49. ഞങ്ങളും ഏതെങ്കിലും ഒരു പ്രവർത്തിക്ക് രൂപം കൊടുക്കുമ്പോൾ അത് മറ്റൊരാളുടെ നേതൃത്വത്തിൽ ഏറ്റെടുത്ത് നടത്തുന്നതിനെക്കാൾ ഞാൻതന്നെ ഏറ്റെടുത്ത് നടത്തുന്നതാണ് എനിക്കിഷ്ടം.
50. സഹപാഠികൾക്ക് നിർദ്ദേശം കൊടുക്കുമ്പോഴും അതനുസരിച്ച് കാര്യങ്ങളും നിർവ്വഹണവും എനിക്കിഷ്ടമാണ്.

1x2

Appendix III A

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

SCALE OF ACHIEVEMENT MOTIVATION

RESPONSE SHEET

പേര് ..... ക്ലാസ്സ് ..... ക്ലാസ്സ്നമ്പർ .....

സ്ക്കൂൾ ..... ആൺകുട്ടി/പെൺകുട്ടി..... വയസ്സ് .....

ക്രമ നമ്പർ	അതെ	തീർച്ചയില്ല	അല്ല	ക്രമ നമ്പർ	അതെ	തീർച്ചയില്ല	അല്ല	ക്രമ നമ്പർ	അതെ	തീർച്ചയില്ല	അല്ല	ക്രമ നമ്പർ	അതെ	തീർച്ചയില്ല	അല്ല	ക്രമ നമ്പർ	അതെ	തീർച്ചയില്ല	അല്ല
1.	O	O	O	11.	O	O	O	21.	O	O	O	31.	O	O	O	41.	O	O	O
2.	O	O	O	12.	O	O	O	22.	O	O	O	32.	O	O	O	42.	O	O	O
3.	O	O	O	13.	O	O	O	23.	O	O	O	33.	O	O	O	43.	O	O	O
4.	O	O	O	14.	O	O	O	24.	O	O	O	34.	O	O	O	44.	O	O	O
5.	O	O	O	15.	O	O	O	25.	O	O	O	35.	O	O	O	45.	O	O	O
6.	O	O	O	16.	O	O	O	26.	O	O	O	36.	O	O	O	46.	O	O	O
7.	O	O	O	17.	O	O	O	27.	O	O	O	37.	O	O	O	47.	O	O	O
8.	O	O	O	18.	O	O	O	28.	O	O	O	38.	O	O	O	48.	O	O	O
9.	O	O	O	19.	O	O	O	29.	O	O	O	39.	O	O	O	49.	O	O	O
10.	O	O	O	20.	O	O	O	30.	O	O	O	40.	O	O	O	50.	O	O	O

Appendix III.B

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

SCALE OF ACHIEVEMENT MOTIVATION

Dr. Kamala S. Pillai & C. Salim Kumar

Instructions:

Read carefully the statements given below. For each statement, three responses 'Y', 'U' and 'N' are possible and these denotes **Yes, Undecided** and No respectively. Separate sheet is provided for recording your responses. Mark your response with the symbol 'X', below the circle of your responses (Y, U, N) for each statement. Try to mark your response to each and every statement.

1. I like to avoid those lessons which I find difficult to study.
2. I would try to utilise maximum of my ability for doing any work.
3. I usually study the lessons taught each day that day itself.
4. I have the feeling that I am lazy.
5. I often put off things I know I should do today.
6. I like hard work.
7. I used to do very little work which I can do.
8. I would spend more time in studying difficult lessons.
9. I find satisfaction in doing well in my studies.
10. I like to mingle with others, who are good at studies like me.
11. Each time I try to score more marks than my previous examinations.
12. I find satisfaction, when I do a work in a befitting manner.
13. I get satisfaction in doing a work better than my earlier work even if I don't outperform others.
14. I would be able to complete my studies very well.
15. I like to present my activities which others can consider as models.

16. I want to become a person admired by others.
17. I want others to come to me for clearing their doubts.
18. I like to be admired of my abilities.
19. I want others to consider my opinions of great value.
20. I dislike being the centre of attention.
21. I like to take my own decisions.
22. I want to mingle with important persons in the community.
23. I like others to appreciate my good activities.
24. Even if I top in my class studies always I like to continue my studies.
25. I try harder to win the top positions when I am in competition with others.
26. I judge my performance on whether I do better than others rather than just getting a good result.
27. It is important to me to perform better than others on a task.
28. I would study my lessons so that I get the top rank in my class.
29. It gives me pleasure in doing things which I am sure to win.
30. If there is tough competition, my performance will be better.
31. I never neglect opportunities of better performance in my studies.
32. I don't mind working hard while others are having fun.
33. There is continuous effort behind the success of my accomplishments in studies.
34. I could study well as I am getting more recognition.
35. The most important thing about studies is accomplishment.
36. I usually get the trophies and prizes for studies.
37. There is satisfaction in work involving technical knowledge and skill.
38. I find satisfaction in studying materials which require high intellectual ability and skill.
39. I feel like giving up a work which I am unable to do correctly.
40. I feel doubt about my learning style whether it will help to attain the goal.
41. I think I am able to study better than anybody else.

45

42. In all study matters, my opinions always come first.

43. I used to take initiative in discussing study matters with my classmates.

44. I would enjoy having authority over my classmates.

45. If given the chance I would become a good leader.

46. My classmates take notice of what I say.

47. I usually think, I am the leader of my group.

48. I enjoy taking initiative in what my classmates should do and get things done.

49. When we plan an activity I would like to direct it myself rather than someone else taking the lead.

50. I like to give direction to my classmates and get things going accordingly.

Appendix III : C

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

SCALE OF ACHIEVEMENT MOTIVATION

RESPONSE SHEET

Name.....Class.....Class No.....
School.....Boy/Girl.....Age.....

Sl.No	Yes	Undecided	No	Sl.No	Yes	Undecided	No	Sl.No	Yes	Undecided	No	Sl.No	Yes	Undecided	No	Sl.No	Yes	Undecided	No
1.	O	O	O	11.	O	O	O	21.	O	O	O	31.	O	O	O	41.	O	O	O
2.	O	O	O	12.	O	O	O	22.	O	O	O	32.	O	O	O	42.	O	O	O
3.	O	O	O	13.	O	O	O	23.	O	O	O	33.	O	O	O	43.	O	O	O
4.	O	O	O	14.	O	O	O	24.	O	O	O	34.	O	O	O	44.	O	O	O
5.	O	O	O	15.	O	O	O	25.	O	O	O	35.	O	O	O	45.	O	O	O
6.	O	O	O	16.	O	O	O	26.	O	O	O	36.	O	O	O	46.	O	O	O
7.	O	O	O	17.	O	O	O	27.	O	O	O	37.	O	O	O	47.	O	O	O
8.	O	O	O	18.	O	O	O	28.	O	O	O	38.	O	O	O	48.	O	O	O
9.	O	O	O	19.	O	O	O	29.	O	O	O	39.	O	O	O	49.	O	O	O
10.	O	O	O	20.	O	O	O	30.	O	O	O	40.	O	O	O	50.	O	O	O

Appendix IV

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION
ACHIEVEMENT TEST IN BIOLOGY(Draft)
FOR SECONDARY SCHOOL PUPILS

HASSAN KOYA. M. P

നിർദ്ദേശങ്ങൾ

1. ഇത് ഒരു ബയോളജി ടെസ്റ്റാണ്. ഉത്തരങ്ങൾ അടയാളപ്പെടുത്തുന്നതിന് വേറെ കടലാസ് തന്നിട്ടുണ്ട്. ചോദ്യക്കടലാസിൽ ഒന്നും എഴുതുകയോ വരക്കുകയോ ചെയ്യരുത്.

2. എല്ലാ ചോദ്യങ്ങൾക്കും എ, ബി, സി, ഡി എന്നീ അക്ഷരങ്ങൾ ഇട്ട് നാല് ഉത്തരങ്ങൾ വീതം കൊടുത്തിരിക്കുന്നു. അവയിൽ ഒന്നുമാത്രമാണ് ശരി. ഉത്തരക്കടലാസിൽ ഓരോ ചോദ്യനമ്പറിനുമെതിരെ എ, ബി, സി, ഡി എന്ന് രേഖപ്പെടുത്തിയിരിക്കുന്നു. ഓരോ ചോദ്യത്തിനും ശരിയായ ഉത്തരം കണ്ടുപിടിക്കുക. അതിനുശേഷം ഉത്തരക്കടലാസിൽ ചോദ്യനമ്പറിനുനേരെ ശരിയുത്തരത്തെക്കുറിക്കുന്ന അക്ഷരത്തിൽ X അടയാളം ഇടുക.

3. നിങ്ങൾ ആദ്യം അടയാളപ്പെടുത്തിയ X ചിഹ്നം തെറ്റായ സ്ഥാനത്താണെങ്കിൽ സ്ഥാനം മാറ്റുന്നതിന് അതിനു ചുറ്റും ഒരു ചെറിയ സമചതുരം (□) വരക്കുകയും ശരിയായ സ്ഥാനത്ത് ചിഹ്നം ഇടുകയും ചെയ്യുക.

4. എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം അടയാളപ്പെടുത്താൻ ശ്രദ്ധിക്കുക.

5. പരിശോധകൻ സ്റ്റാർട്ട് എന്നുപറയുമ്പോൾ ഉത്തരം അടയാളപ്പെടുത്താൻ ആരംഭിക്കുക.

മാതൃക

ഒരാവാസ വ്യവസ്ഥയിലെ ഊർജ്ജത്തിന്റെ പ്രാഥമിക ഉറവിടമേത്?

(A) വായു (B) സൂര്യപ്രകാശം (C) ജലം (D) മണ്ണ്

Q. No. 1. A B C D

1. പാരമ്പര്യ സ്വഭാവത്തെക്കുറിച്ചു പഠിക്കുന്ന ശാസ്ത്രശാഖയുടെ പേരെന്ത്?

   (A) ജീവശാസ്ത്രം (B) ജന്തുശാസ്ത്രം

   (C) സസ്യശാസ്ത്രം (D) ജനിതകശാസ്ത്രം

2. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിൽക്കൂടി വസ്തുക്കളെ വലുതാക്കി കാണിക്കുന്ന ഭാഗം ഏത്?

   (A) ഇലക്ട്രോൺ കിരണാവലി (B) വൈദ്യുതകാന്തങ്ങൾ

   (C) ലെൻസുകൾ (D) പ്രകാശരശ്മികൾ

3. ഒരേ ഘടനയും ധർമ്മവുമുള്ള കോശങ്ങളുടെ കൂട്ടത്തെ എന്ത് പേരിൽ അറിയപ്പെടുന്നു?

   (A) അവയവം (B) അവയവവ്യൂഹം

   (C) കല (D) കോശസമൂഹം

4. ചെറിയ തൻമാത്രകളെ മാത്രം കടത്തിവിടാൻ കഴിയുന്ന സ്തരങ്ങളെ എന്ത് പേർ വിളിക്കുന്നു?

