# METALITERACY AMONG THE STUDENTS OF IITS IN SOUTH INDIA

*Thesis submitted to the University of Calicut in partial fulfilment of the requirements for the award of the Degree of*

**DOCTOR OF PHILOSOPHY IN LIBRARY AND INFORMATION SCIENCE**

*By*

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**CHMK LIBRARY**
**UNIVERSITY OF CALICUT**
**2024**

# DECLARATION

I hereby declare that the work presented in the thesis entitled **Metaliteracy among the Students of IITs in South India** is based on the original work done by me under the guidance of Dr. Abdul Azeez T. A., Former University Librarian, C. H. M. K. Library, University of Calicut, and has not been included in any other thesis submitted previously for the award of any degree. The contents of the thesis have undergone a plagiarism check using *iThenticate* software at C.H.M.K. Library, University of Calicut, and the similarity index found within the permissible limit. I also declare that the thesis is free from AI-generated content.

University of Calicut **Haseena.V.K.K.M.**
Date: 14. 08. 2024

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# CERTIFICATE

I, Dr. Abdul Azeez T. A., do hereby certify that the thesis entitled **Metaliteracy among the Students of IITs in South India** submitted to the University of Calicut, is a record of the bona fide study and research carried out by Ms. Haseena V.K.K.M under my supervision and guidance. The report has not been previously formed the basis for the award of a Degree, Diploma, Title or recognition**.**

Calicut University Campus
Date: 14. 08. 2024

**Dr. Abdul Azeez T. A.**
(Supervising Teacher)

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***Sincerely***

***Haseena.V.K.K.M***

***Dedication***

*This thesis is dedicated to my beloved mother.*

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

| | |
|---|---|
| 24 | Theme 2 and Subthemes |
| 25 | Theme 3 and Subthemes |
| 26 | Theme 4 and Subthemes |

# LIST OF APPENDICES

# LIST OF ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| MS | : | Metaliteracy Scale |
| IL | : | Information Literacy |
| IIT | : | Indian Institutes of Technology |
| IITDH | : | Indian Institute of Technology Dharwad |
| IITTP | : | Indian Institute of Technology Tirupati |
| IITH | : | Indian Institute of Technology Hyderabad |
| IITPKD | : | Indian Institute of Technology Palakkad |
| IITM | : | Indian Institute of Technology Madras |
| ACRL | : | Association of College and Research Libraries |
| ALA | : | American Library Association |
| CVL | : | Critical Visual Literacy |
| QoL | : | Quality of Life |
| HELIA | : | Health Literacy for Adults |
| ICT | : | Information and Communication Technology |
| ODeL | : | Open Distance eLearning |
| KMO | : | Kaiser Meyer Olkin |
| NMLS | : | New Media Literacy Scale |
| CCSS | : | Common Core State Standards |
| AASL | : | American Association of School Librarians |
| OER | : | Open Educational Resources |
| MOOCs | : | Massive Open Online Courses |
| MASE | : | Metaliteracy Self-Efficacy |
| COIL | : | Collaborative Online International Learning |
| XML | : | Extensible Markup Language |
| EFL | : | English Foreign Language |

| | | |
|---|---|---|
| LOA | : | learning-oriented assessments |
| IL_HUMASS | : | Information Literacy Scale for Humanities and Social Science Students |
| PILS | : | Perception of Information Literacy Scale |
| ISTE | : | International Society for Technology in Education |
| TAP | : | Text Audience Production |
| NAMLE | : | National Association for Media Literacy Education |
| EFA | : | Exploratory Factor Analysis |
| CFA | : | Confirmatory Factor Analysis |

# ABSTRACT

Information literacy has transformed significantly over the years, encompassing digital, media, cyber, transliteracy, metaliteracy, etc., reflecting the evolving landscape of information and technology. This study attempts to assess the metaliteracy among students of Indian Institutes of Technology (IITs) in South India, providing valuable insights into the state of the art of metaliteracy among the students and strategies to improve the current status. This topic has been relatively underexplored, particularly within the Indian context. Metaliteracy involves the ability to evaluate information for its bias, reliability, and credibility, and to apply this evaluation in the context of knowledge production and sharing.

The study employed a mixed-method research design, combining quantitative and qualitative approaches with three objectives. The primary objective is to develop and validate a comprehensive Metaliteracy Scale (MS) based on Boateng et al.'s scale construction model, which involves three phases: item development, scale development, and scale evaluation, comprising nine steps. Initially, a pool of 62 items is generated based on a framework of metaliteracy goals and learning objectives across four domains (metacognitive, cognitive, behavioral, and affective), later refined to 56 items through expert validation at the national and international levels, including input from the developers of the metaliteracy framework, such as Trudi E. Jacobson and Thomas P. Mackey. The scale is administered to 824 students across five IITs in South India after pretesting it with four students at IIT Hyderabad. Finally, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted to determine the latent structure by using a split-data strategy into two datasets. The final MS demonstrated high reliability and validity, with a Cronbach’s alpha of 0.945 and a Spearman-Brown Coefficient of 0.914.

Secondly, the study assessed the metaliteracy levels among students of five IITs in South India. For that, fourteen metaliteracy factors were extracted using EFA (*Lifelong Learner, Informed Prosumer, Metalearner, Collaborator, Value-oriented,* *Active & Critical Evaluator, Digitally Literate, Affective, Ethical & Responsible Engagement, Metacognition*, and *Inquisitiveness*) and six independent variables (*Institution, Department, Course, Age, Gender*, and *Socioeconomic status*) were analyzed statistically using SPSS (version 28) and R (version 4.2.1). The findings reveal a high level of metaliteracy skills among the students among the five IITs, regardless of the independent variables. However, significant differences in students' metaliteracy levels were observed across various independent variables such as department, course, age, and socioeconomic status, as their *p* value s were less than the significance threshold. However, other variables like institution and gender did not show significant differences in students' metaliteracy levels.

Finally, qualitative insights were gathered through WhatsApp interviews and analyzed using thematic analysis based on Braun and Clarke's six-phase framework. Four main themes emerged: *Digital Citizenship, Critical Thinking and Reflective Practices, Collaborative Learning and Participation*, and *Ethical Information Use*. Overall, the findings highlight the importance of enhancing educational strategies to foster metaliteracy skills for critical evaluation and ethical information practices among students, preparing them effectively for todays and future complex information environments. These insights contribute to the broader discourse on educational approaches that promote comprehensive metaliteracy across diverse academic settings.

Keywords: Metaliteracy, IITs, Metacognition, Literacy assessment, Digital citizenship, Collaborative learning, Scale development, Ethical information use, Critical evaluation and learning.

## സംഗ്രഹം

വിവരസാങ്കേതികവിദ്യ വികസിച്ചുകൊണ്ടിരിക്കുന്ന പശ്ചാത്തലത്തിൽ, വിവരസാക്ഷരത കഴിഞ്ഞ കുറെ വർഷങ്ങളായി സുപ്രധാനമായ പരിണാമത്തിലൂടെയാണ് കടന്നുപോവുന്നത്. വിവരസാക്ഷരതയിൽ ഡിജിറ്റൽ സാക്ഷരത, മാധ്യമസാക്ഷരത, സൈബർ സാക്ഷരത, ട്രാൻസ്‌ലിറ്ററസി, അതിസാക്ഷരത (മെറ്റാലിറ്ററസി) എന്നിവ പ്രധാനമായും ഉൾച്ചേർന്നിരിക്കുന്നു. അതിസാക്ഷരത എന്ന സാക്ഷരതാരീതി ദക്ഷിണേന്ത്യൻ ഐ.ഐ.ടികളിലെ വിദ്യാർത്ഥികൾക്കിടയിൽ എത്രത്തോളമുണ്ടെന്ന് വിലയിരുത്തുകയും, ഇന്ത്യൻ പശ്ചാത്തലത്തിൽ നിലവിലെ അവസ്ഥ മെച്ചപ്പെടുത്തുന്നതിനുള്ള മാർഗ്ഗങ്ങളും മൂല്യവത്തായ ഉൾക്കാഴ്ചകളും നൽകാനാണ് ഈ പഠനത്തിലൂടെ ശ്രമിക്കുന്നത്. ഇന്ത്യൻ സാഹചര്യത്തിൽ താരതമ്യേന കുറച്ചു പഠനങ്ങൾ മാത്രം നടന്നിട്ടുള്ള മേഖലയാണിത്. വിവരത്തിന്റെ വിശ്വാസ്യത, വിശ്വാസയോഗ്യത, അതിലുൾച്ചേർന്നിരിക്കുന്ന പക്ഷപാതം എന്നിവ വിമർശനാത്മകമായി വിലയിരുത്താനും അതിനനുസരിച്ച് അറിവ് ഉൽപ്പാദിപ്പിക്കാനും പ്രയോഗിക്കാനും ഓൺലൈൻ കൂട്ടായ്മകളിൽ പങ്കിടാനുമുള്ള കഴിവിനെ അതിസാക്ഷരതയായി കണക്കാക്കാം.

മൂന്ന് പഠനലക്ഷ്യങ്ങളെ മുൻനിർത്തി ക്വാണ്ടിറ്റേറ്റീവും ക്വാളിറ്റേറ്റീവുമായ ഡാറ്റകൾ സംയോജിപ്പിച്ച ഒരു സമ്മിശ്ര ഗവേഷണരീതിയാണ് ഈ പഠനം രൂപകൽപ്പന ചെയ്യാനുപയോഗിച്ചത്. ബോട്ടെങ്ങിന്റെയും സംഘത്തിന്റെയും സ്കെയിൽ നിർമ്മാണമാതൃകയെ അടിസ്ഥാനമാക്കി സമഗ്രമായ ഒരു അതിസാക്ഷരതാസ്കെയിൽ വികസിപ്പിക്കുകയും സാധൂകരിക്കുകയും ചെയ്യുക എന്നതാണ് പ്രാഥമിക ലക്ഷ്യം. ഇനം വികസനം, സ്കെയിൽ വികസനം, സ്കെയിൽ വിലയിരുത്തൽ എന്നിങ്ങനെ മൂന്ന് ഘട്ടങ്ങളിലായി ഒമ്പത് സ്റ്റെപ്പുകളാണ് ഈ നിർമ്മാണപ്രക്രിയയിലുള്ളത്. അതിസാക്ഷരതയുടെ ലക്ഷ്യങ്ങളും പഠനോദ്ദേശ്യങ്ങളും അടങ്ങിയിട്ടുള്ള ചട്ടക്കൂടിനെ അടിസ്ഥാനമാക്കി ആദ്യമായി 62 ഇനങ്ങൾ ഉണ്ടാക്കി. ഈ ചട്ടക്കൂട് നാല് ഡൊമെയ്നുകളിൽ (മെറ്റാകോഗ്നിറ്റീവ്, കോഗ്നിറ്റീവ്, ബിഹേവിയറൽ, എഫെക്റ്റീവ്) വ്യാപിച്ചിരിക്കുന്നു. തുടർന്ന് ഈ അതിസാക്ഷരതയെ സംബന്ധിച്ച ചട്ടക്കൂട് വികസിപ്പിച്ചവരായ ട്രൂഡി ഇ. ജേക്കബ്സൺ, തോമസ് പി. മെക്കെ എന്നിവരിൽനിന്നും ദേശീയ-അന്തർദ്ദേശീയ വിദഗ്ധരിൽനിന്നുമുള്ള നിർദേശങ്ങളുൾപ്പെടെ സ്വീകരിച്ച് 56 ഇനങ്ങളിലേക്ക് പരിഷ്ക്കരിച്ചു. ഐ.ഐ.ടി. ഹൈദരാബാദ് ക്യാമ്പസിൽനിന്നുള്ള നാല് വിദ്യാർത്ഥികളിൽ പ്രാഥമിക പരിശോധന നടത്തിയതിനുശേഷം ദക്ഷിണേന്ത്യയിലെ അഞ്ച് ഐ.ഐ.ടികളിൽനിന്നുള്ള 824 വിദ്യാർത്ഥികളിയായി പിന്നീട് ഫൈനൽ സർവേ നടത്തുകയുണ്ടായി. ഈ സർവ്വേഫലത്തെ രണ്ട് ഭാഗമാക്കി തിരിച്ച് ഒന്നിൽ

എക്സ്പ്ലോറേറ്ററി ഫാക്ടർ അനാലിസിസും (ഇഎഫ്എ) മറ്റൊന്നിൽ കൺഫർമേറ്ററി ഫാക്ടർ അനാലിസിസും (സിഎഫ്എ) നടത്തി ഡാറ്റയുടെ ഘടന കണ്ടെത്തി. ക്രോൺബാക്കിന്റെ ആൽഫ (0.945), സ്പിയർമാൻ ബ്രൌൺ കോ-എഫിഷ്യന്റ് (0.914) എന്നിവ കണ്ടെത്തി സ്കെയിലിന്റെ വിശ്വാസ്യതയും സാധുതയും ഉറപ്പാക്കി.

രണ്ടാമതായി, ദക്ഷിണേന്ത്യയിലെ അഞ്ച് ഐ.ഐ.ടികളിലെ വിദ്യാർത്ഥികളുടെ അതിസാക്ഷരതാനില അളക്കുകയുണ്ടായി. ഇഎഫ്എ ഉപയോഗിച്ച് ലഭിച്ച 14 അതിസാക്ഷരതാഘടകങ്ങളുടെയും (ലൈഫ്‌ലോങ്ങ് ലേർണർ, ഇൻഫോംഡ് പ്രൊസ്യൂമർ, മെറ്റാലേർണർ, കൊളാബറേറ്റർ, വാല്യൂ ഓറിയന്റഡ്, ആക്റ്റീവ് ആൻഡ് ക്രിട്ടിക്കൽ ഈവാല്യുവേറ്റർ, ഡിജിറ്റൽ ലിറ്ററേറ്റ്, അഫക്റ്റീവ്, എത്തിക്കൽ ആൻഡ് റെസ്പോൺസിബിൾ എൻഗേജ്മെന്റ്, മെറ്റാകോഗ്നിഷൻ, ഇൻക്വിസിറ്റീവ്നെസ്സ്) കൂടാതെ ആറ് സ്വതന്ത്രഘടകകങ്ങളുടെയും (സ്ഥാപനം, വകുപ്പ്, കോഴ്സ്, പ്രായം, ലിംഗഭേദം, സാമൂഹിക-സാമ്പത്തികനില) ബന്ധം പരിശോധിക്കുകയും ചെയ്തു. സ്വതന്ത്രഘടകങ്ങൾക്ക് അതീതമായി ഈ വിദ്യാർത്ഥികൾക്കിടയിൽ അതിസാക്ഷരത ഉയർന്ന തോതിൽ കാണപ്പെടുകയും ചില ഘടകങ്ങൾ തമ്മിൽ കാര്യമായ വ്യത്യാസങ്ങൾ രേഖപ്പെടുത്തുകയും ചെയ്തിട്ടുണ്ട്.

അവസാനമായി, വാട്ട്സ്ആപ്പ് അഭിമുഖങ്ങളിലൂടെ മൂല്യവത്തായ ഉൾക്കാഴ്ചകൾ ശേഖരിക്കുകയും ബ്രൗണിന്റെയും ക്ലാർക്കിന്റെയും ആറ് ഘട്ട ചട്ടക്കൂടിനെ അടിസ്ഥാനമാക്കിയുള്ള തീമാറ്റിക് വിശകലനം നടത്തുകയും ചെയ്തു. ഉരിത്തിരിഞ്ഞുവന്ന നാല് പ്രധാന തീമുകൾ ഇവയാണ് : ഡിജിറ്റൽ സിറ്റിസൺഷിപ്പ്, വിമർശനാത്മകചിന്തയും പ്രതിഫലനരീതികളും, സഹകരിച്ചുള്ള പഠനവും പങ്കാളിത്തവും, നൈതികവിവരങ്ങളുടെ ഉപയോഗം. ഈ പഠനം വിദ്യാർത്ഥികളിൽ വിമർശനാത്മക മൂല്യനിർണ്ണയത്തിനും നൈതിക വിവരത്തിന്റെ കാര്യക്ഷമമായ ഉപയോഗത്തിനും ആവശ്യമായ അതിസാക്ഷരതാകഴിവുകൾ വളർത്തുന്നതിനുള്ള വിദ്യാഭ്യാസരീതിയുടെ പ്രാധാന്യത്തെ മുന്നോട്ടുവെക്കുന്നു. ഇതുവഴി ഭാവിയിലെ സങ്കീർണ്ണമായ വിവരാന്തരീക്ഷത്തെ ഫലപ്രദമായി നേരിടാൻ വിദ്യാർത്ഥികളെ തയ്യാറാക്കാൻ സാധിക്കും. ഈ ഉൾക്കാഴ്ചകൾ വൈവിധ്യമാർന്ന അക്കാദമിക് പ്രവർത്തനങ്ങളിലുടനീളം സമഗ്രമായ അതിസാക്ഷരത പ്രോത്സാഹിപ്പിക്കുന്ന തരത്തിലുള്ള വിദ്യാഭ്യാസസമീപനങ്ങൾക്ക് പ്രചോദനം നൽകുന്നു.

**താക്കോൽവാക്കുകൾ** : അതിസാക്ഷരത, മെറ്റാകോഗ്നിഷൻ, സാക്ഷരതാവിലയിരുത്തൽ, ഡിജിറ്റൽ പൗരത്വം, സഹകരണപഠനം, സ്കെയിൽ വികസനം, നൈതിക വിവരോപയോഗം, വിമർശനാത്മക വിലയിരുത്തലും പഠനവും.