   (A) അതാര്യ സ്തരങ്ങൾ (B) അർദ്ധതാര്യസ്തരങ്ങൾ

   (C) താര്യസ്തരങ്ങൾ (D) വർണ്ണതാര്യസ്തരങ്ങൾ

5. ജന്തുശരീരത്തിൽ ആഹാരം സംവഹിക്കുന്ന മാദ്ധ്യമമേത്?

(A) ഉപചയം (B) കിണ്വനം

(C) അപചയം (D) ശ്വസനം

6. ജീവിവളിൽ ഓക്സിജന്റെ അഭാവത്തിൽ നടക്കുന്ന ഗ്ലൂക്കോസ് വിഘടനത്തിന്റെ പേരെന്ത്?

(A) ഉപചയം (B) കിണ്വാനം

(C) അപചയം (D) ശ്വസനം

7. ഷഡ്പദങ്ങളുടെ ശ്വസനാവയവം ഏത്?

(A) ശ്വാസകോശം (B) ശ്വസനരന്ധ്രങ്ങൾ

(C) ശ്വസനികൾ (D) ശ്വസനനാളികൾ

8. സസ്തനികളിൽ ദഹിച്ച ആഹാര പദാർത്ഥങ്ങളെ ആഗിരണം ചെയ്യുന്ന അവയവം ഏത്?

(A) വില്ലസ് (B) ചെറുകുടൽ

(C) ആമാശയം (D) വൻകുടൽ

9. താഴെ കൊടുത്തിരിക്കുന്നവയിൽ ശരീര പ്രവർത്തനങ്ങളെ നിയന്ത്രിക്കുന്ന രാസവസ്തു ഏത്?

(A) വൈറ്റമിൻസ് (B) മിനറൽസ്

(C) ഹോർമോൺ (D) ലിംഫ്

10. റൂട്ട് പ്രഷർ അളക്കാൻ ഉപയോഗിക്കുന്ന ഉപകരണത്തിന്റെ പേരെന്ത്?

(A) ലാക്ടോമീറ്റർ (B) മെർക്കുറി മാനോമീറ്റർ

(C) സ്ഫിഗ്മോമാനോമീറ്റർ (D) തെർമോമീറ്റർ

11. ജന്തുക്കൾ ആഹാരത്തിനുവേണ്ടി സസ്യങ്ങളെ ആശ്രയിക്കുന്ന പ്രക്രിയയുടെ പേരെന്ത്?

(A) സ്വപോഷണം (B) പരപോഷണം

(C) പരജീവനം (D) പരോപജീവനം

12. ജീവികൾ ആവിർഭവിക്കുന്ന പ്രതിഭാസത്തെ എന്തുപറയുന്നു?

(A) ജീവൽപ്രവർത്തനം (B) ജീവശാസ്ത്രം

(C) ജീവപരിണാമം (D) ജീവസന്ധാരണം

13. സസ്യശരീരം കോശങ്ങളാൽ നിർമിതമാണെന്ന് കണ്ടുപിടിച്ച ശാസ്ത്രകാരൻ ആര്?

(A) ഷാൻ (B) വിർഷോ

(C) ഹുക്ക് (D) ഷ്ളീഡൻ

14. ഒരു ജീവകോശത്തിൽ മാംസ്യങ്ങൾ നിർമ്മിക്കുന്ന ഭാഗത്തിന്റെ പേരെന്ത്?

(A) റൈബോസോം (B) ലൈസോസോം

(C) സെൻട്രോസോം (D) ക്രോമസോം

15. കോശശ്വസനത്തിന്റെ പ്രവർത്തനം ആദ്യമായി വിശദീകരിച്ച ജൈവരസതന്ത്രജ്ഞനാര്?

(A) ന്യൂട്ടൻ (B) അഡോൾഫ് ക്രെബ്സ്

(C) ഗലീലിയോ (D) ഷാൻ

16. അരുണ രക്താണുക്കൾക്ക് ചുവപ്പുനിറം നൽകാൻ സഹായിക്കുന്ന വസ്തു ഏത്?

(A) പ്ലാസ്മ (B) അൽബുമിൻ

(C) പ്ലേറ്റ്ലറ്റുകൾ (D) ഹീമോഗ്ലോബിൻ

17. പല്ലുകൾക്ക് ബലം കുറയുന്നത് താഴെപറയുന്ന ഏത് പോഷക പദാർത്ഥത്തിന്റെ അഭാവം മൂലമാണ്?

(A) സോഡിയം (B) കാത്സ്യം

(C) അയഡിൻ (D) പൊട്ടാസ്യം

18. രക്തത്തെ കല എന്നുപറയാൻ കാരണമെന്ത്?

(A) രക്തത്തിന്റെ പ്ലാസ്മയിൽ ലവണങ്ങൾ, അമിനോ ആസിഡുകൾ എന്നിവ അടങ്ങിയിട്ടുള്ളതുകൊണ്ട്.

(B) വിവിധ ഇനം രക്തകോശങ്ങൾ അടങ്ങിയിരിക്കുകയാണെങ്കിലും രക്തം ഒരേ ധർമ്മം നിർവ്വഹിക്കുന്നതുകൊണ്ട്.

(C) രക്തം ഹോർമോണുകളെ ശരീരത്തിന്റെ വിവിധ ഭാഗങ്ങളിൽ എത്തിക്കുന്നതുകൊണ്ട്.

(D) കലകൾക്ക് ആവശ്യമായ പദാർത്ഥങ്ങൾ ശരീരത്തിന്റെ എല്ലാ ഭാഗത്തും എത്തിക്കുന്നതുകൊണ്ട്.

19. കോശസ്തരത്തെ വരണതാര്യസ്തരം എന്നു പറയാൻ കാരണം അവ

(A) ചില തന്മാത്രകളെ മാത്രം കടത്തി വിടുന്നു

(B) എല്ലാ തന്മാത്രകളെയും കടത്തിവിടുന്നു.

(C) ഒരു തന്മാത്രയെയും കടത്തിവിടുന്നില്ല

(D) വലിയ തന്മാത്രകളെ മാത്രം കടത്തി വിടുന്നു

20. തരുണാസ്ഥികൾ വഴങ്ങുന്ന സ്വഭാവമുള്ളതാകുവാൻ കാരണം അവയിൽ കോശാന്തരസ്ഥലങ്ങൾ

(A) എണ്ണത്തിൽ വളരെ കുറവായതുകൊണ്ട്

(B) ജല്ലിപോലുള്ള പദാർത്ഥം ഉൾക്കൊള്ളുന്നതുകൊണ്ട്

(C) വായുനിറഞ്ഞവയായതുകൊണ്ട്

(D) എണ്ണത്തിൽ വളരെ കൂടുതലായതുകൊണ്ട്

21. മണ്ണിലെ ജലം സസ്യ ശരീരത്തിൽ കടന്ന് ഇലകളിൽ എത്തുന്നത് താഴെ പറയുന്ന ഏത് ശൃംഖല വഴിയാണ്?

(A) മൂലരോമങ്ങൾ - കോശസ്തരം - കോശഭിത്തി - ഫ്ലോയം - സൈലം

(B) മൂലരോമങ്ങൾ - കോശഭിത്തി - കോശസ്തരം - ഫ്ലോയം - സൈലം

(C) മൂലരോമങ്ങൾ - ഫ്ലോയം- കോശഭിത്തി - കോശസ്തരം - സൈലം

(D) മൂലരോമങ്ങൾ - സൈലം- കോശഭിത്തി - കോശസ്തരം -ഫ്ലോയം

22. ഗ്ലൂക്കോസും ഗ്ലൈക്കോജനും തമ്മിലുള്ള വ്യത്യാസം എന്ത്?

(A) ഗ്ലൂക്കോസ് ധാന്യകത്തിന്റെ ലഘുവായ രൂപമാണ്.

(B) ഗ്ലൈക്കോജൻ ധാന്യകത്തിന്റെ ലഘുവായ രൂപമാണ്.

(C) ഗ്ലൂക്കോസ് ധാന്യകത്തിന്റെ സംഭരണ രൂപമാണ്

(D) ഗ്ലൈക്കോജൻ ധാന്യകത്തിന്റെ സംയുക്ത രൂപമാണ്.

23. കോശശ്വസനം എന്ന പ്രവർത്തനത്തെപ്പറ്റി താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനയിൽ ശരിയായത് ഏത്?

(A) ഗ്ലൂക്കോസിനെ ഓക്സീകരിച്ച് ഊർജ്ജം സ്വതന്ത്രമാക്കുന്നു.

(B) പൈറൂവിക്ക് ആസിഡ് നിർമ്മിക്കപ്പെടുന്നു

(C) ഗ്ലൂക്കോജനെ വിഘടിപ്പിക്കുന്നു.

(D) ഗ്ലൂക്കോസ് നിർമ്മിക്കുന്നു.

24. വാൽമാക്രിയുടേയും മൽസ്യത്തിന്റെയും ശ്വസനാവയവങ്ങൾ തമ്മിലുള്ള സാമ്യം എന്ത്?

(A) ബാഹ്യശകലങ്ങൾ ഉണ്ട്

(B) ശകുല തന്തുക്കൾ ഉണ്ട്

(C) ശകുലങ്ങൾ ഉപയോഗിച്ച് ശ്വസിക്കുന്നു

(D) ശരീരോപരിതലം ശ്വസനപ്രതലമാണ്

25. ദഹനപ്രക്രിയയിൽ പിത്തരസത്തിന്റെ ധർമ്മത്തെക്കുറിക്കുന്ന ഉചിതമായത് താഴെക്കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകളിൽനിന്നും തെരഞ്ഞെടുക്കുക

(A) കൊഴുപ്പിനെ സങ്കീർണ്ണപദാർത്ഥമാക്കി മാറ്റുന്നു

(B) കൊഴുപ്പിനെ സൂക്ഷ്മകണികകളാക്കി മാറ്റുന്നു.

(C) മാംസ്യത്തെ ഊർജ്ജമാക്കി മാറ്റുന്നു

(D) മാംസ്യത്തെ സങ്കീർണ്ണപദാർത്ഥമാക്കി മാറ്റുന്നു.

26. താഴെ കൊടുത്തിരിക്കുന്നവയിൽ ശ്വേതരക്താണുക്കളെ സംബന്ധിച്ച ശരിയായ പ്രസ്താവന ഏത്?

(A) നിശ്ചിത ആകൃതി ഉണ്ട്

(B) ഓക്സിജൻ എത്തിക്കുന്നു

(C) പ്രതിദ്രവം നിർമ്മിക്കുന്നു

(D) രക്തത്തിൽ ഏറ്റവും കൂടുതൽ കാണപ്പെടുന്നു

27. സസ്യത്തിൽ റൂട്ട്പ്രഷറിന്റെ ധർമ്മം വിവരിക്കുന്ന പ്രസ്താവന ഏത്?

(A) കാണ്ഠത്തിൽ ഒരു നിശ്ചിത ഉയരം വരെ ജലം കുറയുന്നതിന് സഹായിക്കുന്നു

(B) ജലം മൂലരോമങ്ങളിൽ പ്രവേശിക്കുന്ന പ്രക്രിയയാണ്

(C) മൂലരോമങ്ങൾ വലിച്ചടുക്കുന്ന ജലം സസ്യത്തിന്റെ ഏറ്റവും മുകളിൽ എത്തുന്നത്

(D) ഇലകളിലേക്ക് ജലം വലിച്ചെടുക്കുന്ന പ്രവർത്തനമാണ്

28. ഒരു ഗ്രാമത്തിൽ മന്തുരോഗമുണ്ടായി. അത് കൂടുതൽ പകരാതിരിക്കാൻ എന്ത് മുൻകരുതൽ എടുക്കാം?

(A) തുറസ്സായ സ്ഥലത്ത് മലമൂത്രവിസർജ്ജനം നടത്താതിരിക്കുക

(B) സ്വീകൃത ആഹാരം എല്ലായ്പ്പോഴും കഴിക്കുക

(C) ഭക്ഷണ പദാർത്ഥങ്ങൾ വൃത്തിയായി സൂക്ഷിക്കുക

(D) കൊതുകുനശീകരണ നടപടികൾ സ്വീകരിക്കുക.

29. ജീവശാസ്ത്രത്തിൽ ദ്വിനാമപദ്ധതിയുടെ സവിശേഷത എന്ത്?

(A) സസ്യലോകവും ജന്തുലോകവുമായി തരംതിരിച്ച് നാമകരണം ചെയ്യുന്ന രീതി

(B) സ്പീഷിസിന്റെയും ജീനസ്സിന്റെയും പേരുചേർത്ത് നാമകരണം ചെയ്യുന്നത്

(C) ജീവജാലങ്ങളെ സാമ്യവ്യത്യാസമനുസരിച്ച് തരംതിരിച്ച് നാമകരണം ചെയ്യുന്നത്

(D) ജീനസ്സിന്റെയും സ്പീഷിസിന്റെയും പേരുചേർത്ത് നാമകരണം ചെയ്യുന്നത്

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30. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിന്റെ ഉപയോഗം വ്യക്തമാക്കുന്ന പ്രസ്താവന തെരഞ്ഞെടുക്കുക

(A) കോശത്തിന്റെ ഏകദേശ ഘടന മനസ്സിലാക്കുവാൻ സഹായിക്കുന്നു.

(B) അതിസൂക്ഷ്മവും സങ്കീർണ്ണവുമായ വസ്തുക്കളെ വ്യക്തമായി കാണാൻ സാധിക്കുന്നു

(C) ജീവൽ പ്രവർത്തനങ്ങൾ കാണാൻ സഹായിക്കുന്നു.

(D) കോശ വിഭജനം കാണാൻ സാധിക്കുന്നു.

31. അന്തർദ്രവ്യജാലികയെ കോശാസ്ഥികൂടം എന്നുപറയാൻ കാരണമെന്ത്?

(A) പദാർത്ഥങ്ങളെ കോശത്തിനുള്ളിലേക്ക് വഹിച്ചുകൊണ്ടുപോകുന്നു.

(B) പ്ലാസ്മാസ്തരം മുതൽ മർമ്മസ്തരം വരെ വ്യാപിച്ചതുകൊണ്ട്

(C) കോശത്തിന് ആകൃതിയും, ദൃഢതയും, ബലവും നൽകുന്നതുകൊണ്ട്

(D) ക്രമരഹിതമായ മടക്കുകൾ ഉള്ളതുകൊണ്ട്

32. താഴെപറയുന്നവയിൽ അവയവ വ്യൂഹത്തിന് ഉദാഹരണം ഏത്?

(A) ഹൃദയം, ധമനികൾ, സിരകൾ, ലോമികകൾ

(B) ശ്വാസകോശം, ശ്വാസനാളം, ശ്വസനികൾ, അന്നനാളം

(C) മസ്തിഷ്കം, സുഷുമ്ന, നാഡികൾ, അസ്ഥികൾ

(D) വായ്, ആമാശയം, വൻകുടൽ, നാസാരന്ധ്രം

33. നാഡീകോശങ്ങളുടെ ഘടനാ സവിശേഷത എന്ത്?

(A) ഉദ്ദീപനങ്ങൾ പ്രക്ഷേപണം ചെയ്യുകയും ആവേഗങ്ങൾ സ്വീകരിക്കുകയും ചെയ്യുന്നു

(B) ഉദ്ദീപനങ്ങളും, ആവേഗങ്ങളും സ്വീകരിക്കുന്നു

(C) ഉദ്ദീപനങ്ങളെ സ്വീകരിച്ചുകൊണ്ട് ആവേഗങ്ങൾ പ്രേക്ഷണം ചെയ്യുന്നു

(D) ആവേഗങ്ങളും ഉദ്ദീപനങ്ങളും പ്രേക്ഷണം ചെയ്യുന്നു

34. കോശപ്രവർത്തനത്തിൽ ഫാഗോസൈറ്റോസിസും പീനോസൈറ്റോസിസും തമ്മിലുള്ള വ്യത്യാസമെന്ത്?

(A) ദ്രാവകകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ആഹാരകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്

(B) ആഹാരകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്.

(C) ആഹാരകണികകളെ വിർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്

(D) ആഹാരകണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്

35. ഒരു കുട്ടിക്ക് മങ്ങിയ വെളിച്ചത്തിൽ കാഴ്ചക്കുറവ് അനുഭവപ്പെടുന്നു. ഇത് കുട്ടിയുടെ ഭക്ഷണത്തിൽ എന്തിന്റെ അപര്യാപ്തതമൂലം ആയിരിക്കാം?

(A) വൈറ്റമിൻ എ (B) അയഡിൻ (C) മാംസ്യം (D) ഇരുമ്പ്

36. മോട്ടോർ അപകടത്തിൽ തലച്ചോറിന് ഗുരുതരമായി ക്ഷതം പറ്റിയ ഒരാൾ അബോധാവസ്തയിൽത്തന്നെ തുടരുന്നു. താഴെപറയുന്ന ഏതാണ് ഏറ്റവും ഉചിതമായ കാരണം?

(A) മരുന്നുകൾ ഫലിക്കാത്തതിനാൽ

(B) നാഡീകോശങ്ങൾക്ക് ക്ഷതം പറ്റിയതുകൊണ്ട്

(C) പുതിയ നാഡീകോശങ്ങൾ ഉണ്ടാകാത്തകാരണം

(D) വിദഗ്ദ്ധചികിത്സ ലഭിക്കാത്തതിനാൽ

37. ക്ഷയരോഗികൾ ചുമച്ചുതുപ്പുമ്പോൾ രക്തം കാണുന്നു. കാരണം എന്ത്?

(A) ഹൃദയത്തിന് രോഗം ബാധിച്ചതുകൊണ്ട്

(B) രക്തക്കുഴലുകൾ പൊട്ടിയതുകൊണ്ട്

(C) ശ്വാസകോശം രോഗബാധിതമായതുകൊണ്ട്

(D) വായിൽ മുറിവുള്ളതുകൊണ്ട്

38. വസൂരിരോഗം ബാധിച്ച രോഗിയെ ശുശ്രൂഷിക്കുന്നത് നേരത്തെ വസൂരിരോഗം ബാധിച്ച ആളായിരുന്നാൽ ശുശ്രൂഷിക്കുന്ന ആൾക്ക് രോഗം ബാധിക്കാൻ സാധ്യത കുറവാണ്, കാരണം എന്ത്?

(A) പൂർണ്ണ ആരോഗ്യം ഉള്ളതുകൊണ്ട്

(B) മുമ്പ് മരുന്ന് കഴിച്ചതുകാരണം

(C) വസൂരിക്കെതിരെ പ്രതിരക്ഷ കിട്ടിയതുകൊണ്ട്

(D) രോഗം പകരുമെന്ന് ഭയം ഇല്ലാത്തതിനാൽ

39. ഗോയിറ്റർ രോഗം ബാധിച്ച ആളുടെ ഭക്ഷണത്തിൽ കടൽമത്സ്യം ഉൾപ്പെടുത്തിയാൽ താഴെ പറയുന്ന് ഏത് പോഷകമാണ് രോഗനിവാരണത്തിന് സഹായിക്കുന്നത്?

(A) സോഡിയം (B) ക്ലോറിൻ (C) അയഡിൻ (D) കാത്സ്യം

40. ഭക്ഷണം കഴിച്ചുകൊണ്ടിരിക്കുമ്പോൾ പൊട്ടിച്ചിരിച്ച കുട്ടി കഠിനമായി ചുമക്കാൻ തുടങ്ങി. കാരണം എന്ത്?

(A) ആഹാരം ശ്വാസനാളത്തിൽ കയറിയതുകൊണ്ട്

(B) ഭക്ഷണം അമിതമായി കഴിച്ചതിനാൽ

(C) ശ്വാസകോശത്തിന് അസുഖം ഉള്ളതുകൊണ്ട്

(D) വായയിൽ ആഹാരം പറ്റിപിടിച്ചതുകാരണം

41. വിദ്യുച്ഛക്തികൊണ്ട് പ്രവർത്തിക്കുന്ന ഇസ്തിരിപ്പെട്ടി ഉപയോഗിക്കുമ്പോൾ പാദരക്ഷകൾ ഉപയോഗിക്കണമെന്ന് പറയുന്നത് എന്തുകൊണ്ട്?

(A) വൈദ്യുതിപ്രവാഹം സുഗമമാക്കാൻ

(B) വൈദ്യുതാഘാതത്തിൽനിന്നും രക്ഷപ്പെടാൻ

(C) ക്രമമായി വൈദ്യുതി പ്രവഹിക്കാൻ

(D) ശരീരത്തിൽക്കൂടിയുള്ള വൈദ്യുതിപ്രവാഹം തടയുന്നതിന്

42. പയർവിത്ത് വെള്ളത്തിലിട്ടാൽ കുറച്ചുസമയം കഴിയുമ്പോൾ കുതിർന്ന് വീർക്കുന്നു. ജലതൻമാത്രകൾ വിത്തിനുള്ളിൽക്കടന്നത് താഴെപറയുന്ന ഏത് പ്രക്രിയ വഴിയാണ്?

(A) ആപാനം (B) അന്തർവ്യാപനം

(C) വ്യതിവ്യാപനം (D) സചേഷ്ടാഗിരണം

43. സുഗന്ധദ്രവ്യങ്ങൾ അടങ്ങിയ കുപ്പി തുറന്നുപിടിച്ചാൽ മുറിയിൽ സുഗന്ധം പരക്കുന്നു. ഈ പ്രവർത്തനം ശാസ്ത്രീയമായി എങ്ങിനെ വിശദീകരിക്കാം?

(A) വ്യതിവ്യാപനം (B) അന്തർവ്യാസം

(C) ആപാനം (D) ആഗിരണം

44. ഛർദ്ദി, അതിസാരം എന്നിവ ഉണ്ടാകുമ്പോൾ ഉപ്പ് ചേർത്ത വെള്ളം കൊടുക്കണമെന്ന് പറയുന്നതെന്തുകൊണ്ട്?

(A) സോഡിയത്തിന്റെ കുറവ് പരിഹരിക്കുന്നു

(B) ഇരുമ്പിന്റെ അംശം നിലനിർത്തുന്നു

(C) എല്ലുകളെ ബലപ്പെടുത്താൻ കാൽസ്യം ലഭിക്കുന്നു

(D) കാഴ്ചശക്തി വർദ്ധിപ്പിക്കുന്നു

45. ഇഡ്ഢലിമാവ് കുഴച്ചത് കുറേസമയം വെച്ചിരുന്നാൽ പുളിക്കുന്നു. ഏത് സൂക്ഷ്മജീവിയുടെ പ്രവർത്തനം മൂലമാണ് പുളിപ്പിക്കൽ നടന്നത്?