# CHAPTER 1

# INTRODUCTION



*Objective of this chapter is to highlight the concept of the metaliteracy framework, study's rationale, its need and significance, objectives and hypotheses, institution profiles, thesis overview, scope, limitations, style manual, and final remarks.*

## 1.1 Introduction

The introductory chapter starts with the rationale behind the study, pointing out the reasons and motivations that led to its inception. It explains the metaliteracy framework and related components in detail as it is the central core of theoretical foundation underpinning this study and is followed by its scope and significance. It outlines the objectives and hypotheses guiding this study and then presents a brief profile of the selected institutions. The chapter concludes with an outline of the thesis and the style manual used, and it ends with some final remarks.

## 1.2 Rationale of the Study

Since the advent of the internet, technology has witnessed substantial transformations, particularly in the era of the digital revolution. Generations Z and Alpha immerse themselves in mobile devices, applications, social media, big data, cloud computing, and artificial intelligence (Alexander et al., 2016). This process of social and technological changes accelerated due to the spread of COVID-19, which is reflected in every sector of society (Agrawal, 2023). The learning experiences before and after the pandemic differed significantly. So, students need to be acquainted with the latest technologies for effective learning and improve their skill sets according to the changing information landscape. Similarly, the evolution of social media and the emergence of collaborative online communities necessitate humans to communicate via advanced digital technology that redefines the rich social structure of user-generated content (Kapoor et al., 2018). Therefore, it is requisite to have a skill set to handle user-generated data decently.

Social media's collaborative, transient, and free-flowing nature requires a specific set of literacies to deeply understand the information landscape and critically analyze, evaluate, produce, and share information in various forms. To engage with massive information content, the skill or competency named 'information literacy' already been proposed by ***Paul G. Zurkowski*** in 1974 as a part of a printed report published on behalf of the National Commission on Libraries and Information Science, who was the president of Software and Information Industry Association at that time (Cowan, 2014). The American Library Association (2000) defines Information Literacy as a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information*"*.

The transformation of literacies also happened over the years into different literacy types. New kinds of literacy types, such as digital literacy, cyberliteracy, media literacy, transliteracy, etc., emerged in the evolution of information literacy over time with the advent of innovative web technologies. A literacy gap is identified to meet the requirements of today's information age. The emergence of new media brings about a significant transformation in the types of learning activities and redefines the skill sets necessary for effective learning and utilization. As a result, a kind of multiple literacy called metaliteracy emerged in 2011, which is detailed in the section below. Metaliteracy is often described as the "literacy of literacies" because it encompasses and enhances all other forms of literacy by promoting critical thinking, ethical engagement, and effective participation in diverse information environments. Moreover, the emergence of the post-truth world, where misinformation and disinformation are common and factual accuracy is often ignored (Mackey & Jacobson, 2019). So, metaliteracy is crucial, and it enables critical evaluation and responsible engagement with information, which are essential for making informed decisions, ethical digital participation, and promoting truth and knowledge in society.

### 1.3 What is Metaliteracy?

Metaliteracy is a comprehensive model for information literacy developed by ***Trudi E. Jacobson*** and ***Thomas P. Mackey*** that emphasizes critical thinking, active collaborative creation, and sharing in a digital age. It is more focused on one's literacies and metacognition. When an individual is called a metaliterate learner, one has the understanding and self-awareness of their literacy strengths and areas for improvement in their learning process. Metaliteracy supports an individual's desire to learn throughout their lifespan and recognizes that learning must be continual to be a well-informed contributing citizen (Mackey & Jacobson, 2014).

The metaliterate learners take ownership of their learning goals, are open to new challenges, adapt to new situations and technologies, reflect on personal growth, and consider multiple perspectives and ideas. Metaliteracy is a crucial concept in today's rapidly evolving information landscape because it goes beyond traditional information literacy to encompass broader skills necessary to navigate and create content in digital and multimedia environments (De Paor & Heravi, 2020).

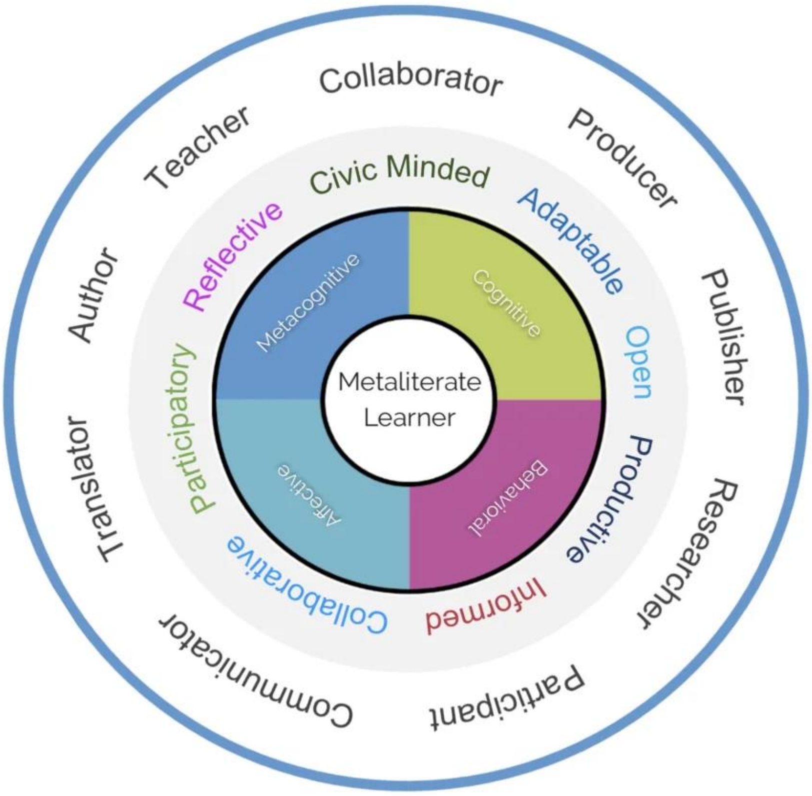
### 1.3.1 Metaliteracy Theoretical Framework

The metaliteracy framework constitutes all the components of metaliteracy and how it differs from other literacy types. "Metaliteracy promotes critical thinking and collaboration in the digital age, providing a comprehensive framework to effectively participate in social media and online communities." This framework focuses on metacognitive reflection as an empowering practice for learners and is considered an umbrella term for acquiring, producing, and sharing information in collaborative online communities. The origin of metaliteracy lies in information literacy (IL); still, it challenges the conventional IL skill-based approaches by identifying different related literacy types, including visual, digital, news, and transliteracy, which integrate with the present emerging technologies (Mackey & Jacobson, 2014).

Figure 1 displays each of the key components of metaliteracy denoted as a series of permeable spheres. The core information literacy component, represented as metaliteracy, is bounded by four aspects: metacognitive, cognitive, behavioural, and affective domains that provide all other-related elements within the model.

**Figure 1**

*Integrated Metaliterate Learner (Mackey & Jacobson, Metaliteracy in a Connected World: Developing Learners as Producers, 2021) (Figure design by Kelsey O'Brien using Genially)*




Basic information literacy (IL) activities, such as determining, accessing, evaluating, and understanding information, have evolved to integrate additional activities like using, incorporating, producing, collaborating, participating, and sharing information. These activities are increasingly mediated by social media, online communities, mobile technologies, and open educational resources (OER). The outer ring of this framework provides roles for individuals engaged in these activities, focusing on knowledge creation and dissemination in participatory settings. This transitional design illustrates the transformation from traditional information literacy into a more inclusive and comprehensive concept of metaliteracy (Mackey & Jacobson, 2019).

### 1.3.2 Learning Domains of Metaliteracy

According to Mackey and Jacobson's (2019) metaliteracy framework, there are four domains of metaliteracy, metacognitive, cognitive, behavioural, and affective. With each of these four domains' aspects clubbing together, one becomes an active metaliterate learner capable of taking one's own responsibility for learning. It emphasizes the development of critical thinking and metacognitive skills across various knowledge domains. It helps individuals become effective and responsible producers and consumers of information in today's rapidly changing digital environment. The learning domains of metaliteracy are:

**1.3.2.1 *Metacognitive***: The metacognitive domain strengthens one's ability to reflect and regulate his/her own learning process. The 'meta′ in metaliteracy corresponds to the same in metacognition, which speaks basically about one's own thinking. This domain focuses on developing self-regulated learning skills, such as goal setting, monitoring one's own learning, and self-reflection. Through self-reflection, an individual can identify strengths and areas of improvement most important in learning. This domain acts as the central part of metaliteracy.

**1.3.2.2 *Cognitive***: The cognitive domain emphasizes developing critical thinking skills, such as analysis, synthesis, evaluation, and application of information. It refers to the degree of comprehension and information attained after completing learning activities successfully. Metacognition is the act of thinking about one's own thinking, whereas cognition is the act of thinking.

**1.3.2.3 *Behavioural***: The behavioral domain supports people's actions while learning or how one actually puts one’s abilities and competencies into practice. The behavioral domain is manifested in both formal learning settings and daily life. A strong foundation of competencies supports metaliteracy's emphasis on higher-level thinking goals.

**1.3.2.4 *Affective***: The affective domain describes people's emotions and attitudes. From a metaliterate perspective, learning impacts affective factors, such as how one feels about a problem or interacts with the other domains. An emotional or attitudinal response may motivate to ask questions and learn more about a particular concern or issue. On the other hand, emotional or attitudinal responses may also make it difficult to assess situations objectively because of deeply held viewpoints that may interfere with logic and reason.

Metaliteracy is a flexible and adaptable framework that can be applied to a wide range of contexts and learning goals. It emphasizes developing lifelong learning skills crucial for success in a rapidly changing digital world. The four interrelated learning domains provide checks and balances to the thinking process. One has to possess the ability in all of these learning domains. Providing with an opportunity to what one can do, what one can control, analyze how one thinks, and how one responds (Mackey & Jacobson, 2019).

### 1.3.3 Metaliterate Learner Characteristics

An individual to be called a metaliterate learner who must possess certain characteristics while dealing with the digital information landscape.

**1.3.3.1 *Collaborative*:** Collaborative means working with a team for a joint endeavor. Collaborative work reinforces the team member to learn as well as to teach. So, the roles of both teacher and learner in shared responsibility as a co-worker to become a metaliterate learner, rather than sticking to the concurrent matters of a community.

**1.3.3.2 *Participatory*:** Participation is already involved in collaborative work. Here, participation means active involvement and critical engagement in society, both connected and divided. As a result of this, individuals responsibly produce and share information, able to identify the original vs. repurposed information, its nature, meaning, and consequences. Metaliterate learners are the active creators of new knowledge in collaborative ways, having the capacity to build communities of trust by generating meaningful communication in social settings.

**1.3.3.3 *Reflective*:** nature means one's own conscious thoughts and feelings. Metaliterate learner can think about one's thinking process and understand the known and unknown things to identify the gaps in knowledge and self-regulations of the learning process.

**1.3.3.4** ***Civic-minded*****:** community-based civic responsibility and social accountability while engaging in the participative networking environment. Metaliterate learners are active participants in community settings rather than in interpersonal communication. One knows the social space and how to consume and create meaningful information on community platforms.

**1.3.3.5** ***Open*****:** Open characteristics foster the ability to teach and learn in a community. It helps to see the various perspectives from one's own and understand the surroundings from different points of view. In addition, metaliterate individuals can openly produce and share information through collaborative work as learners and teachers.

**1.3.3.6** ***Adaptable:*** The adaptive nature of metaliterate learners helps them cope with dynamic technologies, adjust to new learning environments, and act as responsible learners. Cognizant of personal privacy and information security in the digital environment.

**1.3.3.7** ***Productive*****:** Creating original information and ethically producing repurposed information are the major competencies in the new information environment. Metaliterate is one who is able to produce dynamic information in a cognitive way of reflection. In addition, they are adaptable to new gadgets and mobile devices and their use and application through trial-and-error methods.

**1.3.3.8** ***Informed****:* The informed consumer of information is a vital part of metaliteracy dealing with consumer-producer. While handling the information, everyone needs to know the authenticity, source reliability, and content bias. This informed characteristic focuses on distinguishing between facts and fiction and truth and untruth, apart from the informed one who produces and consumes accurate and verifiable information and understands the bias, who is capable of realizing the value of objective and sustained research and sharing it through different media. The above characteristics make a metaliterate learner. So, metaliteracy is a unified construct of these collective learner characteristics.

### 1.3.4 Roles of Metaliterate Learners

The characteristics of understanding reflection, awareness of how one feels about learning, action, and careful thought are encouraged by metaliteracy. Through these processes, some active roles emerged, which are given below:

**1.3.4.1 *Participant*:** Metaliterate participants actively participate in interactive social spaces, including virtual and real-world settings. Participants may include volunteers, facilitators, community members, and voters who emphasize creating trustworthy communities through their responsible and ethical efforts. Consider the crucial function of a local community organizer, who brings people together to take part in a grassroots effort within a particular community. Effective communication is necessary when attempting to bridge differences among participants in any society or across caste divides.

**1.3.4.2 *Communicator*:** A metaliterate communicator can adapt to changing technologies to create and share information with others effectively. They know how to deliver messages while considering diverse audiences in a global community. Journalists, editors, writers, public speakers, and teachers are examples of effective communicators. Consider how liberating that would be. It is the responsibility of a blogger to self-publish a blog in order to communicate something entirely new for an online audience. Consider the responsibilities that come with writing, editing, and posting the blog in an accurate, ethical, and truthful manner. Communication often necessitates the translation of various types of information.

**1.3.4.3 *Translator*:** From the metaliteracy perspective, it refers to more than translating from one language to another. Metaliterate translators have the ability to adopt one form of information to another. It includes the awareness of translating ideas to wider audiences in different formats. Playwrights, artists, media producers, and game designers are some examples of translators. Consider how moviemakers frequently use concepts from plays and books to construct a movie. The creators acknowledge the sources of the original ideas and the things that inspired the new film.

**1.3.4.4** ***Author:*** Authorship is a dynamic process emphasizing information production in various formats. Metaliterate authors stay up to date with effective new methods for producing original information or synthesising trustworthy information from verified sources. They comprehend and promote digital ethics in content creation and sharing. Podcasters, videographers, and songwriters are some types of authors. Consider how digital storytellers create narratives using multimedia, narration, and digital images. When generating and sharing digital information, this creative process necessitates an understanding of how to distinguish between original and repurposed materials.

**1.3.4.5** ***Teacher****:* Metaliteracy advances the notion that learners are also teachers. Metaliterate teachers are open to collaborating with others and taking responsibility for how learning occurs both formally and informally. Metaliteracy teachers who are willing to collaborate with students and accept responsibility for how learning occurs both formally and informally. In a collaborative setting, knowledge is produced and shared. Teachers serve as friends, colleagues, mentors, and community partners. They have an objective perspective toward the current issues before sharing with others.

**1.3.4.6** ***Collaborator:*** Metaliterate collaborators know that strong community building is possible through cooperative ventures that can't be achieved alone. Such collaborators might be a wiki editor, an organization's volunteers, and a project-oriented team. Consider how a web team and graphic designers collaborate to produce images that support a website under development. This individual has to understand the project's objectives and adopt a collaborative strategy that values everyone's input and common aims.

**1.3.4.7** ***Producer****:* Metaliterate learners can produce original and repurposed information across various styles and formats. They are also an effective consumer of information as well as an ethical creator through collaborative efforts. Content developers, curators, media creators, and remixers are examples of such producers.

Think about creating a digital media project, then sharing it on the internet. What ethical considerations went into creating and disseminating items through various media?

**1.3.4.8** ***Publisher:*** Metaliterate understands that information production and dissemination has a variety of forms and needs responsible editorial filters to recognize the truth, diverse content, democratic voices, and inclusiveness. For this, unbiased, objective research is required as a lifelong discovery process. Bloggers, YouTube video producers, and Pinterest creators are examples of publishers. Publishing digital content necessitates a dedication to the accuracy, dependability, and authenticity of the shared material in order to reach a potentially global audience that traditional media may not be able to reach. Also advantageous are cultural sensitivity and communication across various viewpoints and worldviews.

**1.3.4.9** ***Researcher:*** Metaliterate researchers are inquisitive to ask good questions and critical evaluators by checking the authenticity and credibility of information simultaneously by checking one's own bias; contributing uniquely to academia. Researchers are storytellers, historians, and archivists. Think about a proactive patient looking for medical information to get ready for a discussion with their doctor. The retrieved information should be reliable and accurate, and the search should be kept confidential and private. These roles make individuals become metaliterate learners and provide insight into lifelong learning.

### 1.3.5 Metaliteracy Goals and Learning Objectives

There are four main metaliteracy goals, and having a number of learning objectives for metaliterate learners comes under four domains. Some goals are meant to handle today's information landscape, and others echo long-valued information literacy principles used in various educational contexts (Mackey & Jacobson, 2013).

Metaliteracy learning falls into four domains: **behavioral** (what students should be able to do upon successful completion of learning activities—skills, competencies), **cognitive** (what students should know upon successful completion of learning activities—comprehension, organization, application, evaluation), **affective** (changes in learners' emotions or attitudes through engagement with learning activities), and **metacognitive** (what learners think about their own thinking—a reflective understanding of how and why they learn, what they do and do not know, their preconceptions, and how to continue to learn). Each learning objective below fits into one or more of these categories and is labeled as such (**B** for behavioral, **C** for cognitive, **A** for affective, and **M** for metacognitive).