(A) ഈസ്റ്റ് (B) ബാക്ടീരിയ (C) വൈറസ് (D) അമീബ

46. കാറപകടത്തിൽപ്പെട്ട ഡ്രൈവർക്ക് നെഞ്ചിൽ കനത്ത ആഘാതം ഉണ്ടായി. എന്നാൽ പരിശോധനയിൽ ശ്വാസകോശത്തിന് കാര്യമായ ക്ഷതം സംഭവിച്ചതായി കണ്ടില്ല. എന്തായിരിക്കും ശ്വാസകോശത്തെ ആഘാതത്തിൽനിന്നും രക്ഷിച്ചത്?

(A) പ്ലൂറദ്രാവകം (B) പെരിക്കാർഡിയൽ ദ്രാവകം

(C) ജലം (D) വായു

47. തനിച്ചുവളരുന്ന വൃക്ഷങ്ങൾ താരതമ്യേന പൊക്കംകുറഞ്ഞും കൂട്ടമായി വളരുന്ന വൃക്ഷങ്ങൾ പൊക്കം കൂടിയും വളരുന്നതായി കാണുന്നു. ഇതിന് കാരണം എന്ത്?

(A) കൂട്ടമായി വളരുന്ന വൃക്ഷങ്ങൾക്ക് സൂര്യപ്രകാശത്തിന്റെ ലഭ്യതകുറവാണ്

(B) ഇടതിങ്ങി വളരുന്ന വൃക്ഷങ്ങൾക്ക് കൂടുതൽ ജലം ലഭിക്കുന്നു

(C) തനിച്ച് വളരുന്ന വൃക്ഷങ്ങൾക്ക് വായുവിന്റെ ലഭ്യതകുറവാണ്

(D) തനിച്ച് വളരുമ്പോൾ വൃക്ഷങ്ങൾക്ക് കൂടുതൽ ഊർപ്പം ലഭിക്കുന്നു

48. കൈക്ക് ഗുരുതരമായി മുറിവുണ്ടായാൽ വൈദ്യശുശ്രൂഷ ലഭിക്കുന്നതുവരെ കൈപൊക്കിപിടിക്കണമെന്ന് പറയുന്നതെന്തുകൊണ്ട്?

(A) രക്തം പെട്ടെന്ന് കട്ടപിടിക്കാൻ (B) രക്തപ്രവാഹം കുറക്കാൻ

(C) വേദന കുറയാൻ (D) രോഗാണുക്കളിൽനിന്നും രക്ഷനേടാൻ

49. ജലസസ്യങ്ങൾ വളർത്തുന്ന ഒരു അക്വേറിയത്തിലെ ജലം ഇടക്കിടെ മാറ്റേണ്ടതില്ല. കാരണമെന്ത്?

(A) ചെടികൾ ജലത്തിൽനിന്ന് കാർബൺഡൈ ഓക്സൈഡ് സ്വീകരിക്കുന്നു

(B) അന്തരീക്ഷത്തിൽനിന്ന് കാർബൺഡൈഓക്സൈഡ് ജലത്തിൽ ലയിക്കുന്നതിനാൽ

(C) ജലം അന്തരീക്ഷ ഓക്സിജനെ ആഗിരണം ചെയ്യുന്നതുകൊണ്ട്

(D) കാർബൺഡൈഓക്സൈഡ് സസ്യങ്ങൾ ജലത്തിലേക്ക് വിടുന്നതിനാൽ

50. മോണയിൽനിന്നും രക്തസ്രാവം ഉണ്ടായ ഒരാളോട് നെല്ലിക്ക, നാരങ്ങ മുതലായ ഭക്ഷണപദാർത്ഥങ്ങൾ കഴിക്കാൻ നിർദ്ദേശിച്ചത് എന്തിന്റെ കുറവ് നികത്താൻവേണ്ടിയാണ്?

(A) വൈറ്റമിൻ എ (B) വൈറ്റമിൻ കെ

(C) വൈറ്റമിൻ സി (D) വൈറ്റമിൻ ഇ

51. താഴെക്കൊടുത്തിരിക്കുന്ന ഏത് പ്രവർത്തനമാണ് ഉപചയത്തിന് ഉദാഹരണം

(A) കാർബൺഡൈഓക്സൈഡും, ജലവും ഉപയോഗിച്ച് ഗ്ലൂക്കോസ് നിർമ്മിക്കുന്നത്

(B) ഗ്ലൂക്കോസിൽനിന്ന് കാർബൺഡൈഓക്സൈഡും ജലവും നിർമ്മിക്കുന്ന പ്രവർത്തനം

(C) സങ്കീർണ്ണ കാർബോഹൈഡ്രേറ്റുകളെ വിഘടിപ്പിച്ച് ഓക്സിജനും ജലവുമായി മാറ്റുന്നത്

(D) കാർബൺഡൈഓക്സൈഡ് ഓക്സിജനുമായി ചേർത്തുള്ള ഗ്ലൂക്കോസ് നിർമ്മാണം

52. രക്തം കട്ടപിടിക്കുന്ന സങ്കീർണ്ണമായ പ്രവർത്തനം താഴെപറയുന്ന ഏത് ശ്രേണിയിൽ പെടുത്താം?

(A) ഫൈബ്രിൻ → ത്രോംബിൻ + രക്താണുക്കൾ

(B) ത്രോംബിൻ → ഫൈബ്രിൻ + രക്താണുക്കൾ

(C) ത്രോംബോസോപ്ലാസ്റ്റിൻ → ഫൈബ്രിനോജൻ + രക്താണുക്കൾ

(D) ഫൈബ്രിനോജൻ → ത്രോംബോപ്ലാസ്റ്റിൻ + രക്താണുക്കൾ

53. കോശങ്ങളിൽ നടക്കുന്ന ശ്വസനം എന്ന പ്രവർത്തനത്തെ എങ്ങിനെ വിശദീകരിക്കാം?

(A) ലഘുവായ പദാർത്ഥങ്ങളെ വിഘടിപ്പിക്കുന്നു

(B) ഓക്സീകരണം വഴി ഊർജ്ജം ഉൽപാദിപ്പിക്കുന്നു

(C) രക്തത്തിൽ വായു കലരുന്നു

(D) ഓക്സിജനും കാർബൺഡൈഓക്സൈഡും വിനിമയം ചെയ്യപ്പെടുന്നു

54. ഒരാളുടെ രക്തം പരിശോധിച്ചപ്പോൾ ശ്വേതരക്താണുക്കളുടെ എണ്ണം ക്രമാതീതമായി വർദ്ധിച്ചതായി കണ്ടു. ഇതിനു കാരണം താഴെപറയുന്ന പ്രസ്താവനകളിൽ ഏതാണ്?

(A) അരുണരക്താണുക്കളുടെ ഉൽപ്പാതനത്തിന് ആനുപാതികമായി ശ്വേതരക്താണുക്കളുടെ എണ്ണം വർദ്ധിച്ചു

(B) അരുണരക്താണുക്കളെ അപേക്ഷിച്ച് ശ്വേതരക്താണുക്കൾക്ക് വലിപ്പം കുറവായതുകൊണ്ട്

(C) ശരീരത്തിൽ കടന്ന രോഗാണുക്കളെ ചെറുക്കാൻ കൂടുതൽ ശ്വേതാണുക്കളുണ്ടായി

(D) മരുന്നുകഴിച്ചപ്പോൾ ശ്വേതരക്താണുക്കളുടെ എണ്ണം കൂടി

55. ജീവികളുടെ ഉപാപചയ പ്രക്രിയ ഒരു സമവാക്യരൂപത്തിൽ താഴെകൊടുത്തിരിക്കുന്നു. അനുയോജ്യമായ വിശദീകരണം തെരഞ്ഞെടുത്തെഴുതുക.

$$C_6H_{12}O_6 + 6O_2 \rightarrow CO_2 + 6H_2O + \text{ഊർജ്ജം}$$

(A) പ്രകാശ സംശ്ലേഷണത്തിൽ അന്നജത്തിന്റെ ഓക്സീകരണഫലമായി ഊർജ്ജം സ്വതന്ത്രമാക്കുന്നു

(B) ഉപചയ പ്രവർത്തനത്തിൽ ഗ്ലൂക്കോസിനെ ഓക്സീകരിച്ച് ഊർജ്ജം നിർമ്മിക്കുന്നു

(C) ശ്വസനസമയത്ത് അന്നജം കാർബൺഡൈഓക്സൈഡായി മാറുകയും ഓക്സിജൻ സ്വതന്ത്രമാകുകയും ചെയ്യുന്നു

(D) കോശശ്വസനസമയത്ത് ഊർജ്ജം ഉൽപ്പാദിപ്പിക്കപ്പെടുന്നു

56. ഒരു ബീക്കറിലെ ജലത്തിൽ ഏതാനും പഞ്ചസാരത്തരികൾ ഇട്ടാൽ ക്രമേണ ഈ തരികൾ ചെറുതാകുകയും അപ്രത്യക്ഷമാകുകയും ചെയ്യുന്നു. ഈ പ്രവർത്തനത്തെ എങ്ങിനെ വിശദീകരിക്കാം?

(A) പഞ്ചസാരയുടേയും ജലത്തിന്റെയും തൻമാത്രകൾ നിറമില്ലാത്തതിനാൽ വേർതിരിച്ചറിയുവാൻ കഴിയുന്നില്ല

(B) പഞ്ചസാരയുടേയും ജലത്തിന്റേയും തൻമാത്രകളുടെ വലിപ്പം ഒരേപോലെ ആയതിനാൽ

(C) ജലതൻമാത്രകൾ പഞ്ചസാരയുടെ തൻമാത്രകളിലേക്ക് പ്രവഹിക്കുന്നു

(D) പഞ്ചസാര തൻമാത്രകൾ ജലതൻമാത്രകൾക്കിടയിൽ ഒരേപോലെ വ്യാപിക്കുന്നു

57. $6CO_2 + 12H_2S \rightarrow C_6H_{12}O_6 + 12S + 6H_2O$ ഈ സൂത്രവാക്യത്തിൽ അടങ്ങിയിരിക്കുന്ന ഏറ്റവും അനുയോജ്യമായ നിഗമനം തെരഞ്ഞെടുത്തെഴുതുക

(A) പ്രകാശസംശ്ലേഷണക ബാക്ടീരിയ ഹൈഡ്രജനും കാർബൺഡൈഓക്സൈഡും, സൗരോർജ്ജവും ചേർത്ത് ആഹാരം നിർമ്മിക്കുന്നു

(B) സസ്യങ്ങൾ കാർബൺഡൈഓക്സൈഡും ഹൈഡ്രജൻ സൾഫൈഡും ഉപയോഗിച്ച് ആഹാരം നിർമ്മിക്കുന്നു

(C) ഹരിത സസ്യങ്ങൾ സൗരോർജ്ജത്തിന്റെ സാനിധ്യത്തിൽ ഹൈഡ്രജൻ സൾഫൈഡും, കാർബൺഡൈഓക്സൈഡും സംയോജിപ്പിച്ച് ആഹാരം പാകം ചെയ്യുന്നു.

(D) സൂര്യപ്രകാശത്തിന്റെ സാനിധ്യത്തിൽ ബാക്ടീരിയ ഹൈഡ്രജൻ സൾഫൈഡിനെ വിഘടിപ്പിച്ച് സൾഫർ ഉൽപ്പാദിപ്പിക്കുന്നു

58. പാൽ, കരൾ, മുട്ടയുടെ മഞ്ഞക്കരു, പച്ചിലക്കറികൾ എന്നിവ ആഹാരത്തിൽ ഉൾപ്പെടുത്തിയിട്ടും ഒരാളുടെ ത്വക്കിലെ ശൽക്കങ്ങൾ അതേപടി കാണപ്പെട്ടു. പ്രതിവിധിയായി താഴെപറയുന്ന ഏത് പോഷകപദാർത്ഥം നിർദ്ദേശിക്കണം?

(A) നിയാസിൻ (B) തയിമിൻ

(C) റൈബോഫ്ളേവിൻ (D) ഫോളിക് ആസിഡ്

59. റൂട്ട് പ്രഷർ, സക്ഷൻബലം, സംസക്തിബലം, ഒട്ടിച്ചേരൽബലം എന്നീ പ്രവർത്തനങ്ങൾ സസ്യങ്ങളെ എങ്ങിനെ സഹായിക്കുന്നു?

(A) ജലസംവഹത്തിന് (B) പ്രകാശ സംശ്ലേഷണത്തിന്

(C) കോശസ്വസനത്തിന് (D) വ്യതിവ്യാപനത്തിന്

60. ഒരു രാസസംയുക്തത്തിൽ ഹൈഡ്രജനും ഓക്സിജനും തമ്മിലുള്ള അനുപാതം ജലത്തിലേതുപോലെ 2:1 ആണ്. ഇതിൽ 6 കാർബൺ ആറ്റങ്ങളും 12 ഹൈഡ്രജൻ ആറ്റങ്ങളും 6 ഓക്സിജൻ ആറ്റങ്ങളും ഉണ്ട്. ഇതിൽനിന്നും താഴെപറയുന്ന ഏത് പ്രസ്താവനയാണ് ഏറ്റവും അനുയോജ്യമായത്?

(A) ഇത് ഒരു ഹൈഡ്രോകാർബൺ ആണ്

(B) ഇത് $C_2H_{12}O_6$ എന്ന ധാന്യകമാണ്

(C) ഇതിൽ 6 ജലതൻമാത്രകളുണ്ട്

(D) ഇത് ഒരു അമിനോ അമ്ലമാണ്

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Appendix IV A

UNIVERSITY OF CALICUT
DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY
RESPONSE SHEET (Draft)

വിദ്യാർത്ഥിയുടെ പേര് ..... വയസ് .....

ക്ലാസ് ..... ക്ലാസ് നമ്പർ ..... ആൺകുട്ടി/പെൺകുട്ടി

Sl നമ്പർ					Sl നമ്പർ					Sl നമ്പർ				
1	A	B	C	D	21	A	B	C	D	41	A	B	C	D
2	A	B	C	D	22	A	B	C	D	42	A	B	C	D
3	A	B	C	D	23	A	B	C	D	43	A	B	C	D
4	A	B	C	D	24	A	B	C	D	44	A	B	C	D
5	A	B	C	D	25	A	B	C	D	45	A	B	C	D
6	A	B	C	D	26	A	B	C	D	46	A	B	C	D
7	A	B	C	D	27	A	B	C	D	47	A	B	C	D
8	A	B	C	D	28	A	B	C	D	48	A	B	C	D
9	A	B	C	D	29	A	B	C	D	49	A	B	C	D
10	A	B	C	D	30	A	B	C	D	50	A	B	C	D
11	A	B	C	D	31	A	B	C	D	51	A	B	C	D
12	A	B	C	D	32	A	B	C	D	52	A	B	C	D
13	A	B	C	D	33	A	B	C	D	53	A	B	C	D
14	A	B	C	D	34	A	B	C	D	54	A	B	C	D
15	A	B	C	D	35	A	B	C	D	55	A	B	C	D
16	A	B	C	D	36	A	B	C	D	56	A	B	C	D
17	A	B	C	D	37	A	B	C	D	57	A	B	C	D
18	A	B	C	D	38	A	B	C	D	58	A	B	C	D
19	A	B	C	D	39	A	B	C	D	59	A	B	C	D
20	A	B	C	D	40	A	B	C	D	60	A	B	C	D

Appendix IV B

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION
ACHIEVEMENT TEST IN BIOLOGY(Final)
FOR SECONDARY SCHOOL PUPILS

HASSAN KOYA. M. P

നിർദ്ദേശങ്ങൾ

1. ഇത് ഒരു ബയോളജി ടെസ്റ്റാണ്. ഉത്തരങ്ങൾ അടയാളപ്പെടുത്തുന്നതിന് വേറെ കടലാസ് തന്നിട്ടുണ്ട്. ചോദ്യക്കടലാസിൽ ഒന്നും എഴുതുകയോ വരക്കുകയോ ചെയ്യരുത്.

2. എല്ലാ ചോദ്യങ്ങൾക്കും എ, ബി, സി, ഡി എന്നീ അക്ഷരങ്ങൾ ഇട്ട് നാല് ഉത്തരങ്ങൾ വീതം കൊടുത്തിരിക്കുന്നു. അവയിൽ ഒന്നുമാത്രമാണ് ശരി. ഉത്തരക്കടലാസിൽ ഓരോ ചോദ്യനമ്പറിനുമെതിരെ എ, ബി, സി, ഡി എന്ന് രേഖപ്പെടുത്തിയിരിക്കുന്നു. ഓരോ ചോദ്യത്തിനും ശരിയായ ഉത്തരം കണ്ടുപിടിക്കുക. അതിനുശേഷം ഇത്തരക്കടലാസിൽ ചോദ്യനമ്പറിനുനേരെ ശരിയുത്തരത്തെക്കുറിക്കുന്ന അക്ഷരത്തിൽ X അടയാളം ഇടുക.

3. നിങ്ങൾ ആദ്യം അടയാളപ്പെടുത്തിയ X ചിഹ്നം തെറ്റായ സ്ഥാനത്താണെങ്കിൽ സ്ഥാനം മാറ്റുന്നതിന് അതിനു ചുറ്റും ഒരു ചെറിയ സമചതുരം (□) വരക്കുകയും ശരിയായ സ്ഥാനത്ത് ചിഹ്നം ഇടുകയും ചെയ്യുക.

4. എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം അടയാളപ്പെടുത്താൻ ശ്രദ്ധിക്കുക.

5. പരിശോധകൻ സ്റ്റാർട്ട് എന്നുപറയുമ്പോൾ ഉത്തരം അടയാളപ്പെടുത്താൻ ആരംഭിക്കുക.

മാതൃക

ഒരാവാസ വ്യവസ്ഥയിലെ ഊർജ്ജത്തിന്റെ പ്രാഥമിക ഉറവിടമേത്?

(A) വായു (B) സൂര്യപ്രകാശം (C) ജലം (D) മണ്ണ്

Q. No. 1. A **X** C D

1. പാരമ്പര്യ സ്വഭാവത്തെക്കുറിച്ചു പഠിക്കുന്ന ശാസ്ത്രശാഖയുടെ പേരെന്ത്?
   (A) ജീവശാസ്ത്രം (B) ജന്തുശാസ്ത്രം
   (C) സസ്യശാസ്ത്രം (D) ജനിതകശാസ്ത്രം

2. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിൽക്കൂടി വസ്തുക്കളെ വലുതാക്കി കാണിക്കുന്ന ഭാഗം ഏത്?
   (A) ഇലക്ട്രോൺ കിരണാവലി (B) വൈദ്യുതകാന്തങ്ങൾ
   (C) ലെൻസുകൾ (D) പ്രകാശരശ്മികൾ

3. ഒരേ ഘടനയും ധർമ്മവുമുള്ള കോശങ്ങളുടെ കൂട്ടത്തെ എന്ത് പേരിൽ അറിയപ്പെടുന്നു?
   (A) അവയവം (B) അവയവവ്യൂഹം
   (C) കല (D) കോശസമൂഹം

4. ചെറിയ തൻമാത്രകളെ മാത്രം കടത്തിവിടാൻ കഴിയുന്ന സ്തരങ്ങളെ എന്ത് പേർ വിളിക്കുന്നു?
   (A) അതാര്യ സ്തരങ്ങൾ (B) അർദ്ധതാര്യസ്തരങ്ങൾ
   (C) താര്യസ്തരങ്ങൾ (D) വർണ്ണതാര്യസ്തരങ്ങൾ

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5. ജീവിവർഗ്ഗങ്ങളിൽ ഓക്സിജന്റെ അഭാവത്തിൽ നടക്കുന്ന ഗ്ലൂക്കോസ് വിഘടനത്തിന്റെ പേരെന്ത്?

(A) ഉപചയം (B) കിണ്വാനം

(C) അപചയം (D) ശ്വസനം

6. ഷഡ്പദങ്ങളുടെ ശ്വസനാവയവം ഏത്?

(A) ശ്വാസകോശം (B) ശ്വസനരന്ധ്രങ്ങൾ

(C) ശ്വസനികൾ (D) ശ്വസനനാളികൾ

7. ജന്തുക്കൾ ആഹാരത്തിനുവേണ്ടി സസ്യങ്ങളെ ആശ്രയിക്കുന്ന പ്രക്രിയയുടെ പേരെന്ത്?

(A) സ്വപോഷണം (B) പരപോഷണം

(C) പരജീവനം (D) പരോപജീവനം

8. ജീവികൾ ആവിർഭവിക്കുന്ന പ്രതിഭാസത്തെ എന്തുപറയുന്നു?

(A) ജീവൽപ്രവർത്തനം (B) ജീവശാസ്ത്രം

(C) ജീവപരിണാമം (D) ജീവസന്ധാരണം

9. ഒരു ജീവകോശത്തിൽ മാംസ്യങ്ങൾ നിർമ്മിക്കുന്ന ഭാഗത്തിന്റെ പേരെന്ത്?

(A) റൈബോസോം (B) ലൈസോസോം

(C) സെൻട്രോസോം (D) ക്രോമസോം

10. കോശശ്വസനത്തിന്റെ പ്രവർത്തനം ആദ്യമായി വിശദീകരിച്ച ജൈവരസതന്ത്രജ്ഞനാര്?

(A) ന്യൂട്ടൻ (B) അഡോൾഫ് ക്രെബ്സ്

(C) ഗലീലിയോ (D) ഷാൻ

11. അരുണ രക്താണുക്കൾക്ക് ചുവപ്പുനിറം നൽകാൻ സഹായിക്കുന്ന വസ്തു ഏത്?