These learning objectives recognize that “metaliterate learners," as they are called here, must learn continually, given the constantly and rapidly evolving information landscape. Instructors and learners can meet these objectives in various ways, depending on the learning context, by choosing from a menu of learning activities. The objectives are conceived broadly to remain scalable, reproducible, and accessible in a range of contexts (Mackey & Jacobson, 2019).

***Goal 1: Actively evaluate content while also evaluating one's own biases.***

1. Verify expertise but acknowledge that experts do exist. (A, C)
2. Acknowledge that content is not always produced for legitimate reasons and that biases exist, both subtle and overt. (C)
3. Reflect on how you feel about information or an information environment to consider multiple perspectives. (A, M)
4. Consciously seek information from a spectrum of viewpoints and sources. (B)
5. Determine how a source's purpose, document type, and delivery mode affect its value for a particular situation. (B, C)
6. Distinguish between editorial commentary and a research-based perspective, recognizing that values and beliefs are embedded in all information. (C)
7. Determine the value of formal and informal information from diverse online sources, such as scholarly, user-generated, and OERs. (C)

8. Evaluate user-generated information in social media environments and differentiate between opinion and fact. (B, C)

9. Critically assess information from all sources, including dynamic content that circulates online. (B)

10. Examine how you feel about the information presented and how this impacts your response. (A, M)

***Goal 2: Engage with all intellectual property ethically and responsibly.***

1. Differentiate between producing original information and remixing openly licensed content. (C)

2. Challenge yourself to formulate ethical and novel approaches to build upon the ideas of others that you find exciting and engaging. (A, M)

3. Reflect on how to effectively and ethically integrate someone else's intellectual property into your own original and remixed productions. (M)

4. Responsibly produce and share original information and ethically remix and repurpose openly licensed content. (B)

5. Distinguish between public and personal information and make ethical and informed decisions about appropriately sharing information online. (C)

6. Differentiate between copyright, Creative Commons, and open licenses in both the creation and licensing of original and repurposed content. (B, C)

7. Identify and follow the specific intellectual property attribution expectations in the setting in which you are working. (B, C)

***Goal 3: Produce and share information in collaborative and participatory environments.***

1. See oneself as a producer as well as consumer of information. (A, M)

2. Participate conscientiously and ethically in collaborative environments. (B)

3. Protect personal privacy and actively secure your online information. (B, C)

4. Share knowledge accurately and effectively through the production of content using appropriate and evolving formats and platforms. (B)

5. Translate information presented in one manner to another in order to best meet the needs of a particular audience. (B, C)

6. Recognize that learners are also teachers and teach what you know or learn in collaborative settings. (A, B, C)

7. Critically evaluate and verify user-generated content and appropriately apply in new knowledge creation. (B, C)

8. Recognize diverse cultural values and norms to create and share information for global audiences. (B, C)

***Goal 4: Develop learning strategies to meet lifelong personal and professional goals***

1. Recognize that learning is a process and that reflecting on errors or mistakes leads to new insights and discoveries. (M)

2. Assess learning to determine both the knowledge gained and the gaps in understanding. (C, M)

3. Recognize that critical thinking depends upon knowledge of a subject and actively pursue deeper understanding through inquiry and research. (A, B, C, M)

4. Value persistence, adaptability, and flexibility in lifelong learning. (M)

5. Adapt to new learning situations while being flexible about the varied approaches to learning. (A, B)

6. Adapt to and understand new technologies and the impact they have on learning. (A, B)

7. Effectively communicate and collaborate in shared spaces to learn from multiple perspectives. (B, C)

8. Engage in informed, self-directed learning that encourages a broader worldview through the global reach of today's social media environment. (B, M)

9. Apply metaliterate learning as a lifelong value and practice. (M)

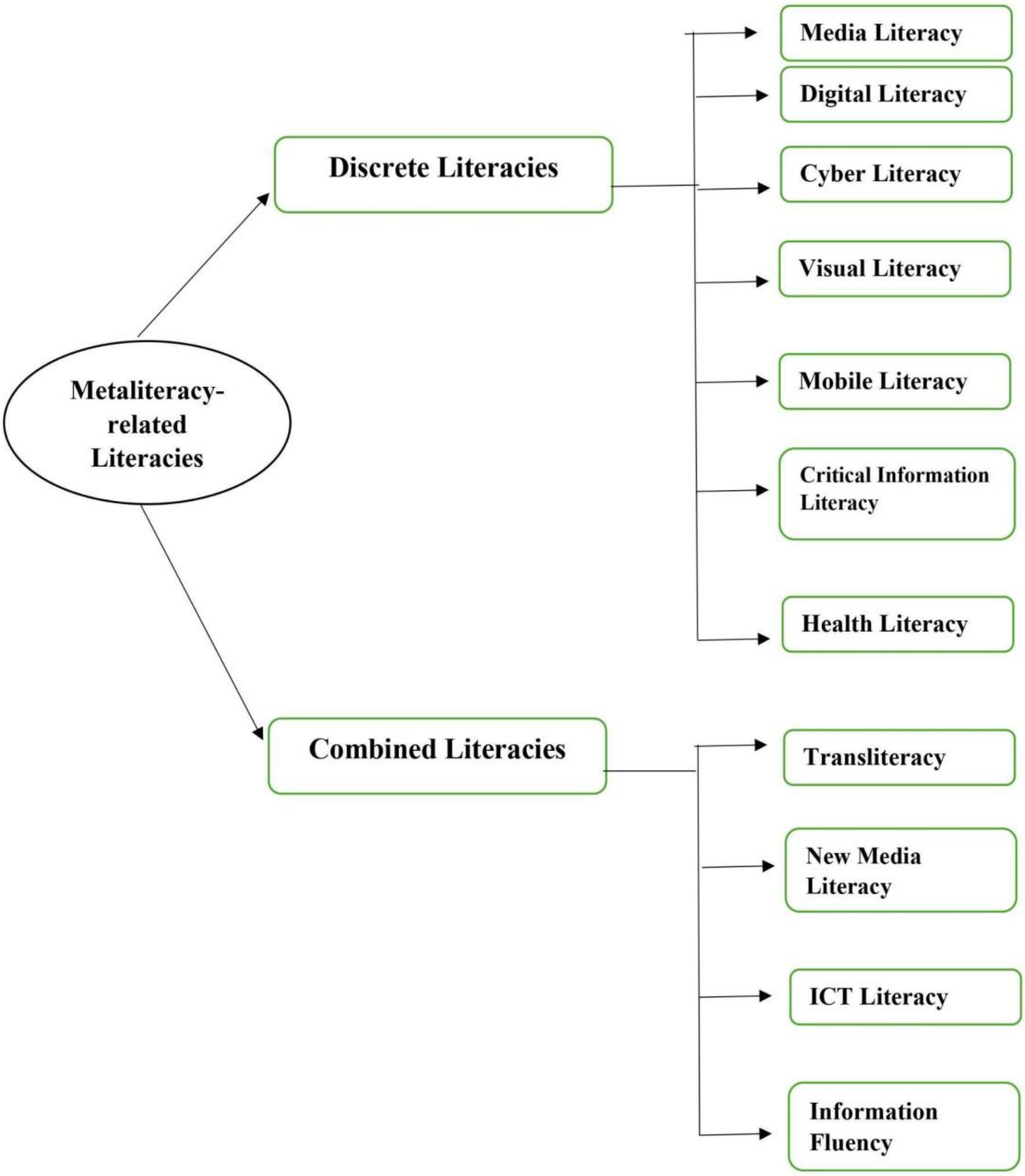
### 1.3.6 Metaliteracy and Related Literacies

The dynamic nature of information literacy's definition has expanded beyond traditional literacy skills, such as reading and writing, into actively participating and sharing to encompass diverse competencies. These multifaceted skills are essential for individuals to thrive as digital citizens in a sustainable digital society (Mammadova, 2022). All these profoundly advanced technologies give birth to many different kinds of literacy types. Change has reflected in the transition from traditional to modern to post-modern and the creation of various literacy types of that time. It is noteworthy that, after two decades of adopting the IL concept, with the emergence of Web 2.0 and the advent of digital social networks, changes occur in the behavior of individuals when faced with information mainly disseminated on social media. Hence, there has been an emergence of a range of diverse literacies: digital, visual, media, cyberliteracy, and fluency in technology (Mackey & Jacobson, 2011).

According to Mackey and Jacobson (2019), “metaliteracy is an independent one; it is only to address such radical changes in the information settings," and the metacognition approach differentiates it from other related literacies. Broadly, the related literacies come under two kinds based on the core characteristics of standard information definition (determine, access, evaluate, understand, use, and incorporate) and provide a foundation for related literacies. The related literacies are categorized into two types: discrete literacies and combined literacies.

**Figure 2**

*Metaliteracy and Related Literacies*




The metaliteracy-related literacy types of discrete and combined literacy are shown in Figure 2, which provides a visual representation of the broad spectrum of literacies required in today's complex information environment. Each literacy type entails specific competencies necessary for effectively navigating, understanding, and utilizing different forms of information and communication. Every kind of literacy and its characteristics are detailed in the following section.

**Table 1**

*Characteristics of Metaliteracy and Related Literacies*

| **Metaliteracy and Related Literacies** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Literacy** | **Characteristics** | | | | | | | | | |
| **Meta** | Determine | Access | Evaluate | Understand | Use | Incorporate | Produce | Collaborate | Participate | Share |
| **Media** | | Access | Evaluate | Analyse | | Create | | | Participate | |
| **Digital** | | Access | Evaluate | Understand | Use | Create | Publish | | Participate | |
| **Cyber** | | Access | Evaluate | Understand | Write | Critique | Design | | Participate | |
| **Visual** | Determine | Find & Access | Interpret, analyse, evaluate | Understand | Use | Create | Design | Participate | | Share |
| **Mobile** | | Access | Credibility detection | Understand | Spatial awareness | Create | Hyper-connect | Collaborate | | Share |
| **Critical** | | More than access | Critically evaluate systems | Understand discipline | Use | Solve problems | Produce | Community | | Share, read, interpret |
| **Health** | | Access to info., | Evaluate credibility, | Analyse risk & | Locate health info. | Interpret test results | Calculate dosages | Community partners | | Shared responsibility |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | services, health care | quality | Benefits | | | | | between patient and physician |
| **Trans** | | Access | Read | Understand | Write | Interact | Produce | Collaborate | Communicate |
| **New Media** | Multitask | Transmedia navigation | Judgment | Stimulation | Play, performance | Distributed cognition | Appropriate | Collective intelligence, negotiation | Networking |
| **ICT** | Define | Access | Evaluate | | Manage | Integrate | Create | Communicate | |
| **Fluency** | Sustained reasoning | Manage complexity | Evaluate | Think abstractly | Test a solution; expect the unexpected | Manage problems | Anticipate changing technologies | Collaborate | Communicate |

Source: (Mackey & Jacobson, 2019)

Table 1 outlines the characteristics of metaliteracy, discrete literacies, and combined literacies, highlighting both commonalities and unique features of each type. Common IL characteristics, such as the ability to *access, understand, evaluate,* and *use* information, are present in most literacies, demonstrating that basic IL is inherently explicit. While the *incorporating* skill is not explicitly stated in other literacies, they possess similar attributes. Additionally, skills such as *produce, collaborate, participate,* and *share* are evident in other literacies, which contribute to redefining the original IL. It also illustrates how related literacies influence metaliteracy, providing a comprehensive model that equips learners for a complex social world (Mackey & Jacobson, 2014). Overall, the diverse and evolving landscape of literacies spans from traditional information literacy to more advanced types, each with distinct yet overlapping skills, reflecting the nature of the modern information environment (Ungerer, 2016).

## 1.4 Need and Significance of the Study

This study addresses the critical need for understanding and implementing metaliteracy among students at IITs in South India. By emphasizing the significance of metaliteracy within higher education in India, the study aims to transform IL instruction into metaliteracy-based instruction, thereby better equipping students for the demands of the 21st century and enabling them to navigate today's complex digital and information landscape. The following points reveal the significance of the study.

### 1.4.1 Need for metaliteracy in higher education.

In higher education, metaliteracy is essential because it enables students to become active, responsible participants in the digital world. Through metaliteracy, students learn to critically evaluate information from various sources, create and share ethical content, and respect diverse perspectives, including social media and online communities. By integrating metaliteracy into the curriculum, higher education institutions can better prepare students for success in the $21^{st}$-century workplace and society. Due to the explosion of online information, metaliteracy goes beyond traditional information literacy to encompass a broader set of skills necessary to navigate, create, and share online content.

### 1.4.2 Need for a metaliteracy assessment.

Considering the importance of metaliteracy in areas like higher education, its assessment is of utmost significance. Currently (as of 2024), there are no specific scales designed to measure metaliteracy. Developing a metaliteracy scale is essential to evaluating students' proficiency in navigating and creating information in today's evolving educational landscape shaped by the digital age. Such an assessment aids educators and librarians in identifying skill gaps and pinpointing areas where students may require additional support or training to become competent and ethical digital citizens. Moreover, it offers valuable insights into the effectiveness of metaliteracy instruction, empowering educators to make informed decisions about curriculum development and instructional strategies (Sales, 2022). By assessing metaliteracy, institutions demonstrate their commitment to staying abreast of the dynamic information landscape, ensuring students acquire the necessary skills to actively and responsibly engage in today's digital world.

## 1.5 Statement of the Problem

In the rapidly evolving digital landscape, where information is abundant and easily accessible, possessing strong skill sets is crucial for academic success and professional development. Metaliteracy is a multifaceted set of literacy skills essential for navigating the complexities of the modern information landscape. Hence, the upcoming generation must be adept at navigating and critically assessing information. Therefore, educational institutions must prioritize inculcating such competencies among the students. IITs are premier educational institutions in India, renowned for outstanding academic excellence and innovative research. Therefore, students must extend beyond academics and ensure their skill set to thrive in this new technological era. In essence, the study addresses the current state of the art and valuable insights into understanding metaliteracy among IIT students. In this context, the study is titled as "***Metaliteracy among the Students of IITs in South India***."

## 1.6 Definitions of the Key Terms

To ensure conceptual clarity, defining the key terms used in the study's title is important. The key terms include Metaliteracy, Student, IIT, and South India.

### 1.6.1 Metaliteracy

According to Mackey and Jacobson (2018), "metaliteracy is intended to promote critical thinking and collaboration in the digital age and provide a comprehensive framework for effective participation in social media and online communities through the acquisition, production, and sharing of knowledge in collaborative online communities."

### 1.6.2 Student

The Cambridge Dictionary defines a student as “a person who is learning at a college or school” (University Press, 1995).

### 1.6.3 IIT

Indian Institutes of Technology (IITs) are a group of autonomous, prestigious engineering and technology-oriented institutes of higher education established and declared as Institutes of National Importance by the Parliament of India (*IITs | Government of India, All India Council for Technical Education*, n.d.)

### 1.6.4 South India

South India, also known as Peninsular India, is the southern part of the Deccan Peninsula in India, encompassing the five states including Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, and Kerala, as well as the union territories of Lakshadweep and Puducherry (South India, 2024).

## 1.7 Objectives of the Study

The objectives of the study are as follows:

1. To develop and validate a metaliteracy scale for the students.
2. To assess the metaliteracy level among the students of five IITs in South India.
3. To understand the subjective experience of students' information behaviour at five IITs in South India.

## 1.8 Hypotheses

The researcher has formulated six hypotheses for testing with appropriate statistical methods.

1. There is no significant difference in students' metaliteracy levels among the five IITs in South India.
2. There is no significant difference in students' metaliteracy levels across the departments of study at the five IITs in South India.
3. There is a significant difference in students' metaliteracy levels across course levels at the five IITs in South India.
4. There is a significant difference in students' metaliteracy levels across different age categories at the five IITs in South India.
5. There is no significant difference in metaliteracy levels among students of different genders at the five IITs in South India.
6. There is a significant difference in students' metaliteracy levels across various socioeconomic status categories at the five IITs in South India.

## 1.9 Profile of the Selected Institutes:

The IITs are Centrally Funded Technical Institutes (CFTIs) situated across India, owned by the Government of India's Ministry of Education, and operated under the Institutes of Technology Act, 1961. As of 2024, there are 23 IITs in India. As per the establishment years, these IITs were categorized into first, second, and third generations. The first IIT was established in India in 1961 and the latest in 2016. This study consists of five IITs from the five southern states of India, which belong to all three generations such as the first (IITM-Tamil Nadu), second (IITH-Telangana), and third generations (IITTP-Andhra Pradesh, IITPKD-Kerala, and IITDH-Karnataka).

### 1.2.1 Indian Institute of Technology Madras -IITM

IITM became the third Indian Institute of Technology among the first-generation IITs, set up by the Indian government in 1959 as a part of the first Indo-German agreement in Bonn with financial support from West Germany. Prof.