(A) പ്ലാസ്മ (B) അൽബുമിൻ

(C) പ്ലേറ്റ്ലറ്റുകൾ (D) ഹീമോഗ്ലോബിൻ

12. പല്ലുകൾക്ക് ബലം കുറയുന്നത് താഴെപറയുന്ന ഏത് പോഷക പദാർത്ഥത്തിന്റെ അഭാവം മൂലമാണ്?

(A) സോഡിയം (B) കാത്സ്യം

(C) അയഡിൻ (D) പൊട്ടാസ്യം

13. രക്തത്തെ കല എന്നുപറയാൻ കാരണമെന്ത്?

(A) രക്തത്തിന്റെ പ്ലാസ്മയിൽ ലവണങ്ങൾ, അമിനോ ആസിഡുകൾ എന്നിവ അടങ്ങിയിട്ടുള്ളതുകൊണ്ട്.

(B) വിവിധ ഇനം രക്തകോശങ്ങൾ അടങ്ങിയിരിക്കുകയാണെങ്കിലും രക്തം ഒരേ ധർമ്മം നിർവ്വഹിക്കുന്നതുകൊണ്ട്.

(C) രക്തം ഹോർമോണുകളെ ശരീരത്തിന്റെ വിവിധ ഭാഗങ്ങളിൽ എത്തിക്കുന്നതുകൊണ്ട്.

(D) കലകൾക്ക് ആവശ്യമായ പദാർത്ഥങ്ങൾ ശരീരത്തിന്റെ എല്ലാ ഭാഗത്തും എത്തിക്കുന്നതുകൊണ്ട്.

14. തരുണാസ്ഥികൾ വഴങ്ങുന്ന സ്വഭാവമുള്ളതാകുവാൻ കാരണം അവയിൽ കോശാന്തരസ്ഥലങ്ങൾ

(A) എണ്ണത്തിൽ വളരെ കുറവായതുകൊണ്ട്

(B) ജല്ലിപോലുള്ള പദാർത്ഥം ഉൾക്കൊള്ളുന്നതുകൊണ്ട്

(C) വായുനിറഞ്ഞവയായതുകൊണ്ട്

(D) എണ്ണത്തിൽ വളരെ കൂടുതലായതുകൊണ്ട്

15. ഗ്ലൂക്കോസും ഗ്ലൈക്കോജനും തമ്മിലുള്ള വ്യത്യാസം എന്ത്?

(A) ഗ്ലൂക്കോസ് ധാന്യകത്തിന്റെ ലഘുവായ രൂപമാണ്.

(B) ഗ്ലൈക്കോജൻ ധാന്യകത്തിന്റെ ലഘുവായ രൂപമാണ്.

(C) ഗ്ലൂക്കോസ് ധാന്യകത്തിന്റെ സംഭരണ രൂപമാണ്.

(D) ഗ്ലൈക്കോജൻ ധാന്യകത്തിന്റെ സംയുക്ത രൂപമാണ്.

16. കോശശ്വസനം എന്ന പ്രവർത്തനത്തെപ്പറ്റി താഴെ കൊടുത്തിരിക്കുന്ന പ്രസ്താവനയിൽ ശരിയായത് ഏത്?

(A) ഗ്ലൂക്കോസിനെ ഓക്സീകരിച്ച് ഊർജ്ജം സ്വതന്ത്രമാക്കുന്നു.

(B) പൈറൂവിക്ക് ആസിഡ് നിർമ്മിക്കപ്പെടുന്നു

(C) ഗ്ലൂക്കോജനെ വിഘടിപ്പിക്കുന്നു.

(D) ഗ്ലൂക്കോസ് നിർമ്മിക്കുന്നു.

17. ദഹനപ്രക്രിയയിൽ പിത്തരസത്തിന്റെ ധർമ്മത്തെക്കുറിക്കുന്ന ഉചിതമായത് താഴെക്കൊടുത്തിരിക്കുന്ന പ്രസ്താവനകളിൽനിന്നും തെരഞ്ഞെടുക്കുക

(A) കൊഴുപ്പിനെ സങ്കീർണ്ണപദാർത്ഥമാക്കി മാറ്റുന്നു

(B) കൊഴുപ്പിനെ സൂക്ഷ്മകണികകളാക്കി മാറ്റുന്നു.

(C) മാംസ്യത്തെ ഊർജ്ജമാക്കി മാറ്റുന്നു

(D) മാംസ്യത്തെ സങ്കീർണ്ണപദാർത്ഥമാക്കി മാറ്റുന്നു.

18. താഴെ കൊടുത്തിരിക്കുന്നവയിൽ ശ്വേതരക്താണുക്കളെ സംബന്ധിച്ച ശരിയായ പ്രസ്താവന ഏത്?

(A) നിശ്ചിത ആകൃതി ഉണ്ട്

(B) ഓക്സിജൻ എത്തിക്കുന്നു

(C) പ്രതിദ്രവം നിർമ്മിക്കുന്നു

(D) രക്തത്തിൽ ഏറ്റവും കൂടുതൽ കാണപ്പെടുന്നു

19. ഒരു ഗ്രാമത്തിൽ മന്ത്രുരോഗമുണ്ടായി. അത് കൂടുതൽ പകരാതിരിക്കാൻ എന്ത് മുൻകരുതൽ എടുക്കാം?

(A) തുറസ്സായ സ്ഥലത്ത് മലമൂത്രവിസർജ്ജനം നടത്താതിരിക്കുക

(B) സംസ്കൃത ആഹാരം എല്ലായ്പ്പോഴും കഴിക്കുക

(C) ഭക്ഷണ പദാർത്ഥങ്ങൾ വൃത്തിയായി സൂക്ഷിക്കുക

(D) കൊതുകുനശീകരണ നടപടികൾ സ്വീകരിക്കുക.

20. ജീവശാസ്ത്രത്തിൽ ദ്വിനാമപദ്ധതിയുടെ സവിശേഷത എന്ത്?

(A) സസ്യലോകവും ജന്തുലോകവുമായി തരംതിരിച്ച് നാമകരണം ചെയ്യുന്ന രീതി

(B) സ്പീഷിസിന്റെയും ജീനസ്സിന്റെയും പേരുചേർത്ത് നാമകരണം ചെയ്യുന്നത്

(C) ജീവജാലങ്ങളെ സാമ്യവ്യത്യാസമനുസരിച്ച് തരംതിരിച്ച് നാമകരണം ചെയ്യുന്നത്

(D) ജീനസ്സിന്റെയും സ്പീഷിസിന്റെയും പേരുചേർത്ത് നാമകരണം ചെയ്യുന്നത്

21. ഇലക്ട്രോൺ മൈക്രോസ്കോപ്പിന്റെ ഉപയോഗം വ്യക്തമാക്കുന്ന പ്രസ്താവന തെരഞ്ഞെടുക്കുക

(A) കോശത്തിന്റെ ഏകദേശ ഘടന മനസ്സിലാക്കുവാൻ സഹായിക്കുന്നു.

(B) അതിസൂക്ഷ്മവും സങ്കീർണ്ണവുമായ വസ്തുക്കളെ വ്യക്തമായി കാണാൻ സാധിക്കുന്നു

(C) ജീവൽ പ്രവർത്തനങ്ങൾ കാണാൻ സഹായിക്കുന്നു.

(D) കോശ വിഭജനം കാണാൻ സാധിക്കുന്നു.

22. അന്തർദ്രവ്യജാലികയെ കോശാസ്ഥികൂടം എന്നുപറയാൻ കാരണമെന്ത്?

(A) പദാർത്ഥങ്ങളെ കോശത്തിനുള്ളിലേക്ക് വഹിച്ചുകൊണ്ടുപോകുന്നു.

(B) പ്ലാസ്മാസ്തരം മുതൽ മർമ്മസ്തരം വരെ വ്യാപിച്ചതുകൊണ്ട്

(C) കോശത്തിന് ആകൃതിയും, ദൃഢതയും, ബലവും നൽകുന്നതുകൊണ്ട്

(D) ക്രമരഹിതമായ മടക്കുകൾ ഉള്ളതുകൊണ്ട്

23. താഴെപറയുന്നവയിൽ അവയവ വ്യൂഹത്തിന് ഉദാഹരണം ഏത്?

(A) ഹൃദയം, ധമനികൾ, സിരകൾ, ലോമികകൾ

(B) ശ്വാസകോശം, ശ്വാസനാളം, ശ്വസനികൾ, അന്നനാളം

(C) മസ്തിഷ്കം, സുഷുമ്ന, നാഡികൾ, അസ്ഥികൾ

(D) വായ്, ആമാശയം, വൻകുടൽ, നാസാരന്ധ്രം

24. കോശപ്രവർത്തനത്തിൽ ഫാഗോസൈറ്റോസിസും പീനോസൈറ്റോസിസും തമ്മിലുള്ള വ്യത്യാസമെന്ത്?

(A) ദ്രാവകകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ആഹാരകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്

(B) ആഹാരകണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ ഉള്ളിലാക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്.

(C) ആഹാരകണികകളെ വിർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്

(D) ആഹാരകണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് പീനോസൈറ്റോസിസ്, ദ്രാവക കണികകളെ വിസർജ്ജിക്കുന്ന പ്രവർത്തനമാണ് ഫാഗോസൈറ്റോസിസ്

25. ഒരു കുട്ടിക്ക് മങ്ങിയ വെളിച്ചത്തിൽ കാഴ്ചക്കുറവ് അനുഭവപ്പെടുന്നു. ഇത് കുട്ടിയുടെ ഭക്ഷണത്തിൽ എന്തിന്റെ അപര്യാപ്തതമൂലം ആയിരിക്കാം?

(A) വൈറ്റമിൻ എ (B) അയഡിൻ (C) മാംസ്യം (D) ഇരുമ്പ്

26. ക്ഷയരോഗികൾ ചുമച്ചുതുപ്പുമ്പോൾ രക്തം കാണുന്നു. കാരണം എന്ത്?

(A) ഹൃദയത്തിന് രോഗം ബാധിച്ചതുകൊണ്ട്

(B) രക്തക്കുഴലുകൾ പൊട്ടിയതുകൊണ്ട്

(C) ശ്വാസകോശം രോഗബാധിതമായതുകൊണ്ട്

(D) വായിൽ മുറിവുള്ളതുകൊണ്ട്

27. വസൂരിരോഗം ബാധിച്ച രോഗിയെ ശുശ്രൂഷിക്കുന്നത് നേരത്തെ വസൂരിരോഗം ബാധിച്ച ആളായിരുന്നാൽ ശുശ്രൂഷിക്കുന്ന ആൾക്ക് രോഗം ബാധിക്കാൻ സ്ധ്യത കുറവാണ്, കാരണം എന്ത്?

(A) പൂർണ്ണ ആരോഗ്യം ഉള്ളതുകൊണ്ട്

(B) മുമ്പ് മരുന്ന് കഴിച്ചതുകാരണം

(C) വസൂരിക്കെതിരെ പ്രതിരക്ഷ കിട്ടിയതുകൊണ്ട്

(D) രോഗം പകരുമെന്ന് ഭയം ഇല്ലാത്തതിനാൽ

28. ഗോയിറ്റർ രോഗം ബാധിച്ച ആളുടെ ഭക്ഷണത്തിൽ കടൽമത്സ്യം ഉൾപ്പെടുത്തിയാൽ താഴെ പറയുന്ന് ഏത് പോഷകമാണ് രോഗനിവാരണത്തിന് സഹായിക്കുന്നത്?