Humayun Kabir, the Union Minister for Scientific Research and Cultural Affairs, conducted the inauguration. It is located in Chennai (formerly known as Madras) with a 620-hectare wooded expanse and operates as a residential institute hosting approximately 550+ faculty members, 8000+ students, and 1250+ administrative and support staff. Professor V. Kamakoti has been the Director at IIT Madras since 2022. IIT Madras has 17 departments and an advanced research hub offering undergraduate, postgraduate, and research degrees across Engineering, Science, Humanities, and Management disciplines. It also offers joint degrees, international masters, non-campus BS, exchange programs, and plans for an offshore campus in Tanzania's Zanzibar in 2023. The five-story air-conditioned and wifi-enabled central library offers information services and access to bibliographic, digital, and printed resources, catering to the scholarly and informational requirements of the Institute's community. In 2023, IIT Madras secured the 250th position in the QS World University Rankings, 53rd in Asia, and 1st in the overall category by the National Institutional Ranking Framework (NIRF) (*Indian Institute of Technology Madras*, n.d.).

### 1.2.2 Indian Institute of Technology Hyderabad-IITH

IITH started on 18 August 2008 with technical and financial assistance from the Japanese government at a temporary campus and then shifted to its 600-acre permanent site in Kandi, Sangareddy, by July 2015. The founding Director was Prof. U. B. Desai, and Prof B S Murty has been the present Director of IIT Hyderabad since 2019. IITH has 18 departments that offer undergraduate, postgraduate, and Ph. D programs in all the classical engineering disciplines, applied sciences, design, and several modern interdisciplinary areas as of 2024. According to the QS World University Rankings for 2023, IIT Hyderabad secured a position between 581 to 590 globally and the 49th spot in Asia. Within India, as per the National Institutional Ranking Framework of 2023, IIT Hyderabad stood at the 8th position among engineering institutes and 14th overall.

### 1.2.3 Indian Institute of Technology Tirupati-IITTP

IIT Tirupati, established as one of the newest Indian Institutes of Technology, was inaugurated by the Government of India in 2015. Its establishment marked a significant milestone in expanding the IIT system, aiming to provide quality education and advanced research opportunities in the field of technology and sciences. The Institute started its operations from a temporary campus before moving to its current location. Situated in the serene landscapes of Tirupati, Andhra Pradesh, the Institute operates as a residential campus. While specific details on the faculty, student count, and administrative staff might have evolved since its inception, IIT Tirupati is committed to offering undergraduate, postgraduate, and research programs across various engineering, science, and technological disciplines. The Institute envisions becoming a hub for innovation and academic excellence, fostering a culture of research-driven education and interdisciplinary collaborations among students and faculty. Ongoing developments and aspirations for future expansion are central to IIT Tirupati's growth trajectory within the esteemed network of Indian Institutes of Technology.

### 1.2.4 Indian Institute of Technology Palakkad-IITPKD

IIT Palakkad, one of the newest additions to the Indian Institute of Technology system, was founded by the Government of India in 2015. It began operations temporarily on the Ahalia Integrated Campus, Kozhippara, Palakkad, located in Kerala. In 2018, it moved to its current sprawling campus spread across 500 acres at Kanjikode, Palakkad. The Institute focuses on fostering excellence in education, research, and innovation in various engineering, technology, and sciences fields. With a growing faculty comprising over 70 members and an expanding student body, IIT Palakkad offers undergraduate, postgraduate, and doctoral programs across ten departments. The Institute prioritizes research-driven education, collaborative projects, and interdisciplinary studies, aiming to emerge as a center of academic and technological prominence in the region. As a testament to its growing stature, IIT Palakkad continues to make strides in academic achievements and research endeavors, carving its niche within the prestigious IIT fraternity.

### 1.2.5 Indian Institute of Technology Dharwad-IITDH

IIT Dharwad commenced its operations in July 2016, formerly run in a temporary campus of Water and Land Management Institute (WALMI) in the Belur Industrial Area, located on the outskirts of Dharwad city. IIT Bombay is the mentor institute for IIT Dharwad as part of their mentorship plan. As of 2022, IITDH offers seven courses covering various fields of engineering. Prof Venkappayya R. Desai is the present director of IITDH as of 2024.

## 1.10 Scope and Delimitations of the Study

The study will help understand the level of metaliteracy among the student community of IITs in South India. The study will assess students' ability in the collaborative production and sharing of information in participatory digital environments and the efficiency of technology usage by the sample of students from multiple disciplines within the five IITs such as IIT Madras (IITM), IIT Hyderabad (IITH), IIT Tirupati (IITTP), IIT Palakkad (IITPKD) and IIT Dharwad (IITDH). The comparison of metaliteracy across the institute, course, department, gender, age, and socioeconomic status in a quantitative manner. Besides, the information-seeking behavior was assessed in a qualitative way using the interview method.

The delimitation of the present study is cross-sectional, thereby limiting the generalizability of the findings to this specific demographic. Moreover, only currently enrolled students are included during the data collection period (2022-2023), excluding faculty, staff, and alumnus.

## 1.11 Outline of Thesis

The thesis is structured into five chapters; the appendices and bibliography are provided at the end of the thesis. The overview of each chapter is as follows:

**Chapter I** covers an overview of the metaliteracy framework, its domains, and its relevance in the Indian scenario. It also emphasizes the study's need and significance, problem statement, definition of key terms, study objectives, hypotheses, scope and limitations.

**Chapter II** delves into a comprehensive review of the literature covering both Indian and global studies in the study area. The studies have been categorized into three themes: changing the notion of information literacy into metaliteracy, literacy assessment, and scale construction and validation.

**Chapter III** outlines the study's mixed methodology of three sub-studies, including chosen variables, the data collection tool, sample details, data collection and consolidation procedures, and data analysis techniques employed.

**Chapter IV** comprises the analysis and interpretation of results, presented as tables and graphs for simplified comprehension.

**Chapter V** provides a comprehensive summary of the overall results of the analysis, checks the tenability of hypotheses, and offers study suggestions and recommendations for further research, as well as conclusions of the study.

**Appendices** contain supplementary material that provides a more comprehensive understanding of the content, including metaliteracy scale, detailed results of the factor analysis and supporting documents for the study's analysis. The **bibliography** consists of a complete list of sources that have been used or referenced in the writing of this thesis.

## 1.12 Style Manual Used

In this study, the researcher adhered to APA 7th edition guidelines for references and bibliography, with slight variations in in-text citations.

## 1.13 Conclusion

The chapter aims to provide the groundwork by underscoring the unique contributions of metaliteracy to the broader field of information literacy and highlighting the need to assess and enhance metaliteracy skills, which are essential for students navigating the complex information landscape of the digital age. It provides a detailed explanation of metaliteracy literature, including its theoretical frameworks, learning domains, and the characteristics and roles of a metaliterate learner, and explains the relationship between metaliteracy and other related literacies as it is the conceptual foundation for the study. The need and significance of this study are thoroughly examined, stressing its potential impact on educational practices and clearly defining the problem statement and key terms to ensure clarity and focus. Additionally, the chapter outlines the study's objectives and hypotheses and the scope within the selected IITs in South India. The study's results will significantly enhance educational strategies and develop metaliterate learners, ultimately preparing students to effectively engage with and contribute to the digital world.

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# CHAPTER 2

# REVIEW OF LITERATURE



*Purpose of this chapter is to review literature related to the study topic, organized into three sections. It draws on relevant data from various sources published over time, which serves as the study's foundation.*

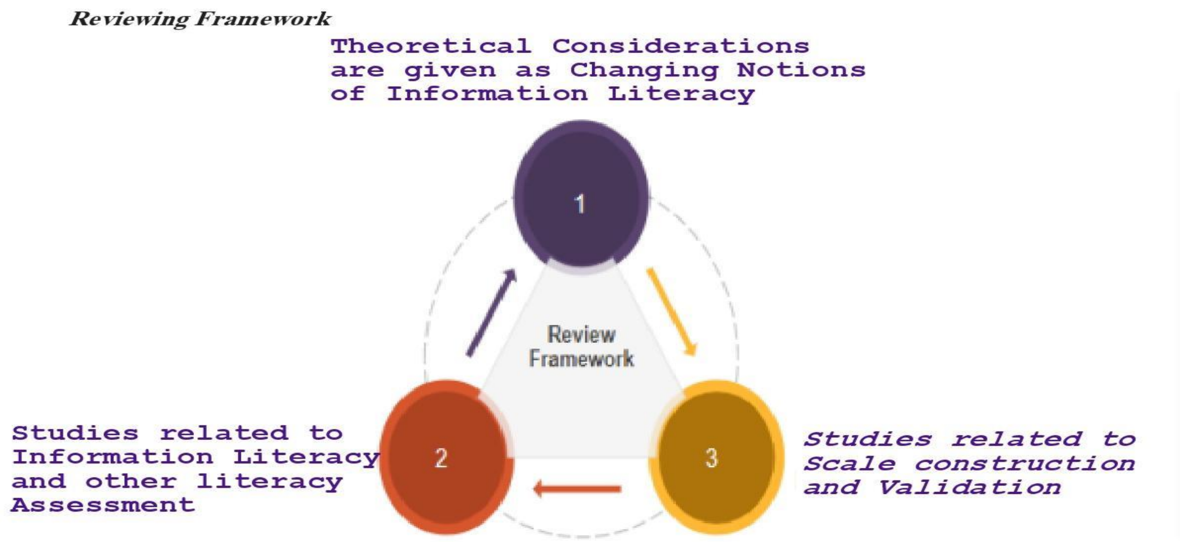

*Haseena.V.K.K.M and Abdul Azeez.T.A "Metaliteracy among the Students of IITs in South India" Thesis. University of Calicut,2024*

## 2.1 Introduction

This chapter aims to lay the theoretical framework and development of groundwork related to metaliteracy research and examines various other literacy types relevant to the present study. The literature review is organized into three sections, which primarily include studies that illustrate the conceptual advancement of metaliteracy from information literacy and other various types of literacies; secondly, different literacy assessment tools and instruments; thirdly, scale construction and validation-associated literature. It may investigate how assessing literacy skills contributes to students' learning outcomes, critical thinking abilities, metacognitive process, and information literacy competencies. The review framework is structured into three sections covering all the related studies, as illustrated in figure 3.

**Figure 3**

*Reviewing Framework*




The scholar thoroughly examined numerous studies across various databases to gain insight into different aspects of the research problem and narrated lessons learned from previous researchers and practitioners. In addition to English-written publications, other language publications were reviewed after being translated into

English. Studies for the literature review were retrieved from various platforms and databases, including SCOPUS, Google Scholar, Web of Science, EBSCO, ERNET PsycINFO, ProQuest, Shodhganga, and open archives repositories. Moreover, academic social media networks and open educational resources (OER) were utilized. Despite digital documents, some print resources also were referred from CHMK Library and IIT Hyderabad Library. The search was performed using keywords including metaliteracy, information literacy, digital literacy, multiple literacies, scale construction, literacy assessment, metacognition, types of literacies, media literacy, etc. After extensively reviewing numerous studies, the relevant ones were carefully chosen and incorporated into this chapter. The thorough examination of existing research and scholarly literature on this topic helps to identify gaps, trends, and contradictions in current knowledge. It helps to establish the rationale and significance of new research studies.

The following are the three major sections of the literature review:

1. **Changing Notions of Information Literacy into Metaliteracy**
2. **Metaliteracy and other Information Literacy Assessment**
3. **Scale Construction and Validation**

## 2.2 Changing Notions of Information Literacy into Metaliteracy

Changing notions of information literacy refer to the evolving conceptualization of what it means to be information literate in response to the dynamic nature of information and technology. This literature review indicates the transition from traditional information literacy into a new literacy called metaliteracy. This changeover has undergone different phases and various literacy types, such as digital, media, health, transliteracy, etc. Information literacy has evolved over time as the ways of accessing and interacting with information have changed. Many happenings have led to changing notions of information literacy, from the paradigm shift from print to digital, due to the advent of the internet (Spezi, 2016). A thorough examination of studies related to the evolution stages of these literacy types were mentioned in detail.

Information literacy's early roots trace back to the 19th century. IL has been an active concept since it was first coined by Paul Zurkowski in 1974, and there has been much discussion in the literature about the term and its definition since its inception. The concept has been continually clarified over the past few years through different models and standards created, and various definitions were proposed (Kurbanoglu, 2013). A plethora of definitions were found in the literature, and most were very prominent in the area of library and information science. The widely accepted definition of higher education is given below by American Librarian Association (ALA) in 1989.

Information literacy is a set of abilities requiring individuals to *"recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information."*

Such a definition simplifies the task of IL, which is to seek, evaluate, use, and create for the needs of the users. In other words, IL is a set of abilities requiring individuals to recognize when information is needed and to locate, evaluate, and use the needed information effectively. Several other efforts have been made to define the concept better in different contexts. IL defined as a human rights issue in the 2005 Alexandria Proclamation.

"*Information literacy empowers people in all walks of life to seek, evaluate, use and create information effectively to achieve their personal, social, occupational and educational goals. It is a basic human right in a digital world and promotes social inclusion in all nations*" (Garner, 2005).

IL has been defined in multiple ways by incorporating various concepts and components. IL is considered a critical component of lifelong learning and emphasizes its importance in developing critical thinking skills to navigate the increasingly complex information environment and empowering individuals to participate fully in a democratic society (Bruce, 1997). Then, the definition of IL integrates the ability to locate and evaluate digital resources such as online databases, search engines, and social media platforms. Once digital data emerged, the focus turned to critical thinking. The IL is not just limited to finding and using information but also critically evaluating it. It includes analyzing the credibility and bias of sources and recognizing misinformation and fake news (El Rayess et al., 2018). The era comes with the collaborative learning process, where individuals work together to share information and build knowledge, including working in online communities and using social media to collaborate (McLoughlin & Lee, 2007). With the changes in technologies, it is essential that individuals need to develop and refine their skills over time through lifelong learning. It helps to learn new technologies and tools for accessing and evaluating information. With the increasing globalization of information, information literacy now includes the ability to locate and evaluate information from different cultures and perspectives. This includes being able to navigate information in different languages and understanding the cultural context in which information is produced and shared globally (Caena & Redecker, 2019).

The changing notions of IL can be grouped into three broader captions such as *social*, *technological* and *cultural* changes (Kapitzke, 2001). These changes have influenced the way create, access, evaluate, and use information. Social changes have impacted IL by altering the ways in which people communicate, collaborate, and access information. The rise of social media created new opportunities for individuals to connect and share information and requires critical thinking skills to evaluate the accuracy and reliability of the information shared (Kling, 2000). Technological changes have also had a significant impact on IL. The widespread availability of digital technologies has transformed the way produce, distribute, and consume information. People must now navigate complex digital environments through search engines and databases to find information and evaluate its credibility (Bruce, 2003). Cultural changes have also affected the way approach IL. Different cultures have different attitudes toward information, privacy, and knowledge-sharing. Therefore, it is important to consider cultural perspectives when developing IL programs and policies (Al-Alawi et al., 2007).

Information literacy has established itself as an important subfield of librarianship with the goal of organizing and making books accessible to as many people as possible. The library professional used to provide user education for educating users to navigate the required information. However, despite the fact that librarians promote information literacy by enhancing democratic participation by all citizens, their efforts to improve the '*quality control'* of information rely on authentic sources (Pawley, 2003).

In the IL evolution, a series of other literacies emerged due to expanding knowledge and changing mediums. The transformation of information literacy into other literacies can happen in several ways, as follows.

a) ***Integration of concepts***: IL concepts and skills can be integrated with other literacies to create a more comprehensive approach. For example, in digital literacy, information literacy skills are adapted to include digital technologies (Koltay, 2011).

b) ***Building on existing skills***: IL skills can be built upon to create other literacies. Media literacy builds on information literacy skills by including the ability to analyze and evaluate media content that as an integration of existing skills.

c) ***Expansion of knowledge***: Information literacy knowledge can be expanded to cover other topics and areas. Such as financial literacy expands on information literacy by including knowledge about personal finance (Remund, 2010).

d) ***Application of skills***: Information literacy skills can be applied to different contexts to create various literacies. Cases like civic literacy apply information literacy skills to understand how the government works.

e) ***Collaboration***: Collaboration between different subject areas and disciplines can lead to the transformation of information literacy into various literacies. Educators in different disciplines can collaborate to create interdisciplinary approaches that integrate information literacy concepts and skills with other literacies (Lotherington & Jenson, 2011).

Overall, Information literacy is an essential skill for navigating the rapidly evolving technological landscape of the twenty-first century. As technology continues to permeate every aspect of society, individuals must become proficient in accessing, evaluating, and utilizing information effectively. The concept of information literacy is broad and involves a wide range of skills, including critical thinking, problem-solving, and communication (Chen, 2023). The ability to distinguish between reliable and unreliable information, to understand and interpret data, and to effectively communicate information to others is crucial in today's interconnected global community. The traditional IL concept has been amalgamated into several other literacies due to the dynamic nature of information, and different models and frameworks have also evolved.

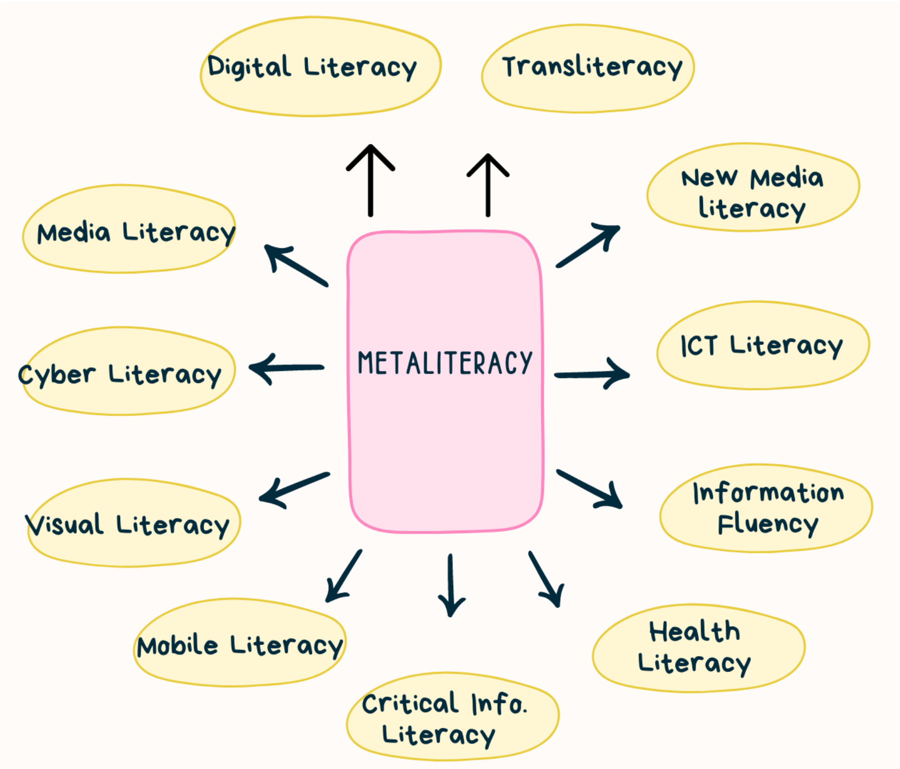
Eisenberg and Berkowitz (1990) developed a model of information literacy that emphasized the importance of information-seeking strategies, evaluation of information sources, and communication of information. The model reflected a more active and participatory approach to information literacy that was needed to address the changing nature of information in the digital age. Most of them agreed that the IL concept needed to be broadened to include not only traditional sources of information but also new forms of media and communication technologies. In another study, Koltay (2011) emphasized the importance of media literacy, digital literacy, and visual literacy in the development of a comprehensive approach to information literacy.

In 2015, the Association of College and Research Libraries (ACRL) revised its Information Literacy for Higher Education framework to better align with the evolving landscape of information in the digital age. The Framework emphasizes the importance of critical thinking, creativity, and adaptability in the development of information literacy skills. It also acknowledges the role of technology in creating, disseminating, and evaluating information (American Library Association, 2015). The updated framework introduces six core concepts, known as "frames" each representing a different aspect of information literacy: "*Authority Is Constructed and Contextual*" emphasizes that information sources are influenced by their creators' authority, which varies by context and needs, "*Information Creation as a Process*" recognizes the various stages through which information is produced and disseminated; "*Information Has Value*" acknowledges the economic, social, and educational value of information; "*Research as Inquiry*" views research as an iterative process of asking questions and seeking answers; "*Scholarship as Conversation*" understands scholarly work as part of an ongoing dialogue among researchers; and "*Searching as Strategic Exploration*" approaches information seeking as a strategic and flexible process. Meanwhile, The International Society for Technology in Education (ISTE) has established standards for K-12 students utilizing technology in the classroom. The standards encompass seven key areas: empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator (Aird & Mackey, 2024). Several standards have been developed over time, but all aim to support lifelong learning and informed citizenship by equipping individuals with the necessary skills to navigate and assess information in various contexts.

Information literacy is not only limited to academic settings but also applicable across many contexts, including personal, professional, and civic life. In the current digital age, the concept of information literacy has become more complex and nuanced, as the sheer amount of information available makes navigating and evaluating it increasingly difficult. As such, the ability to be information literate is crucial to becoming a successful and informed member of society (Haider & Sundin, 2022). The '*information literate*' is called a 'digitizen' who is capable of handling multiple literacies. These new forms of literacies include digital, media, cyberliteracy, health, visual, mobile, ICT, new media literacy, transliteracy, etc. It is crucial to observe how new literacies are being used in real-world settings around the globe. All these literacies have their own characteristics, and they are essential in today's information world.

**Figure 4**

*Metaliteracy and Related Literacy Types*




➢ **Digital Literacy**

The phrase 'digital literacy' emerged during the 1990s and was used by a number of authors this term to describe the ability to read and write in multimedia format; among them, prominently Paul Gilster introduced it. As the use of digital technology became more widespread, the definition of digital literacy continued to evolve and be defined in a variety of ways, such as the ability to find, evaluate, use, and create information using digital technology (Lloyd & Talja, 2010). The digital literacy "involves the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills" (American Library Association, 2013). Thus, digital literacy has become an essential component of education as technology has become ubiquitous in our daily lives and the workplace. It requires both technical skills to operate various communication technologies, as well as soft skills, such as writing and critical thinking, to evaluate and produce digital content. Digital literacy is becoming increasingly important for students of all ages, as savvy consumers need to be able to understand, analyze, create, and communicate information using a range of different technologies (Mohammedyari & Singh, 2015).

As digital technologies continue to play an increasingly important role in our lives, it is essential that individuals possess the skills and competencies needed to navigate the digital world effectively and responsibly. While information literacy has traditionally focused on the skills and competencies required to locate, evaluate, and use information, digital literacy encompasses a broader range of skills and competencies that enable individuals to effectively navigate the digital world (Belshaw, 2012). In today's information landscape, individuals must be able to effectively navigate and utilize digital tools and platforms to access, analyze, and communicate information. A range of skills is required, including using search engines and databases, evaluating digital sources, and effectively communicating using digital technologies (Haleem et al., 2022). The key aspect of the shift to digital literacy is the increased focus on digital citizenship, which includes issues such as online safety, privacy, and responsible use of digital resources. However, information is increasingly available in digital format, and individuals must be able to effectively navigate the vast amount of information available online to locate reliable and relevant sources.

Digital literacy is about equipping students with the skills to use digital technologies to understand, evaluate, and create content in a global digital world. It's not just about using technologies like the internet but rather having a strong technological skill set that allows individuals to communicate effectively through social media platforms, access information online, and use other digital communication tools. Digital literacy encourages to think critically and responsibly when using computers, the internet, and social networks, allowing us to embrace our ever-growing digital world with enthusiasm (Dicks, 2009).

Developing digital literacy skills is essential for modern living and involves learning how to use technology responsibly and safely. Digital education includes teaching internet safety, such as creating strong passwords and understanding privacy settings on social media networks. Such knowledge is an important part of a person's general education, integrating technology into daily life. To fully benefit from modern methods and technologies for communication, a basic understanding of the internet is necessary (Tomczyk, 2020). Digital literacy includes practical skills such as how to create websites or make YouTube videos, as well as understanding when it is appropriate to use certain technologies in a sustainable way. With technology becoming more sophisticated each day, digital literacy is important for people of all ages to be able to understand a broader range of digital tools. People with digital literacy are able to manipulate data on Excel sheets and even read books on their Kindle devices; this knowledge gives them access to new communication channels that were not available before (Buckingham, 2015).

There are numerous studies addressing students' digital literacy. Khulwa and Luthfia (2023) focused on a study that examined to what extent digital literacy prepares students for success in online courses. The study was conducted using a quantitative survey method, among which four hundred and twelve students from an Indonesian university were surveyed with a stratified random sampling technique to provide a representative sample across academic departments. Students' existing levels of digital literacy impact their readiness for online learning, especially in critical thinking and information literacy. Lack of technological and communication literacy still prevents any noticeable change. The results of this study show that enhancing students' digital literacy can enhance their preparedness for online learning.

In a case study, Reza et al. (2022) investigated the EFL (English Foreign Language) student digital competence profile. A total of 21 people were treated, including students of the English Education Study Program and the Faculty of Teacher Training and Education at Universitas Muhammadiyah Cirebon. A sample of 12 people was taken, and data were collected from them using observation, a digital literacy competence questionnaire, and an unstructured interview. The result revealed that students have good competence in ICT literacy and media literacy. The students can use digital literacy as a media and learning resource because of its wide range of applications.

Meanwhile, Harerimana et al. (2022) evaluated digital literacy among first-year nursing students at a South African institution. The population comprised 82 nursing students from the four-year nursing program. The findings revealed that the students have basic computer abilities, internet skills, internet access, and internet literacy. Adequate digital literacy at the entry level of the nursing program is critical for academic performance and future use of technology in nursing education and practice. The overall score for online abilities was higher in the female group than in the male group, and the overall score for digital device usage was higher in the 20-year-old and older age groups. Many similar studies highlight the necessity of digital literacy among various communities by underscoring the requisites in the digital age.

- ***Media Literacy***

Media literacy is a 21st-century educational approach. It provides a framework for accessing, analyzing, evaluating, creating, and interacting with communications in various formats, including print, video, and the Internet. Media literacy fosters an understanding of the role of media in society, as well as the essential skills of inquiry and self-expression required of democratic citizens. Due to the widespread availability and consumption of media content, media literacy has become increasingly important in modern times (Livingstone, 2004).

Several frameworks and models have been created to guide the instruction and evaluation of media literacy skills. The prominent five core concepts of the media literacy framework developed by the National Association for Media Literacy Education (NAMLE) outlined five key concepts for media literacy: media construction, language, representation, audiences, and effects (Thoman & Jolls, 2004). Other frameworks, such as the TAP framework (Text Audience Production), focus on three key competencies in media literacy. By using the TAP framework, people can learn to identify the different elements of a media message, understand its purpose, and evaluate its accuracy and bias. It can help people to make informed decisions about the information they consume and to be more resistant to the influence of the media (Considine, 2009). The digital media literacy framework identifies nine essential skill topics based on research. It provides resources for each category, such as reading media, media representation, finding and verifying, ethics and empathy, privacy and security, consumer awareness, community engagement, and making and remixing (Lim et al., 2009).

Many studies were conducted among various student communities to assess media literacy. In an embedded mixed design study, Ulu-Aslan and Baş (2023) checked how modern fairy tales can improve critical thinking and media literacy skills in education. The study involved 43 seventh-grade students from a school in Mus, Turkey, during the 2021–2022 academic year. Over eight weeks, one group engaged in activities using fairy tale-based media, while the other group followed traditional textbook lessons. Various tests and interviews were used to collect data on critical thinking and media literacy skills. The results showed that the group using fairy tale media activities demonstrated significant improvement in these skills compared to the control group. Additionally, observations and student work indicated enhancements in reflective and creative thinking. The quantitative findings were supported by qualitative data, providing insights into how these improvements occurred.

In another study, Esmaeil Pounaki et al. (2022) checked the relationship between media literacy and information literacy among postgraduate students in communication science and information science at Tehran University and Allameh Tabatabai University by using applied research with a survey-correlation method. The Cronbach's Alpha value of 0.936 was used as the questionnaire's reliability and descriptive and inferential statistical methods. The findings indicated that students' information and media literacy levels were above average. Students' media literacy has a strong correlation to their family's socioeconomic status. The Pearson correlation test also revealed a statistically significant relationship between the media literacy and information literacy variables.

In summary, studies suggested that media literacy is an essential educational approach in the 21st century, offering a robust framework for individuals to navigate and critically engage with diverse forms of media. By equipping people with the skills to access, analyze, evaluate, create, and interact with media content, media literacy fosters informed and active participation in a democratic society. As media continues to permeate every aspect of daily life, enhancing media literacy remains crucial for empowering individuals to make informed decisions and resist undue media influence.

- **Cyber Literacy**

Cyberliteracy concerns the knowledge, skills, and competencies required to effectively navigate, understand, and engage with cyber technologies, online platforms, and the broader digital environment. It encompasses understanding digital citizenship, online safety and security, information literacy, critical thinking, ethical behavior, and the responsible use of digital resources. COVID-19 has caused people to become more dependent on cyberspace, making them vulnerable to cyberspace risks. Libraries can help reduce security breaches caused by human error (Kont, 2023). Many studies discussed cyber literacy in terms of security awareness, cyberattacks, and related issues.

A survey was carried out by Ismailova and Muhametjanova (2016) to check students' information security awareness rate in Kyrgyz Republic. A sample of 172 students from various university departments was collected, and results revealed that despite the large number of reports about computer crimes on the internet, cybercrime awareness is relatively low, and students are generally unaware of many aspects of computer crime. This investigation was conducted to ascertain the relationship between students' information security awareness, computer literacy, and educational background. Concluded that despite the widespread use of information technology, information security topics must be taught to prevent individuals from becoming victims of cybercrime.

Zwilling et al. (2022) examined the relationships between cyber security awareness, knowledge, and protection instrument use among individuals in Israel, Slovenia, Poland, and Turkey. The results indicated that internet users were adequately aware of cyber threats but employed only typically common rudimentary protective measures. The correlation between cyber literacy and cyber awareness was exhibited. The interaction between awareness, knowledge, and behavior varies depending on the country and the connection between awareness and protection mechanisms.

In another study, Khulwa and Luthfia (2023) investigated cyber-attack awareness training effectiveness in humans under the dimensions of technical optimism, cyber optimistic bias, cyber self-efficacy, and general worry responses to a cyber-attack. A revised “Stimulus-Organism-Response” theory was used to check Generation Z's (born late 1990s and the early 2010s) awareness of countermeasures after an attack. This study failed to demonstrate the utility and need for Generation Z to be aware of countermeasures "after" a catastrophic cyberattack. The level of technical optimism and cyber self-efficacy decreased. However, reading countermeasures did not enhance the optimism and self-efficacy of the subjects after the attack happened.

However, the computer system is only as secure as its weakest link. Often, organizations and nations invest in technologies, neglecting that information security cannot be guaranteed without user education. Therefore, employees and users are usually the weakest link in the security chain. Organizations can significantly enhance their overall security posture by training individuals to recognize and respond to potential security threats.  Ismailova and Muhametjanova (2016) tested the cybercrime awareness rate of users in two Central Asian countries. Students from two public universities in each country were selected as the target population. In Kazakhstan, the gender and age of respondents affect the rate of cybercrime awareness, whereas in Kyrgyzstan, neither factor has an effect. Although, there was a statistically significant difference in the cybercrime awareness of users based on their country of residence. There was a slight variation in the information security knowledge among students in two Central Asian countries.

Ultimately, the body of research on cyber literacy underscores its critical role in fostering security awareness, understanding cyberattacks, and addressing related issues such as data privacy and ethical technology use. As our reliance on digital technologies continues to grow, so does the complexity and prevalence of cyber threats. Therefore, enhancing cyber literacy is essential for equipping individuals and organizations with the knowledge and skills to navigate the digital landscape safely and responsibly, as well as the need to integrate comprehensive cyber literacy education into various sectors.

- **Visual Literacy**

Visual literacy refers to the ability to interpret, understand, and communicate through visual images. It involves the skills and competencies necessary to analyze, evaluate, and make meaning from visual representations such as photographs, charts, graphs, diagrams, videos, and other visual media. Visual literacy goes beyond simply perceiving images; it encompasses the capacity to comprehend the messages, symbols, and visual elements within a given context and to effectively communicate using visual means. Visual literacy is essential in today's visually saturated world, where images play a significant role in communication, advertising, journalism, education, and various fields. It enables individuals to decode and understand the intended meanings, messages, and visual rhetoric embedded within images (Brill & Maribe Branch, 2007). Visual literacy also encompasses the ability to create and produce visual content, utilizing design principles, aesthetics, and visual storytelling techniques to effectively convey ideas and information.

Schönborn and Anderson (2006) discussed the nature and significance of visualization in biochemistry education and claimed that students should be explicitly taught visual literacy and the skills for utilizing visualization tools as required components of all biochemistry curricula. This study found that relatively little pedagogical attention has been paid to this critical component of biochemistry education despite the fact that a wide range of static, dynamic, and multimedia visual presentations continues to flood current educational resources exponentially. Findings revealed varied levels of visual literacy among different science education domains and research experience of students in biochemistry education and proposed criteria for promoting visualization and visual literacy among students.

Brown and Savić (2023) stated the importance of critical visual literacy (CVL) in intercultural learning and showed a redesign task implemented with secondary school EFL students in Norway. CVL is an approach to picture reading that recognizes that all texts were constructed rather than neutral and attempts to position the reader to embrace a specific worldview. Redesign projects allow students to think critically about these ideas and generate alternative texts that reflect their personal worldviews. It demonstrated how the work fostered critical reading, investigation of multiple perspectives, and engagement with socio-political issues. Such critical reading abilities were essential for navigating the increasingly complex visual and multicultural landscapes that students face in their daily lives.

Another study explored undergraduate students' experiences with visual reflection in a visual studies class using a phenomenographic approach to analyze 29 visual journals and a thematic analysis of 9 semi-structured interviews. The goal was to understand how visual reflection can help students enhance their multimodal literacy skills. The study suggested that incorporating visual reflection across all areas of knowledge creation is beneficial because it improves academic learning, builds multimodal literacies, and promotes knowledge visualization (Guglietti, 2023).

Developing visual literacy skills allows individuals to become critical consumers and creators of visual media, empowering them to navigate and analyze the visual information presented in their daily lives. It enhances communication, promotes critical thinking, fosters creativity, and enriches the understanding and interpretation of visual representations across different contexts and disciplines (Hattwig et al., 2013). Perhaps visual literacy is crucial for students as it enhances their ability to interpret and communicate complex information effectively through images and visual media, fostering critical thinking and creativity.