(A) സോഡിയം (B) ക്ലോറിൻ (C) അയഡിൻ (D) കാത്സ്യം

29. ഭക്ഷണം കഴിച്ചുകൊണ്ടിരിക്കുമ്പോൾ പൊട്ടിച്ചിരിച്ച കുട്ടി കഠിനമായി ചുമക്കാൻ തുടങ്ങി. കാരണം

എന്ത്?

(A) ആഹാരം ശ്വാസനാളത്തിൽ കയറിയതുകൊണ്ട്

(B) ഭക്ഷണം അമിതമായി കഴിച്ചതിനാൽ

(C) ശ്വാസകോശത്തിന് അസുഖം ഉള്ളതുകൊണ്ട്

(D) വായയിൽ ആഹാരം പറ്റിപിടിച്ചതുകാരണം

30. ഇഡ്ഡലിമാവ് കുഴച്ച് കുറേസമയം വെച്ചിരുന്നാൽ പുളിക്കുന്നു. ഏത് സൂക്ഷ്മജീവിയുടെ പ്രവർത്തനം മൂലമാണ് പുളിപ്പിക്കൽ നടന്നത്?

(A) ഈസ്റ്റ് (B) ബാക്ടീരിയ (C) വൈറസ് (D) അമീബ

31. കാറപകടത്തിൽപ്പെട്ട ഡ്രൈവർക്ക് നെഞ്ചിൽ കനത്ത ആഘാതം ഉണ്ടായി. എന്നാൽ പരിശോധനയിൽ ശ്വാസകോശത്തിന് കാര്യമായ ക്ഷതം സംഭവിച്ചതായി കണ്ടില്ല. എന്തായിരിക്കും ശ്വാസകോശത്തെ ആഘാതത്തിൽനിന്നും രക്ഷിച്ചത്?

(A) പ്ലൂറദ്രാവകം (B) പെരിക്കാർഡിയൽ ദ്രാവകം

(C) ജലം (D) വായു

32. കൈക്ക് ഗുരുതരമായി മുറിവുണ്ടായാൽ വൈദ്യശുശ്രൂഷ ലഭിക്കുന്നതുവരെ കൈപൊക്കിപിടിക്കണമെന്ന് പറയുന്നതെന്തുകൊണ്ട്?

(A) രക്തം പെട്ടെന്ന് കട്ടപിടിക്കാൻ (B) രക്തപ്രവാഹം കുറക്കാൻ

(C) വേദന കുറയാൻ (D) രോഗാണുക്കളിൽനിന്നും രക്ഷനേടാൻ

33. ജലസസ്യങ്ങൾ വളർത്തുന്ന ഒരു അക്വേറിയത്തിലെ ജലം ഇടക്കിടെ മാറ്റേണ്ടതില്ല. കാരണമെന്ത്?

(A) ചെടികൾ ജലത്തിൽനിന്ന് കാർബൺഡൈ ഓക്സൈഡ് സ്വീകരിക്കുന്നു

(B) അന്തരീക്ഷത്തിൽനിന്ന് കാർബൺഡൈഓക്സൈഡ് ജലത്തിൽ ലയിക്കുന്നതിനാൽ

(C) ജലം അന്തരീക്ഷ ഓക്സിജനെ ആഗിരണം ചെയ്യുന്നതുകൊണ്ട്

(D) കാർബൺഡൈഓക്സൈഡ് സസ്യങ്ങൾ ജലത്തിലേക്ക് വിടുന്നതിനാൽ

34. മോണയിൽനിന്നും രക്തസ്രാവം ഉണ്ടായ ഒരാളോട് നെല്ലിക്ക, നാരങ്ങ മുതലായ ഭക്ഷണപദാർത്ഥങ്ങൾ കഴിക്കാൻ നിർദ്ദേശിച്ചത് എന്തിന്റെ കുറവ് നികത്താൻവേണ്ടിയാണ്?

(A) വൈറ്റമിൻ എ (B) വൈറ്റമിൻ കെ

(C) വൈറ്റമിൻ സി (D) വൈറ്റമിൻ ഇ

35. കോശങ്ങളിൽ നടക്കുന്ന ശ്വസനം എന്ന പ്രവർത്തനത്തെ എങ്ങിനെ വിശദീകരിക്കാം?

(A) ലഘുവായ പദാർത്ഥങ്ങളെ വിഘടിപ്പിക്കുന്നു

(B) ഓക്സീകരണം വഴി ഊർജ്ജം ഉൽപാദിപ്പിക്കുന്നു

(C) രക്തത്തിൽ വായു കലരുന്നു

(D) ഓക്സിജനും കാർബൺഡൈഓക്സൈഡും വിനിമയം ചെയ്യപ്പെടുന്നു

36. ഒരാളുടെ രക്തം പരിശോധിച്ചപ്പോൾ ശ്വേതരക്താണുക്കളുടെ എണ്ണം ക്രമാതീതമായി വർദ്ധിച്ചതായി കണ്ടു. ഇതിനു കാരണം താഴെപറയുന്ന പ്രസ്താവനകളിൽ ഏതാണ്?

(A) അരുണരക്താണുക്കളുടെ ഉൽപ്പാതനത്തിന് ആനുപാതികമായി ശ്വേതരക്താണുക്കളുടെ എണ്ണം വർദ്ധിച്ചു

(B) അരുണരക്താണുക്കളെ അപേക്ഷിച്ച് ശ്വേതരക്താണുക്കൾക്ക് വലിപ്പം കുറവായതുകൊണ്ട്

(C) ശരീരത്തിൽ കടന്ന രോഗാണുക്കളെ ചെറുക്കാൻ കൂടുതൽ ശ്വേതാണുക്കളുണ്ടായി

(D) മരുന്നുകഴിച്ചപ്പോൾ ശ്വേതരക്താണുക്കളുടെ എണ്ണം കൂടി

37. ഒരു ബീക്കറിലെ ജലത്തിൽ ഏതാനും പഞ്ചസാരത്തരികൾ ഇട്ടാൽ ക്രമേണ ഈ തരികൾ ചെറുതാകുകയും അപ്രത്യക്ഷമാകുകയും ചെയ്യുന്നു. ഈ പ്രവർത്തനത്തെ എങ്ങിനെ വിശദീകരിക്കാം?

(A) പഞ്ചസാരയുടേയും ജലത്തിന്റെയും തൻമാത്രകൾ നിറമില്ലാത്തതിനാൽ വേർതിരിച്ചറിയുവാൻ കഴിയുന്നില്ല

(B) പഞ്ചസാരയുടേയും ജലത്തിന്റേയും തൻമാത്രകളുടെ വലിപ്പം ഒരേപോലെ ആയതിനാൽ

(C) ജലതൻമാത്രകൾ പഞ്ചസാരയുടെ തൻമാത്രകളിലേക്ക് പ്രവഹിക്കുന്നു

(D) പഞ്ചസാര തൻമാത്രകൾ ജലതൻമാത്രകൾക്കിടയിൽ ഒരേപോലെ വ്യാപിക്കുന്നു

38. $6CO_2 + 12H_2S \rightarrow C_6H_{12}O_6 + 12S + 6H_2O$ ഈ സൂത്രവാക്യത്തിൽ അടങ്ങിയിരിക്കുന്ന ഏറ്റവും അനുയോജ്യമായ നിഗമനം തെരഞ്ഞെടുത്തെഴുതുക

(A) പ്രകാശസംശ്ലേഷണക ബാക്ടീരിയ ഹൈഡ്രജനും കാർബൺഡൈഓക്സൈഡും, സൗരോർജ്ജവും ചേർത്ത് ആഹാരം നിർമ്മിക്കുന്നു

(B) സസ്യങ്ങൾ കാർബൺഡൈഓക്സൈഡും ഹൈഡ്രജൻ സൾഫൈഡും ഉപയോഗിച്ച് ആഹാരം നിർമ്മിക്കുന്നു

(C) ഹരിത സസ്യങ്ങൾ സൗരോർജ്ജത്തിന്റെ സാന്നിധ്യത്തിൽ ഹൈഡ്രജൻ സൾഫൈഡും, കാർബൺഡൈഓക്സൈഡും സംയോജിപ്പിച്ച് ആഹാരം പാകം ചെയ്യുന്നു.

(D) സൂര്യപ്രകാശത്തിന്റെ സാന്നിധ്യത്തിൽ ബാക്ടീരിയ ഹൈഡ്രജൻ സൾഫൈഡിനെ വിഘടിപ്പിച്ച് സൾഫർ ഉൽപ്പാദിപ്പിക്കുന്നു

39. റൂട്ട് പ്രഷർ, സക്ഷൻബലം, സംസക്തിബലം, ഒട്ടിച്ചേരൽബലം എന്നീ പ്രവർത്തനങ്ങൾ സസ്യങ്ങളെ എങ്ങിനെ സഹായിക്കുന്നു?

(A) ജലസംവഹത്തിന് (B) പ്രകാശ സംശ്ലേഷണത്തിന്

(C) കോശസ്വസനത്തിന് (D) വ്യതിവ്യാപനത്തിന്

40. ഒരു രാസസംയുക്തത്തിൽ ഹൈഡ്രജനും ഓക്സിജനും തമ്മിലുള്ള അനുപാതം ജലത്തിലേതുപോലെ 2:1 ആണ്. ഇതിൽ 6 കാർബൺ ആറ്റങ്ങളും 12 ഹൈഡ്രജൻ ആറ്റങ്ങളും 6 ഓക്സിജൻ ആറ്റങ്ങളും ഉണ്ട്. ഇതിൽനിന്നും താഴെപറയുന്ന ഏത് പ്രസ്താവനയാണ് ഏറ്റവും അനുയോജ്യമായത്?

(A) ഇത് ഒരു ഹൈഡ്രോകാർബൺ ആണ്

(B) ഇത് $C_2H_{12}O_6$ എന്ന ധാന്യകമാണ്

(C) ഇതിൽ 6 ജലതൻമാത്രകളുണ്ട്

(D) ഇത് ഒരു അമിനോ അമ്ലമാണ്

UNIVERSITY OF CALICUT
ACHIEVEMENT TEST IN BIOLOGY

RESPONSE SHEET (FINAL)

വിദ്യാർത്ഥിയുടെ പേര് .....ക്ലാസ്.....ക്ലാസ് നമ്പർ.....