- **Mobile Literacy**

The importance of mobile literacy, especially during COVID-19, cannot be overstated. With the sudden shift to remote learning and working, people of all ages had to learn how to use their mobile devices in new and innovative ways. Mobile literacy is the ability to use mobile devices to access, create, and share information and to communicate effectively. It is a critical skill in today's world, and it is even more important during a pandemic when people rely on their devices more than ever before (Pinto et al., 2021). Studies on various mobile technologies across different communities were discussed.

Slepneva and Ladosha's (2022) conference paper discussed how the Department of Foreign Languages at a technical university adapted to teaching remotely during the global pandemic. It covered the readiness of language teachers for online teaching based on both technical skills and teaching methods. The article also shared findings from a survey of undergraduate students, views based on faculty members' ICT skills, and their satisfaction with remote learning. The study found a connection between students' overall satisfaction with online classes and teachers' proficiency with computers and mobile devices, as indicated by Spearman's correlation coefficient.

Taylor (2017) analyzed how teenagers aged 15-16 navigate their use of mobile technologies in educational settings, drawing from a social theory of literacy. The study merged insights from sociological studies of mobile technologies and emerging literacy practices to create a theoretical framework for understanding mobile device literacy, especially within social contexts. It explores individuals' behaviors concerning economic, social, cultural, and symbolic factors. This research developed key concepts like the "mobile field," the "monopoly-membership dynamic," and "digital travelers," which offer valuable insights for analyzing current educational and literacy trends.

Jere-Folotiya et al. (2014) examined the impact of a computer-based literacy game called GraphoGame™ on the literacy skills of first-grade students in an African urban area. The study involved 573 first-grade students from Government schools, randomly assigned to either a control group (314 students) or various intervention groups (259 students). The GraphoGame™ was implemented on cellphones provided to students at their schools and supervised by teachers. Each student underwent assessment using a set of locally developed cognitive tests, measuring emergent literacy skills (Orthography test), decoding ability (Spelling test), vocabulary (Picture Vocabulary Test—PVT), and arithmetic (Zambia Achievement Test—ZAT). The results indicated that the game positively impacted the Spelling test, aligning with the skill GraphoGame™ aimed to enhance. The most effective intervention involved exposing both teachers and students to the game. Additionally, students' initial letter knowledge was found to have predicted their proficiency. Collectively, these studies emphasize the critical role of mobile literacy in navigating today's digital landscape, particularly in times of crisis, and provide valuable insights for educators, policymakers, and researchers.

- **Critical Information Literacy**

Critical information literacy is a type of information literacy that focuses on the ability to evaluate information critically. It is a skill that is essential in today's world, where bombarded with information from a variety of sources. Critical information literacy can help us to identify reliable sources of information, to evaluate the credibility of information, and to use information effectively (Tewell, 2015). Unlike traditional library instruction, which focuses on finding and evaluating information, critical library pedagogies aim to empower students to analyze and question the power dynamics that shape the perceived value of information.

Kastner and Cheng (2019) conducted a study focusing on the critical information literacy of engineering students enrolled in a foundational course during their first semester, which included a project related to the National Academy of Engineering Grand Challenges. Over the initial two years of the study, the course coordinator and the engineering librarian worked together to provide literacy instruction to one team by helping them access resources and meet referencing requirements. The findings showed that 77% of the teams successfully met the referencing requirements. In contrast, only a small percentage (5%) failed to meet these requirements, where instructions were not applied.

Educational innovations like digital badges are a great way to track progress toward goals like information literacy. However, few quantitative studies have determined what employers think about digital badges or information literacy skills. Raish and Rimland (2017) conducted an online survey among college graduates to know the usage of digital badge technology and understand what skills students have learned from the employers. The findings revealed that workplaces value information literacy and metaliteracy; employers want more specific student skill representations; digital badges can be a kind of recognition for students' hard work. From these studies, it's clear that critical information literacy is crucial in today's information-saturated world. Collaboration between educators and librarians significantly enhances students' ability to navigate and evaluate information effectively.

- **Health Literacy**

Health literacy refers to an individual's ability to obtain, understand, and apply health information and services to make informed decisions about their own health. It involves various skills, such as reading and numeracy, as well as the capacity to evaluate and navigate health-related information (Liu et al., 2020). Many studies were conducted on health literacy and its assessments across the globe.

Yasemi et al. (2023) investigated how university students' electronic health literacy and quality of life (QoL) were impacted during the COVID-19 pandemic. The study employed a cross-sectional method, administering two questionnaires—the E-Health Literacy Scale and the World Health Organization QoL—to 260 health students at Semnan University of Medical Sciences in Iran. Analysis was conducted using multiple logistic model regression. The findings revealed that 84.2% of students exhibited strong e-health literacy, and 76.4% reported good QoL. Additionally, students' e-Health literacy was positively associated with proficiency in the English language and Internet skills. These results underscore the importance of promoting electronic health tools among university students to enhance QoL during the COVID-19 pandemic.

Similarly, Fatemeh Zahra Ahmadi et al. (2018) assessed health literacy and its determinants among students at Farhangian University. The study involved 932 students who completed face-to-face administration of the Health Literacy for Adults (HELIA) test. Additionally, participants responded to a 33-item questionnaire covering five dimensions of health literacy: health information, reading, understanding, appraisal, and behavioral intention, using a five-point Likert scale. Descriptive statistical tests were employed for data analysis. The study revealed that age, gender, and marital status significantly influenced health literacy levels among the student population. The findings underscored the importance of developing, implementing, and evaluating educational interventions to address limited health literacy among students.

Overall, studies suggest that health literacy plays a crucial role in empowering individuals to make informed decisions about their health. It also underscored the importance of enhancing health literacy among diverse populations and implementing targeted interventions to improve health outcomes and decision-making abilities.

- **Information Fluency**

Building strong faculty-librarian partnerships is crucial for preparing students for information fluency. Such collaborations enable educators and librarians to work together to promote effective research skills, critical thinking, and information literacy among students Raish and Rimland (2017) highlight the importance of such partnerships in promoting research skills, critical thinking, and information literacy among students.

Additionally, Sharkey (2006) analyzed information literacy, critical thinking, and computer literacy in higher education and discussed the application of the information fluency model created by the Associated Colleges of the South. The two-fold review case study primarily reviewed literature on higher education information literacy, critical thinking, and computer literacy. The second portion described the pilot GS 175 Information Strategies course, applied the information fluency model, and evaluated its success.

The results indicated that employers, educators, and students demonstrated robust critical thinking, analytical, research, and technology skills. It was emphasized that universities were responsible for integrating technology faster, and information retrieval and library instruction programs and courses needed to evolve and adapt according to the courses. Overall, these studies emphasize the need for collaborative efforts and innovative approaches to prepare students for information fluency in an increasingly digital world.

- **ICT Literacy**

Information and Communication Technology (ICT) literacy refers to the ability to use digital technology effectively to access, manage, evaluate, and create information. It encompasses a range of skills and competencies, including basic computer skills such as using word processing software and internet browsers, as well as more advanced abilities like data analysis, digital communication, and media literacy. Many studies stated that ICT literacy is essential in today's digital world, enabling individuals to navigate and thrive in various personal, educational, and professional contexts.

Scherer and Siddiq (2019) examined how students' socioeconomic status (SES) relates to their ICT literacy levels through a meta-analysis. They analyzed data from 32 K-12 student samples using three-level random effects modeling. The analysis revealed a noteworthy finding: while a positive and significant correlation between SES and ICT literacy was relatively small in magnitude. It also suggested that a relationship between socioeconomic status and ICT literacy is not as strong as the associations typically found in mathematics and reading domains. This observation underscores a gap in ICT education, indicating a need for further exploration and targeted interventions to address disparities in ICT literacy among students from different socioeconomic backgrounds.

Alternatively, in a different study, Miftakhurrohmah et al. (2023) investigated the impact of guided inquiry-based E-Module learning on students' critical thinking skills and ICT literacy. The study included 207 Indonesian students. The results revealed a significant influence on students' critical thinking skills and ICT literacy after treatment using Guided inquiry-based E-Modules. The use of Inquiry-Based E-Modules to implement the syntax of students' critical thinking skills had a positive impact on students.

Another study was conducted by Moto et al. (2018) among junior high school students to assess $21^{st}$-century information, media, and ICT literacy. A sample of 380 students was selected per the five-level multistage clustering sampling. The data were collected using a 73-item Likert-type agreement scale questionnaire in 2017. The confirmatory factor analysis, Bartlett's test of sphericity, standard deviation, and the Kaiser Meyer Olkin (KMO) test were performed as data analysis. The findings revealed that ICT literacy is more prevalent than media and information literacy.

Similarly, Lembani et al. (2023) looked into students' readiness and experience with the fast-paced convergence of ICT and higher education. In total, students were profiled using structured text-based online interviews. ICT material possession and competencies, as well as their experience with Open Distance and Open Learning (ODeL), were collected and analysed. According to the findings, the majority of students (72%) who had prior knowledge about the basic ideas of ODeL modalities expressed satisfaction with the e-learning environment. In contrast, traditional students (28%) found the learning mode problematic. There were statistically significant correlations between ICT competencies or preparedness and the level of prior academic qualifications. To ensure that students are not left behind as ICT in distance education proliferates, principal component analysis revealed that prior knowledge of the ODeL modalities is an important attribute that contributes to students' preparedness for the e-learning environment, thus bridging the gap between expected and actual expectations. In summary, these studies collectively underscore the complex interplay of factors influencing ICT literacy among students and the importance of adopting innovative approaches to enhance ICT education and support students' digital literacy development.

### New-media Literacy

With the emergence of new media technologies, individuals are expected to consume, produce, share, and critique digital content. In order to be literate in new media, they must also understand the sociocultural and emotive aspects of new media in addition to its technical characteristics. New media literacy (NML) is a set of essential abilities required for living and working in the 21st century's mediated and participatory society. Koc and Barut (2016) attempted to fill out this gap by constructing a theoretically-grounded New Media Literacy Scale (NMLS) for university students. A sample of 1226 students from state universities in Turkey was selected to develop a 35-item NMLS with four factors such as -functional consumption, critical consumption, functional presumption, and critical presumption by using both the exploratory and confirmatory factor analyses. The construct validity and reliability were determined by incorporating internal consistency coefficients, item-total correlations, and item discrimination powers. Within the contexts of pedagogy and research, potential uses of NMLS for assessing students' new media literacy were addressed. Meanwhile, a reliable and valid 86-item instrument has been developed by L. Lee et al. (2015) to measure youth's NML based on the same framework with 12 dimensions. The population was 574 Singapore students whose ages ranged between 10 to 17. This comprehensive assessment tool has a two-dimensional framework, action frequency, and skills scales to assess students' NML, which can be used to develop more responsive policies for the 21st century.

Most teachers unanimously agree that critical thinking about media matters for students. To prove this, Nettlefold and Williams (2021) surveyed ninety-seven primary and secondary school teachers to understand the challenges in implementing media literacy in classrooms as part of the Australian Broadcasting Corporation and the University of Tasmania’s National Media Literacy Project in 2018. The study emphasized a generational divide concerning Australians' increasing consumption of digital and social media news sources and suggested that the responses require new resources for reviewing teacher training, curriculum support, broader community collaboration, and more in-depth research. These inferences highlight the critical role of new media literacy in empowering individuals to navigate the complexities of today's media landscape effectively and underscore the need for ongoing efforts to enhance media literacy education in educational settings.

- **Transliteracy**

Transliteracy offers a unified view of what it means to be literate in the twenty-first century. It is not a new behaviour, but it has only just been discovered as a viable idea as a result of the internet's impact on new ways of thinking about human communication. Transliteracy is defined as "the ability to read, write, and interact across a range of platforms, tools, and media ranging from signing and orality through handwriting, print, TV, radio, and film, to digital social networks" (Thomas et al., 2007).

The Common Core State Standards (CCSS) best apply this notion of a transliterate student to the curriculum. The AASL (American Association of School Librarians) 21st-Century Learning Standards seem prescient in their smooth agreement to CCSS. Transliteracy is widely adopted by forward-thinking school librarians as an extension of information fluency, technology, and media literacy. The prospect of generating transliteracy-proficient students stimulates collaboration among technology professionals, classroom instructors, school librarians, resource specialists, and administrators. When collaborative school librarians do their homework, they look for commonalities among national topic area standards. The CCSS was associated with topic area requirements in school libraries. Each school librarian is responsible for bringing that message from home to school learning communities and preparing to lead (Bush, 2012).

Runchina et al. (2022) focused on the abilities and habits that Italian licei classici students faced new formative situations. Two quantitative instruments (one pertaining to digital attitudes and skills and the other to transmedia attitudes) were administered among 400 students. The findings demonstrated that the majority of young people have access to technology and prefer mobile phones. Furthermore, despite their proclivity for transmedia practices, they face challenges in becoming the creative component contributing to digital citizenship.

Scholars have redesigned information literacy in the last 20 years to confront an oversaturated information world and Web 2.0's participatory culture. Researchers outside of LIS have promoted transliteracy—the convergence of information, visual, digital, and other literacies—to help students find and evaluate knowledge. Metaliteracy has helped LIS professionals rethink information literacy paradigms and redefine students as producers and sharers. However, few research has examined how literacies can promote student digital scholarship endeavors. Digital humanities instructors teach metaliteracy, yet few researchers outside research institutions, elite private colleges, and extensive public history programs conducted digital humanities initiatives or produced case studies about them. In a case study Su et al. (2021) explored an undergraduate class project at Texas A&M University-Corpus Christi. Students created a digital home for the South Texas Stories oral history project with one archivist, two librarians, and the professor. This initiative taught students' primary sources, information, visual, and digital literacy. The authors contended that such digital projects promote metaliteracy and transliteracy, giving students a holistic learning experience in which they can practice their skills and that they can be implemented at any institution, even those with historically underserved populations. Transliteracy offers students a versatile learning experience adaptable to various educational settings. As transliteracy continues to evolve, it remains a vital skill in preparing individuals to navigate and thrive in today's increasingly digital age.

- **Metaliteracy**

The prefix' *meta*' that originates in the Greek language denotes change through meanings like "behind", "beyond" and "after". According to the Oxford English Dictionary, meta, used as a prefix, highlights inherent properties about/of the original word (Simpson & Weiner, 2022). For instance, metacognition implies thinking about one's thought processes. In this line, metaliteracy tries to encompass the different aspects of one's literacies.

The early roots of metaliteracy may be traced back to the ancient Greek science of ignorance, Agnoiology. This practice of evaluating knowledge by addressing ignorance is reminiscent of certain elements of metaliteracy such as self-reflection, metacognition, and critical thinking. Philosophical foundations of epistemology and ontology are also fundamental to the principles of metaliteracy. Since the late 20th century, a renewed interest in metaliteracy due to internet-enabled technological innovations led to many scholars using the term 'metaliteracy' in different contexts and meanings across different areas.

In the context of linguistic literacy, Watson and Shapiro (1988) used the term metaliteracy skills to refer to skills other than the more general "metalinguistic" skills, including conventional book reading and school-based literacy instruction. Reeder and Shapiro (1993) further added that metalinguistic knowledge included both emerging linguistic awareness and print awareness. But they note that print awareness is metaliterate knowledge as it requires navigating through the dominant technology of the time. Along with print awareness the nuances of language was also essential in this conceptualization of metaliteracy. Studies on focal reading suggest that metaliteracy is the metacognitive awareness of underlying processes in literary engagement (Courtland et al., 1998). According to Rosenblatt (1982) these processes include efferent reading that emphasizes understanding objective information while aesthetic reading focuses on the subjective experiences of interacting with the text. Sumara (1995) proposes focal reading as an exercise to understand these processes by rendering "visible usually invisible".

Schirato and Webb (2003) draw on Bourdieu's conceptualization of reflexivity as metaliteracy to illustrate how it enables individuals to take multiple perspectives. Sisco (1995) observes how this helps an individual to negotiate with authoritative discourse using individual persuasive discourse. The author notes that this enhances mobility through public and private literacy experiences.

With emerging Information and Communication Technologies (ICT), the meaning of metaliteracy further expanded. Spring and Campbell (1995) argue that the metaliteracy revolution is a reiteration of the earlier literary movements. Additionally, the authors point out that the difference is in the use of multiple media to supplement the written text. This enhances the information and the engagement, thereby making recipients actively involved in the information exchange processes. Heba (1997) adds that unifying multiple media into a single discursive space allows better interaction with information. However, Thompson et al. (2004) emphasize the need for ethical practice while engaging in such spaces.

Transitioning from traditional media to widely interconnected online spaces has posed new challenges, especially with regard to engaging with information. This requires people to be skilled in navigating through multiple media ethically and responsibly. This is especially essential for a post-truth world (Jacobson & Mackey 2019). In a post-truth world, objective truth is often disregarded, and misinformation spreads quickly, thereby distorting public opinion and decision-making. Despite technological advances, controlling misinformation is not feasible. Hence, it is important to equip consumers with expertise to navigate information in a post-truth world.

In this context, Jacobson and Mackey proposed the metaliteracy framework in their article in 2011. According to Mackey and Jacobson (2013), metaliteracy is defined as "a pedagogical model that empowers learners to be reflective and informed producers of information both individually and in collaboration with others". Unlike traditional literacy types, metaliteracy focuses on the prosumer and the production and consumption of information rather than the information itself. In this way, metaliteracy becomes a literacy of literacies. It enables metaliteracy to have a broad scope to accommodate new conceptualizations and technical innovations associated with literacies. Therefore, metaliteracy is an emerging concept that has developed in response to the changing nature of information in the digital age. It refers to the ability to understand and critically evaluate the various forms of information available today and the ability to use and create these forms of information ethically and responsibly (Mackey & Jacobson, 2014). The authors asserted that traditional conceptions of information literacy are no longer sufficient in the digital age. Instead, they propose a new framework for understanding literacy that encompasses a broader range of skills and knowledge, including the ability to create and share information. They also emphasize the importance of ethical and responsible use of information and the need for learners to be able to adapt to changing technologies and information environments (Mackey & Jacobson, 2011). The metaliteracy represents a new level of competency necessary for learners to navigate the complex and constantly changing information landscape. It suggests that metaliteracy is closely related to digital literacy and information literacy but represents a more holistic and integrated approach to literacy in the digital age.

Since the publication of Mackey and Jacobson's article, there has been a growing body of research on metaliteracy. Some researchers have focused on developing and testing frameworks for metaliteracy, while others have explored the practical applications of metaliteracy in education and other settings. In a study, Jacobson and Friedman (2020) presented a specific set of OER (Open Educational Resources) that are meant to improve students' ability to think critically and learn under the rubric of the metaliteracy framework. It describes a successful collaboration between a teacher and a librarian who used these resources to improve the student experience and get students to pay more attention to their own learning. The metaliteracy conceptualization provides a framework for students to meet better learning situations encountered through OER use. Moreover, it employs open educational practices; students work with OER and may be active creators of knowledge. O'Brien et al. (2017) explain a metaliteracy-based course developed and taught at the University at Albany under three MOOC (Massive Open Online Course) platforms- Connectivist, Coursera, and Canvas to improve self-regulated and self-empowered learning. As a reconceptualization of information literacy, metaliteracy conceptualizes the learner as an active and metacognitive producer of digital information in online communities and social media environments. The ACRL Framework for Information Literacy in Higher Education acknowledges that metaliteracy, specifically metacognition, influenced its development (Jacobson et al., 2021). Several goals, such as ethical information acquisition, critical evaluation, and responsible information sharing propounded by previous information literacy frameworks may overlap with the metaliteracy framework. However, in the previous frameworks, practical steps to achieve these goals are not comprehensive. It is incredibly challenging in developing countries like India, where information literacy frameworks are often limited to library systems.

## 2.3 Metaliteracy and Other Information Literacy Assessment

The librarian enriches the teaching-learning of higher education through IL instructional programs. Many studies outline the different methods of IL assessment, including questionnaires, portfolios, observation, and other kinds of analysis of bibliographies. Although IL framework has been widely adopted by academic libraries, there is a non-availability of tools for practical self-assessment. There is a requirement for reliable and valid framework-based scales to know students' IL practices and knowledge (Oakleaf, 2010). A few researchers have developed advanced tools and instruments for information literacy assessment and related concepts.

The metaliteracy level of students' is still considerably low (Kristiana et al., 2022). Also the adequacy of the metaliteracy assessment tools is also essential. Some of the researchers attempted to design assessment tools. Michelot et al. (2022) developed metaliteracy self-efficacy (MASE) in the French language to assess the level of preservice teachers' metaliteracy self-efficacy and its affect on critical thinking. The preservice teachers were from three French-speaking countries (Wallonia, France, and Quebec). The environmental factors (training type, country of study, and employment) and personal determinants (metaliteracy self-efficacy) were analyzed among 245 preservice teachers using the sequential mixed design, including tools such as a translated version of the Halpern Critical Thinking Assessment and metaliteracy self-efficacy. The findings underscore the impact of individual determinants such as self-efficacy in metaliteracy and belief in the likelihood of pursuing a teaching career. A predictive model is also proposed, outlining critical thinking skills based on self-efficacy and metaliteracy, training type, and the interaction between employment.

Schuster and Stewart (2021) conducted a longitudinal case study on strategies for promoting literacy and metaliteracy development in international and multicultural classrooms of Chinese EFL students. The analysis is based on the combination of metaliteracy, constructive alignment, and learning-oriented assessments (LOA) promoting student engagement with theories of knowledge organization and extensible markup language (XML) data-encoding standards. Some assessments were crucial, like a module' From Information to Knowledge' to scaffold effective learning. Also, the observations agreed to redesign curriculum design strategies for implementing constructive alignment through metaliteracy-oriented LOA for collaborative learning.

Mackey and Aird (2021) investigated the redesign of a course in "Digital Storytelling" by incorporating metaliteracy to enhance Collaborative Online International Learning (COIL). Students from the United States and Prague, Czech Republic, actively engage in this fully online global course, focusing on digital storytelling production. Integrating the metaliteracy framework meant for metacognitive reflection and active participation in social information environments. A collaborative teaching team from the United States and Europe revamped the course, infusing metaliteracy into learning activities and self-assessment processes. As students delve into digital storytelling, they assume distinct metaliterate learner roles (such as producer, collaborator, researcher), evaluate their learning across four metaliterate learning domains (affective, behavioral, cognitive, metacognitive), and reflect on their coursework through metaliteracy characteristics (such as collaborative, open, reflective, civic-minded). This COIL course enriches the internationalization of education by blending metaliteracy with digital storytelling in an innovative manner.

Kean and Robinson (2019) examined the effectiveness of a video training program created by a liaison librarian at a university as part of library instruction for health science students. This idea comes from the metaliteracy framework and the

'See One, Do One, Teach One' instructional methodology. Even though a formal assessment of the needs was to be conducted, the qualitative content analysis of the students' responses was positive. The study suggested that personalized video instruction provides wide accessibility to students in a global learning environment and the timeframe is convenient for both the student and the librarian and offers effective IL instruction. While there is still much work to be done to develop and refine frameworks for metaliteracy, there is growing evidence that metaliteracy can be integrated into a wide range of educational contexts and can help learners develop the skills and knowledge they need to be successful in today's information-rich environment.

Ashley et al., (2013) constructed an assessment tool that was specifically targeted at critical news media literacy of college students. The assessments of relevant content, construct, and predictive validity to understand news production and consumption within the three-domain framework. A sample of 338 students from two courses was selected, and the principal axis factoring method of factor analysis was employed. The confirmatory factor was also carried out using structural equation modeling to evaluate the fit of this one-dimensional model on the two additional samples of college students. It was demonstrated that scale is highly internally consistent. This scale would be a good predictor of knowing about recent events and an effective method for teachers to test whether their students understand the news before or after an educational intervention.

Mahmood (2017) reviewed forty-five studies on self-efficacy scales concerning the IL assessment of students. It revealed that most of the research failed to include any psychometric properties of the data-gathering tools they employed. Finally selected, 22 scales were selected in the English language; self-efficacy is the most discussed IL-related component, and the other is self-confidence. Digital library-related activities and resource searching have also been covered in several studies. The good quality of scale construction is to be promoted in the academic community.

A widely used 28-item scale was developed by Serap Kurbanoglu et al. (2006) in Turkish and English, with Cronbach's alpha of 0.92 and 0.91, respectively. This scale helps literacy instructors evaluate an individual's self-efficacy levels for information literacy in three levels: basic, intermediate, and advanced, with a seven-point Likert scale response that touches all the IL components. IL_HUMASS is a self-assessment scale for Spanish and Portuguese humanities and social science graduate students. It comprises 26 items in four aspects of IL: information search, processing, communication dissemination, and evaluation. It was constructed based on the three related components of IL- self-efficacy, motivation, and source of learning. The IL components were treated in a bi-dimensional manner in the mixed analysis, including quantitative and qualitative aspects (Pinto, 2010).

The Perception of Information Literacy Scale (PILS) was developed by Doyle et al. (2019) and consisted of 36 items based on six constructs of the information literacy framework. The validity and reliability of all the subscales are consistent with all six subscales. PILS helps academic librarians to measure how students perceive information literacy knowledge for their instructional design and is helpful for assessment activities. Digital literacy is considered the 'survival skill in the digital era' (Eshet-Alkalai, 2004). Developing digital literacy skills is crucial for humanity in the twenty-first century. In the higher education system, teachers have a major role in imparting digital literacy; therefore, it is essential to integrate skill training into teacher-education programs. Numerous studies have concentrated on the developmental processes of assessing digital literacy.

Literacy assessment has gained increasing attention in recent years due to the growing importance of skills in education and the workplace. A 47-item self-report questionnaire using a 5-point Likert scale developed for assessing teenagers' digital literacy. It comprises six factors- communication skills, device security skills, personal security skills, informational skills, technological skills, and critical skills (Rodríguez-de-Dios et al., 2016). A variety of approaches to literacy assessment have been proposed, ranging from self-assessment tools to performance-based assessments. Self-assessment tools typically involve a series of questions or statements that allow individuals to evaluate their own literacy skills. While self-assessment tools can be useful for identifying areas where individuals may need additional support, they are limited by the potential for bias and the tendency for individuals to overestimate their own abilities (Peng & Yu, 2022).

Performance-based assessments were another approach to literacy assessment. These assessments require individuals to demonstrate their literacy skills through the completion of tasks such as conducting a web search or creating a digital artifact. While performance-based assessments can provide a more objective measure of different mobile literacy skills, they can be time-consuming and may not fully capture the complexity of literacies (Schmid et al., 2020). Rubrics is also a literacy assessment scoring tool that defines specific criteria for evaluating performance on a task. Rubrics can be used to evaluate a range of literacy skills, such as the ability to evaluate online sources or to communicate effectively using different technologies. Rubrics provide a standardized method for evaluating literacy skills and can be useful for providing feedback to learners (Brookhart, 2013).

Fraillon et al., (2014) aimed to develop a framework to assess students' digital literacy skills globally. For that, they identified four key areas of digital literacy: accessing information, understanding information, evaluating information, and creating information. The framework was then used in the International Computer and Information Literacy Study 2013, which involved over 60,000 students from 21 countries. The results showed that students had varying levels of digital literacy skills across the four areas, with students from high-income countries generally performing better. The study concluded that the digital literacy assessment framework can provide valuable insights into the current state of digital literacy skills and inform policy and educational interventions to improve these skills globally.

A digital literacy assessment study by van Deursen and van Dijk (2014) to develop a comprehensive instrument to assess digital skills and the digital divide. Four main dimensions of digital skills, operational, formal, information, and strategic, were identified. They also examined the effect of socioeconomic status on digital skills, finding that education level and income significantly impact digital skills, with higher levels of education and income positively correlated with better digital skills. This digital skills instrument can be used to identify individuals and groups with low levels of digital skills and develop tailored interventions to improve digital skills. All these studies underscored the requirements of proper measurement tools for literacy evaluation and enhanced skill training accordingly.

In the realm of metaliteracy, several new assessments have emerged aimed at gauging individuals' proficiency. Metaliteracy badging system is an example of metaliteracy designed to recognize and assess metaliteracy skills in individuals. A digital badge is a kind of digital credential, like a digital certificate, that explains the skill and competencies acquired by an individual as a part of the badging system. Each digital badge has unique metadata of the institute and certificate requirements that are easy to track and verify in a web-based interactive online mode. The advantages of the digital badge are both employers and recruiters can easily verify one's expertise and knowledge; it is convenient to store and use as it is an electronic form, which makes it easier to track and distribute; the recognition of the institution's brand and it will be a motivation for an individual for the professional skill development, and lifelong learning. Educators and students can acquaint themselves with different skill sets through the digital badging system. There are different online platforms provided by various institutions as digital badging systems across the world (Kysheniuk, 2022).

Digital badges can be used as a tool for the assessment of online instruction in higher education rather than a digital credential operating mechanism through different platforms. MOOCs (Massive Open Online Courses) are designed for massive learners in open access mode via a free web-based platform for e-learning (Abramovich, 2016). The metaliteracy badging system is a platform for developing the metaliterate competencies, which is an online-collaborative project undertaken by a team of librarians, faculty members, and instructional designers to facilitate learners to accomplish metaliteracy goals and objectives. This globally accessible course has five top badges, including

- **Master Evaluator:** This badge recipient is competent in finding and evaluating relevant information suitable for their needs using effective search strategies in a dynamic information environment.

- **Producer and Collaborator:** This badge signifies a responsible prosumer, both in individual and collaborative settings globally.

- **Digital Citizen**: This badge highlights the civic responsibilities of individuals for actively participating in collaborative digital spaces.

- **Ultimate Metaliteracy badge**: This badge marks the overall improvements in an individual's metaliteracy skills. These badges facilitate inculcating metaliteracy skills in individuals.

- **Empowered Learner badge**: This badge emphasizes on metacognitive reflection, critical thinking, and the role of learner as teacher in enabling self-reflection about learning processes.

There are a lot of institutes across the world that provide digital badges through MOOCs. SUNY's (State University of New York) collaborative team has created four different digital badges on three different MOOC platforms as a part of metaliteracy assessment. The MOOCs were started between 2013 and 2015 through Connectivist, Canvas, and Coursera, which is related to the metaliteracy learning objectives (O'Brien et al., 2017).

Implementing a digital badging system in India could significantly foster a culture of lifelong learning, skill development, and digital empowerment, ultimately contributing to individual growth, societal advancement, and economic prosperity. The appearance of the pandemic disease (COVID-19) has doubled the relevance of digital education, which has no boundaries for e-learning. The paradigm shifts in the entire university curriculum due to technological advancement led to the utilization of machine learning and artificial intelligence for the issuance of digital badges via blockchain-based platforms like Udemy, Coursera, Upgrade, etc. The learners can get an opportunity to personalize learning and engagement in the classroom by taking control of their education and making goals for the future (Achindh, 2022). In developing countries like India, many digital badging systems exist in different subject domains. In 2019, a three-day workshop of 14 senior educationalists from three Indian states who discussed the engagement of future thinking, creating digital badges by using OER and MOOCs, and motivation for professional learning by creating 'badged open courses' was held in New Delhi. The participants were enthusiastic about the potential of digital badges for teachers and agreed that the design of such courses is useful for professional development and challenges to overcome. Moreover, as motivational drivers, the education authorities may reflect the significance of formal qualifications in academic and professional life in India (Wolfenden et al., 2019). Self-motivated and self-directed informal student learning is a new horizon for open education by using open resources. These digital badges are a flexible tool for effective competency-based models of education that can promote competencies and thinking skills. Also suitable for promoting experiential learning and performance assessment (Elkordy, 2016). although these many developments occurred globally, within the multiple literacies, especially in metaliteracy area, the academics in the developing countries are still not reached up to the level for several reasons. Overall, Metaliteracy is an important competency required in today's world, especially in this age of disruptive technology. The research gap was identified in the creation of assessment tools, especially since there were no studies available to understand the metaliteracy scale construction in the Indian context.

## 2.4 Scale Construction and Validation

Different kinds of literacy types and frameworks theoretically explain their importance in real situations. However, the practical assessments are significantly less effective in measuring them. Various tools were commonly used for literacy assessment, such as questionnaires, scales, schedules, etc. Each tool has its own relevance, and its development is essential for proper assessment. Scale construction is significant because it provides a systematic and reliable way to measure the construct it intends to measure. Developing well-constructed scales is essential in every field of study (Clark & Watson, 2019). Scale construction is the process of creating a measure to assess a particular construct or psychological variable. It involves defining the construct, generating items, item analysis, refinement, and validation. It allows researchers to measure the construct and accurately understand and predict reliable results. Scale construction is an evidence-based process that allows for accurate and standardized measurement of psychological constructs, essential for understanding behavior, evaluating interventions, and making informed diagnoses and treatment decisions (Furr, 2011).

In a study, Lee et al. (2010) developed and validated a comprehensive measure of health literacy for Spanish and English language speakers. The scale consisted of 44 items that measured three domains of health literacy: functional, communicative, and critical. The items were developed based on a review of existing health literacy measures, input from a panel of experts, and feedback from community members. The authors conducted a pilot study with 234 participants to refine the scale and then administered it to a sample of 1,055 adults. The results of the study showed that the scale had good reliability and validity in both Spanish and English language speakers. It found that the scale was able to differentiate between individuals with different levels of health literacy and predict health outcomes such as medication adherence and self-efficacy. The authors concluded that their comprehensive measure of health literacy could be a useful tool for researchers and clinicians in addressing health disparities among diverse populations.

On the basis of replies from 474 Chinese university students, researchers created and validated a peer feedback literacy measure. Four components emerged from exploratory and confirmatory factor analyses: feedback-related knowledge and abilities, cooperative learning ability, appreciation of peer feedback, and willingness to participate. The constructed scale had good psychometric qualities and indicated some significant associations with student major, year, and prior experience (Dong et al., 2023).

Similarly, Arpaci and Aslan, (2023) devised a psychometric scale to assess social media users' cybercrime awareness. On the basis of information gathered from 1045 social media users, the psychometric properties of the Cybercrime Awareness on Social Media Scale (CASM-S) were evaluated. Exploratory factor analysis (EFA) and principal component analysis were utilized to determine the fundamental factor structure of the scale (N = 545). The results revealed that the scale's factor structure is unidimensional. The scale was determined to have a high degree of internal consistency ($\alpha = 0.957$). To verify the factor structure of the CASM-S (N = 500), a confirmatory factor analysis (CFA) was conducted. In addition, the concurrent validity of the instrument was assessed ($r = 0.855$, p .001). The results demonstrated that the CASM-S is a reliable and valid instrument for measuring social media users' cybercrime awareness.