സ്കൂളിന്റെ പേര് .....ആൺകുട്ടി/പെൺകുട്ടി

Sl. No.					Sl. No.				
1	A	B	C	D	21	A	B	C	D
2	A	B	C	D	22	A	B	C	D
3	A	B	C	D	23	A	B	C	D
4	A	B	C	D	24	A	B	C	D
5	A	B	C	D	25	A	B	C	D
6	A	B	C	D	26	A	B	C	D
7	A	B	C	D	27	A	B	C	D
8	A	B	C	D	28	A	B	C	D
9	A	B	C	D	29	A	B	C	D
10	A	B	C	D	30	A	B	C	D
11	A	B	C	D	31	A	B	C	D
12	A	B	C	D	32	A	B	C	D
13	A	B	C	D	33	A	B	C	D
14	A	B	C	D	34	A	B	C	D
15	A	B	C	D	35	A	B	C	D
16	A	B	C	D	36	A	B	C	D
17	A	B	C	D	37	A	B	C	D
18	A	B	C	D	38	A	B	C	D
19	A	B	C	D	39	A	B	C	D
20	A	B	C	D	40	A	B	C	D

Appendix IV D

UNIVERSITY OF CALICUT

DEPARTMENT OF EDUCATION

ACHIEVEMENT TEST IN BIOLOGY (FINAL) FOR SECONDARY SCHOOL PUPILS

Hassan Koya. M. P

Time: 40 mts

Instructions:

1. This is a test in Biology. Separate Response sheet is provided for making answers. Do not write anything in the question paper.
2. For each question four answers are given marked by A, B, C and D of which only one answer is correct. Find the correct answer to each question. Then mark it in the answer sheet, against the particular question number, by putting an 'X' mark on the letter denoting the correct answer.
3. To change the first marking at a wrong place, draw a small ([ ]) around the first marking and put another mark on the correct place.
4. Begin to answer when the invigilator say 'Start'.

Example:

Which is the primary source of energy in an ecosystem?

A. Air B. Sunlight C. Water D. Earth

Marking the answer Q. No. 1

A	X	C	D

1. Name the Branch of science dealing with hereditory characteristics.

   A. Biology B. Zoology C. Botany D. Genetics

2. Which part of the electronmicroscope magnifies the objects?

   A. Beam of electron B. Electromagnets C. Lens
   D. Light rays

3. Name the group of cells having similar structure and function?

   A. Organ B. Organ system C. Tissue D. Cluster of cells

4. Name the membrane through which only smaller molecules are allowed to pass through

   A. Impermeable membrane B. Semipermeable membrane
   C. Permeable membrane D. Selectively permeable membrane

5. Name the process of breaking down of glucose in the absence of oxygen

   A. Anabolism B. Fermentation C. Catabolism D. Respiration

6. Which is the respiratory organ in insects?

   A. Lungs B. Spiracles C. Branchioles D. Tracheae

7. What is the phenomena where animals depend on plants for their food?

   A. Autotrophism B. Heterotrophism
   C. Epiphytism D. Symbiosis

8. Give the name of the process of the origin of organisms

   A. Life processes B. Biology C. Evolution
   D. Life maintenance

9. Name the part of a cell where protein synthesis takes place

   A. Ribosome, B. Lysosome, C. Centrosome, D. Chromosome

10. Name the scientist who first explained the reactions in cellular respiration

    A. Newton B. Adolf Krebs C. Galileo D. Shwan

11. Which is the pigment that gives red colour to the red blood corpuscles

    A. Plasma B. Albumin C. Platelets D. Haemoglobin

12. Which of the nutrient deficiency causes unhealthy teeth?

    A. Sodium B. Calcium C. Iodine D. Potassium

13. Why blood is called a tissue?

A. Blood plasma contains salts and amino acids
B. Blood performs the same functions even though it contains different blood cells
C. Blood carries hormones to different parts of the body
D. Blood carries the materials required by the tissues to all parts of the body.

14. Cartilages are tender because the intercellular spaces in them are

A. fewer in number
B. filled with gelly-like substance
C. filled with air
D. Very large in number

15. What is the difference between glucose and glycogen?

A. Glucose is a simple form of carbohydrate
B. Glycogen is a simple form of carbohydrate
C. Carbohydrate is stored as glucose
D. Glycogen is a complex form of carbohydrate

16. Which of the following is correct regarding cellular respiration

A. Oxidises glucose and releases energy
B. Pyruvic acid is produced
C. Breaks down glycogen
D. Produces glucose

17. From among the following statements choose the best one regarding the function of bile in the process of digestion.

A. Transforms fat molecules into complex substances
B. Splits fat molecules into smaller molecules
C. Changes proteins into energy
D. Changes protein into complex substance

18. Which of the following statement is correct regarding white blood corpuscles?

A. Have a definite shape
B. Brings oxygen to heart
C. Produces antibody
D. Seen in large quantities in blood

19. Elephentiasis is seen spreading in a vilalge. What precaution can be taken to prevent the disease from spreading more?

A. Not to urinate or defaecate in open places
B. Always eat balanced diet
C. Keep food materials clean
D. Adopt measures to destroy mosquitoes.

20. What is the speciality of Binomial nomenclature in Biology?

A. Naming by classifying into plants and animals
B. Naming by using the specific name and generic name
C. Naming living being according to similarities and dissimilarities
D. Naming by using the generic name and specific name

21. Indicating thecorrect use of electron microscope

A. Helps to understand the overall structure of a cell.
B. Helps to see very minute and complex objects clearly
C. Helps to see life processes.
D. Helps to see cell division.

22. Why is endoplasmic reticulum called as skeleton of the cell?

A. Transports materials into the cell
B. It extends from plasma membrane to nuclear membrane.
C. Renders shape, strength and rigidity to the cell
D. Having irregular foldings.

23. Which of the following is an example of an organ system.

A. Heart, Arteries, Veins,Capillaries
B. Lungs, Wind pipe, Tracheae, Oesophagus
C. Brain, spinal cord, nerves, bones
D. Mouth, Stomach, Large intestine, Nose

24. Differentiate Phagocytosis and Pinocytosis in cellular processes?

A. Intake of liquid particles is phagocytosis, Intake of food particles is pinocytosis
B. Intake of food particles is phagocytosis, Intake of liquid particles is pinocytosis
C. Giving out food particles is phagocytosis, giving out liquid particles is pinocytosis.
D. Giving out food particles is pinocytosis, giving out liquid particles is phagocytosis.

25. A child experiences poor vision in dim light. Which of the following deficiency in his diet is the cause of his poor vision?

A. Vitamin A B. Iodine C. Protein D. Iron

26. Blood is seen in the sputum of a T.B. patient when be coughs? Give the reason.

A. Heart is affected by the disease B. Blood vessels are punctured
C. Lungs are infected D. Injury in the mouth

27. A person who had affected by chicken-pox earlier will not usually contract the same disease when he is nursing a chickenpox patient. Give reason.

A. Person is fully healthy.
B. Person took medicines earlier.
C. Person got resistance towards chicken-pox.
D. No fear of being infected again.

28. When marine fishes are included in the diet of Goitre patient the disease is seen gradually cured. Why?

A. Sodium B. Chlorine C. Iodine D. Calcium

29. A child who burst out laughing while eating suddenly coughing violently. Why?

A. Food entered in the wind pipe
B. Consumed too much of food
C. Due to lung disease
D. Food being stuck in the mouth.

30. Which micro-organism causes fermentation of batter?

A. Yeast B. Bacteria C. Virus D. Amoeba

31. During a car accident, the driver had a severe blow in his chest. On medical check-up his lungs were not found to be seriously affected. What might have protected the lungs from the blow?

A. Pleural fluid B. Pericardial fluid
C. Water D. Air in the lungs

32. If the hand is severely cut, it is advised to hold the hand up the shoulder till medical assistance is made available. Why?

A. To help the blood clot easily
B. To minimise flow of blood
C. To give relief for pain
D. To get protection from infection

33. If water plants are grown in an aquarium its water need not be changed frequently. Why?

A. Plants absorb carbondioxide from water
B. Atmospheric carbon dioxide dissolves in water
C. Water absorbs atmospheric oxygen.
D. Plants release carbondioxide into water.

34. A person who has bleeding gums was advised by a doctor to eat fruits such as gooseberry, citrus etc. Which of the following deficiency is compensated

A) Vitamin A B) Vitamin K C) Vitamin C D) Vitamin E

35. Give the appropriate explanation of the process of cellular respiration?

A. Breaks down simpler substances
B. Liberates energy by oxidation
C. Air mixes with blood
D. Exchange of oxygen and carbondioxide takes place

36. A person's blood when tested was found to have enormously high WBC. Which of the following statements best explains this finding.

A. The WBC count increased in proportionate to the increase in RBC count
B. WBC are smaller when compared to RBC
C. More WBC are formed to resist the germs entered into the body
D. WBC count increased by consuming medicines.

37. Sugar granules when put into a beaker of water decreases in size gradually and disappears. How is this process explained?

A. As both sugar and water molecules are colourless cannot be disciminated.
B. Sugar and water molecules are of the same size
C. Water molecules enter into sugar molecules
D. Sugar molecules spread evenly among the water molecules.

38. Choose the best inference from the following equation

$$6CO_2 + H_2S \xrightarrow{\text{light}} C_6H_{12}O_6 + 12S + 6H_2O$$

A. Photosynthetic bacteria synthesise food using hydrogen, carbondioxide and light
B. Plants synthesise food by using carbondioxide and hydrogen sulphide
C. Green plants synthesise food by combining hydrogen sulphide and carbondioxide in the presence of sunlight
D. Bacteria breaks down hydrogen sulphide in the presence of sunlight to produce sulphur

39. How does root pressure, suction force, cohesion and adhesion help plants?

A. In the transportation of water
B. In photosynthesis
C. In cellular respiration
D. In osmosis.

40. The ratio of Hydrogen and Oxygen in a chemical compound is 2:1 as in water. There are six carbon atoms, 12 hydrogen atoms and 6 oxygen atoms in it. Which of the following is the best conclusion?

A. It is a hydrocarbon
B. It is $C_6H_{12}O_6$ carbohydrate
C. It contains six water molecules
D. It is an amino acid.

UNIVERSITY OF CALICUT
ACHIEVEMENT TEST IN BIOLOGY

RESPONSE SHEET (FINAL)

Name of Student ..... Class ..... Class No. .....

Name of School ..... Boy / Girl

Sl. No.					Sl. No.				
1	A	B	C	D	21	A	B	C	D
2	A	B	C	D	22	A	B	C	D
3	A	B	C	D	23	A	B	C	D
4	A	B	C	D	24	A	B	C	D
5	A	B	C	D	25	A	B	C	D
6	A	B	C	D	26	A	B	C	D
7	A	B	C	D	27	A	B	C	D
8	A	B	C	D	28	A	B	C	D
9	A	B	C	D	29	A	B	C	D
10	A	B	C	D	30	A	B	C	D
11	A	B	C	D	31	A	B	C	D
12	A	B	C	D	32	A	B	C	D
13	A	B	C	D	33	A	B	C	D
14	A	B	C	D	34	A	B	C	D
15	A	B	C	D	35	A	B	C	D
16	A	B	C	D	36	A	B	C	D
17	A	B	C	D	37	A	B	C	D
18	A	B	C	D	38	A	B	C	D
19	A	B	C	D	39	A	B	C	D
20	A	B	C	D	40	A	B	C	D

Appendix IV F

Achievement Test in Biology - Scoring Key

Question No.	Correct answer	Question No.	Correct answer
1	D	21	B
2	A	22	C
3	C	23	A
4	B	24	B
5	B	25	A
6	D	26	C
7	B	27	C
8	C	28	C
9	A	29	A
10	B	30	A
11	D	31	A
12	B	32	B
13	B	33	B
14	B	34	C
15	A	35	B
16	A	36	C
17	B	37	D
18	C	38	A
19	D	39	A
20	D	40	B