In the twenty-first century, educators have argued for the value of information and communication technology (ICT) literacy and questioned how it may be taught both formally and informally, enabling students to participate in this highly technology-dependent society. Lau and Yuen (2014) stated that inadequate empirical measures to evaluate students' ICT literacy. A seventeen-item perceived ICT scale was constructed by them to assess students’ ICT literacy under three factors: information literacy (information), internet literacy (communication), and computer literacy (technology). Validation was carried out using a stratified random sample of 826 junior secondary school students from 36 institutions in Hong Kong. The scale's reliability and validity proved satisfactory, and exploratory factor analysis was performed for the factorability. ICT literacy scale serves as a valuable tool in pedagogy, enabling educators to assess, plan, differentiate, and enhance ICT-related pedagogical and educational instruction.

In closing, scale validation and construction play a pivotal role in ensuring the reliability and validity of measurement tools used in various research fields. Through meticulous attention to detail, rigorous testing, and statistical analysis, researchers can develop scales that accurately capture the constructs they intend to measure. By incorporating assessment tools into teaching practices, educators can better equip students with the necessary digital skills and competencies for success in the digital age.

## 2.5 Conclusion

Following a comprehensive review of the relevant literature on the concept of metaliteracy and its potential impact on students' information literacy skills, the inferences drawn from this chapter highlight several key points. First, the transition from traditional information literacy to metaliteracy signifies a shift towards recognizing the multifaceted nature of information engagement in the digital era. This broader perspective acknowledges the need for individuals not only to seek and evaluate information but also to produce and share it responsibly. Second, the integration of metaliteracy with other forms of information literacy underscores the importance of a comprehensive approach to information literacy education, reflecting the interconnectedness of various literacies in practical applications. Finally, the emphasis on assessment and scale construction reveals the necessity for robust, validated tools to measure these complex literacies effectively. Existing literature primarily focuses on theoretical frameworks and pedagogical approaches to enhance metaliteracy, but there is limited empirical evidence regarding valid and reliable assessment tools and strategies. Therefore, there is a need for further research to develop and validate assessment instruments that can accurately measure students' metaliteracy levels and provide valuable insights into their competency in critically evaluating and using information across various digital platforms. It ensures educational programs can accurately gauge and enhance students' capabilities in navigating the modern information landscape. Such research would contribute to advancing educational practices and promote the development of essential metaliteracy skills among students in the digital age.

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# CHAPTER III

# METHODOLOGY



*This chapter gives methodology used for the study. It gives a clear picture of mixed method, variables, sample, tool, statistical techniques and ethical considerations.*

*Haseena.V.K.K.M and Abdul Azeez.T.A "Metaliteracy among the Students of IITs in South India" Thesis. University of Calicut,2024*

## 3.1 Introduction

In social science research, the method describes how a researcher intends to conduct the research in a logical, systematic plan to solve the research problem. Such a research approach produces reliable and valid results that address the researcher's study objectives. It includes what data will be collected, where it will be collected, and how it will be collected and analyzed (Symbaluk, 2019). The research design involves determining how the chosen method will be applied to answer the research question. The study's design can be considered a blueprint detailing what will be done and how this will be accomplished. It outlines the overall research strategy, including the methods and procedures used to collect and analyze data (Hedrick et al., 1993). A well-designed research design will help ensure that the research question is answered rigorously and systematically, providing accurate and trustworthy outcomes (Kelley et al., 2003). This chapter describes the study's methodological techniques and research design and goes into detail with overall processes that are relevant to the study.

## 3.2 Research Design

A research design serves as a plan for a study, offering a clear insight into the investigator's actions and methods employed in their research (Alhassan & Ankeli, 2022). It guides decisions on data collection, participant selection, data analysis, methods, and overall research execution (Peel, 2020). Choosing an efficient design process becomes crucial for effectively addressing research objectives and discussing findings. The present study used *a mixed-method research design* using qualitative and quantitative datasets, which is considered most effective since it combines qualitative and quantitative research approaches. It starts with the scale development, the quantitative descriptive survey of assessment, and exploring subjective experiences by dividing into three sub-studies of the whole research depicted in figure 5.

**Figure 5**

Mixed Method Research

**Mixed Method Study**

1) Development and Validation of a Metaliteracy Scale

2) Quantitative Descriptive Study (Survey Assessment)

*Statistical Analysis*

3) Qualitative Exploratory Study (Interview)

*Thematic Analysis*

Overall Research Interpretation

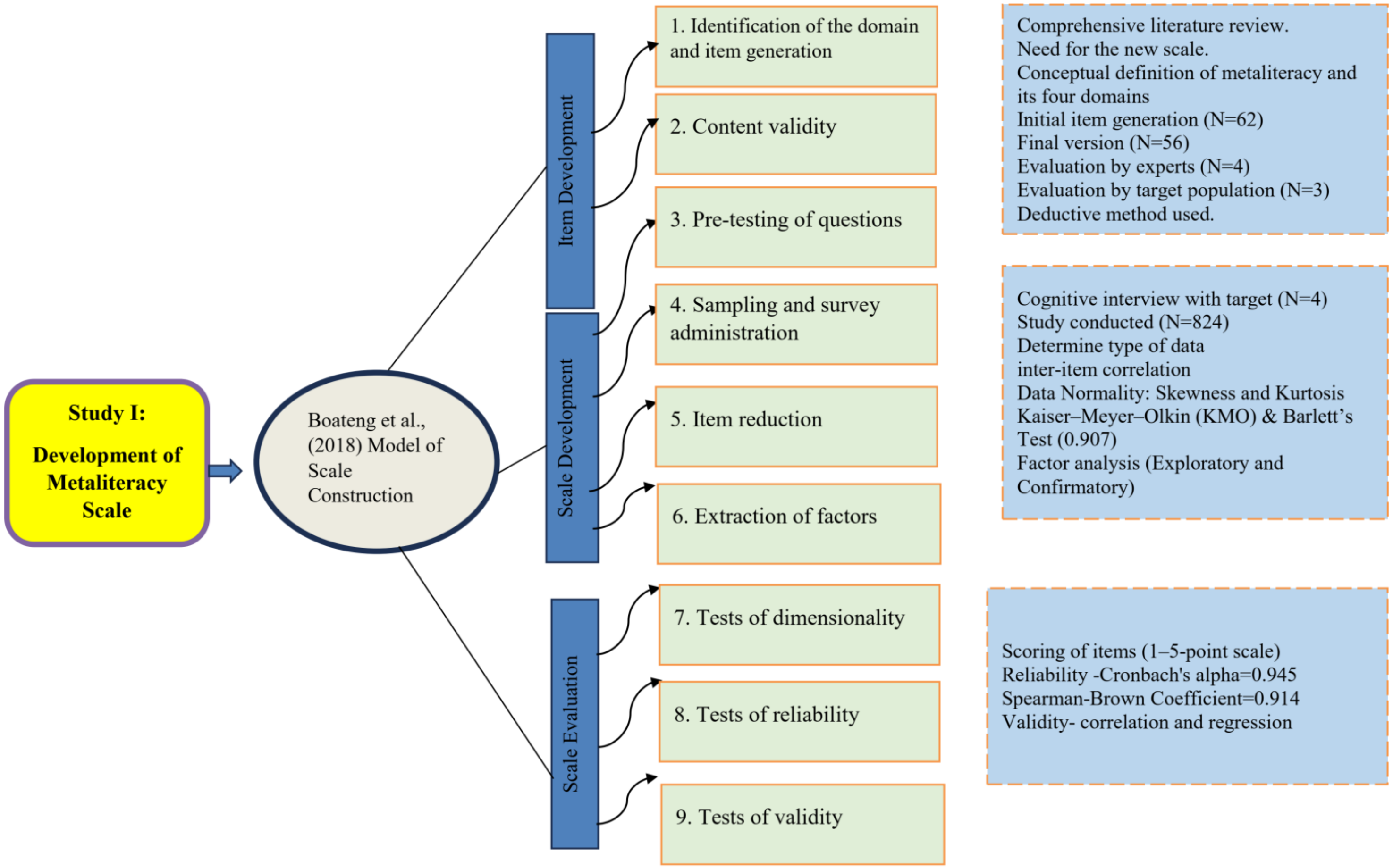
### 3.3 Study I: Development and Validation of Metaliteracy Scale (MS)

The study's primary objective is to develop and validate a metaliteracy scale for the students. After reviewing related studies, there is a need to design a new scale as it is no longer available to measure the metaliteracy competency of Indian students to the researcher's best knowledge. Developing a valid and reliable scale for measuring students' metaliteracy is crucial in today's information landscape, as students are expected to navigate and evaluate abundant digital information from various online sources. Therefore, the researcher has developed and validated a preliminary version of the MS is based on a metaliteracy framework by Thomas P. Mackey and Trudi E. Jacobson (2018). The research design for Study 1 is depicted in Figure 6.

The process of developing the MS, based on Boateng et al. (2018) scale construction model, involves three phases consisting of a total of nine steps. The initial phase involves the generation of items, a critical step where researchers identify and develop a pool of potential items that align with the construct under investigation. Based on the metaliteracy framework's goals and objectives, these items, as well as the domains, were identified. The deductive method was used as it is based on a theoretical framework. This initial phase yields a pool of 62 statements, which underwent expert evaluation for content validity, resulting in a final version with 56 statements. Moving into the second phase, the focus shifts towards refining items. Cognitive interviews are conducted with students at IITH to ensure clarity and understanding of survey items. Based on their feedback, revisions are made to refine the scale further. Following this, in the final phase, the target sample size is determined using G-power software, and the survey is administered across five IITs in South India based on a voluntary survey. This cross-sectional analysis used exploratory factor analysis and confirmatory factor analysis to analyze the collected data effectively. Moreover, reliability testing is conducted to ascertain the consistency and stability of the scale's measurement over time, often assessed through measures like internal consistency and test-retest reliability. Chapter 5 provides a comprehensive overview of the development process.

**Figure 6**

*Research design of study I- Development of Metaliteracy Scale*

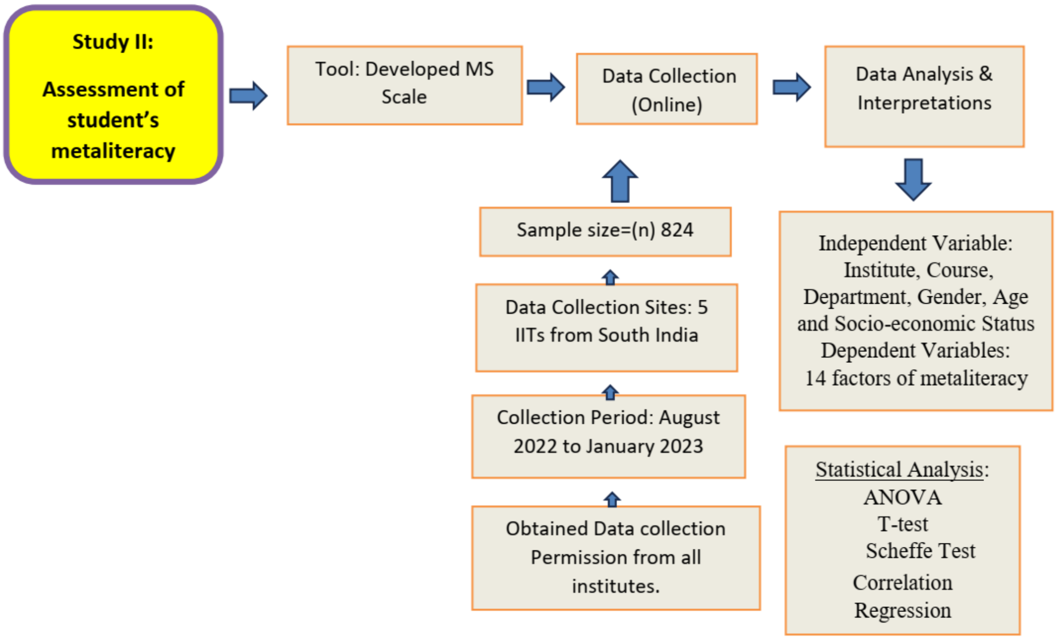


### 3.4 Study II: Assessment of Student's Metaliteracy:

The assessment of students's metaliteracy has been analyzed to better understand the research problem by using a quantitative data set. This approach typically involves collecting and analyzing numerical and narrative data to comprehensively understand the research question or problem (Williams, 2007). The research design for Study 2 is depicted in Figure 7.

**Figure 7**

*Research Design of Study II: Assessment of Metaliteracy*

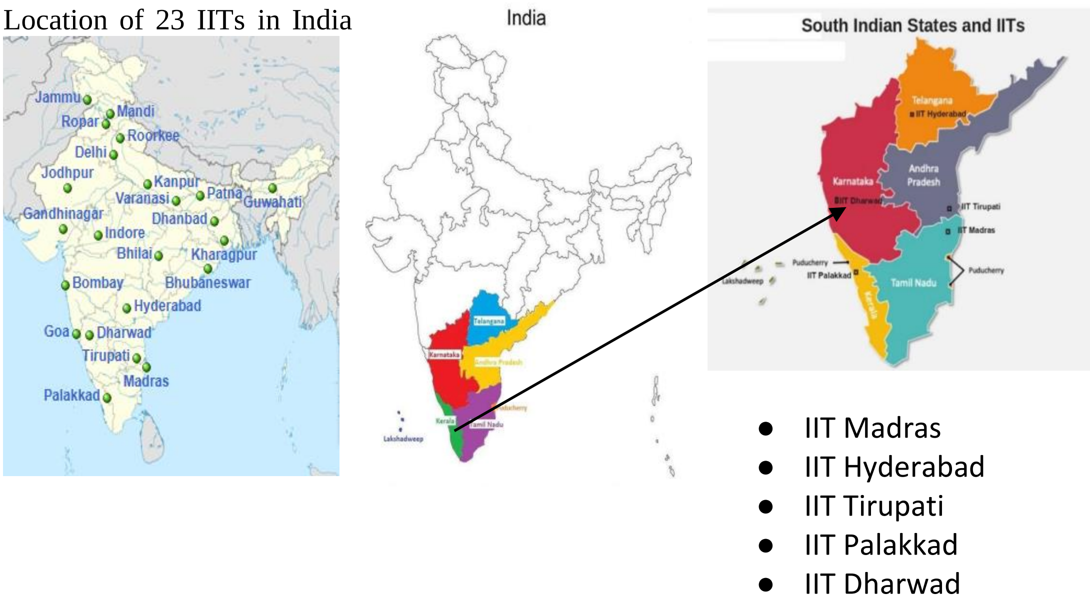



#### 3.4.1 Study Area

IITs are Centrally Funded Technical Institutes (CFTIs) located across India, managed by the Ministry of Education of the Government of India and governed under the Institutes of Technology Act, 1961. As of 2024, there are 23 IITs spread across the country. These IITs are categorized into three generations based on their establishment years. This study includes representatives from all three generations of IITs in South India. IIT Madras, established in 1959, is a part of the first generation. IIT Hyderabad, established in 2008, belongs to the second generation. The third generation includes IIT Tirupati, IIT Palakkad, and IIT Dharwad, with the first two being established in 2015 and later in 2016 (*Department of Higher Education | Government of India, Ministry of Education*, n.d.). The selected five IITs are from five southern states: Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala. The selected five IITs are as shown in figure 8.

**Figure 8**

*Study Area.*




### 3.4.2 Variables of the Study

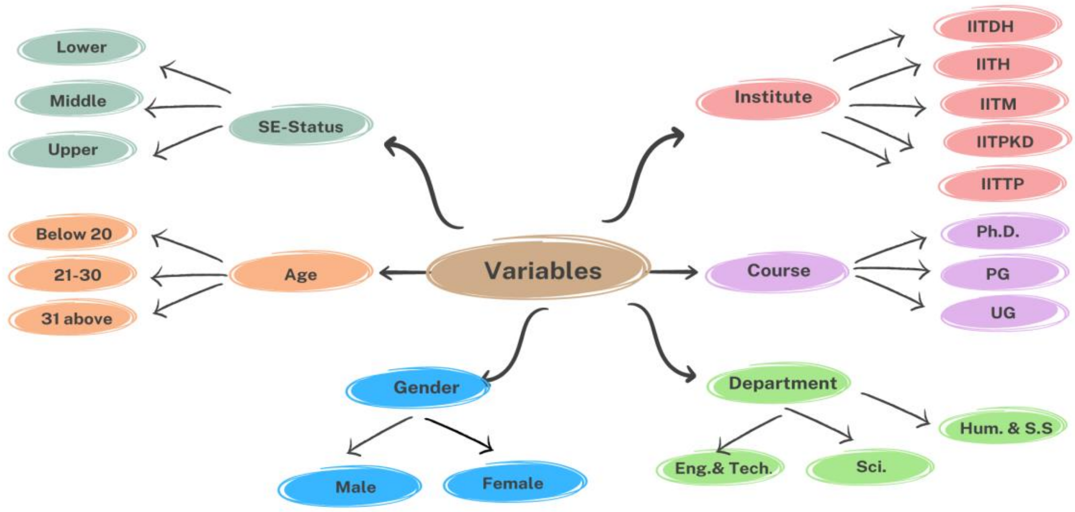
Variables in the study fall into two categories: classificatory and study variables.

#### 3.4.2.1 Classificatory Variable

Classificatory variables, or categorical variables, also called independent variables, categorize or classify data into different groups or categories. It serves as the cause or driver of change in a study, allowing researchers to investigate how alterations in this variation influence the outcome, thus enabling the examination of cause-and-effect relationships (Nathans et al., 2012). The classificatory variables and their categorization are shown in Figure 9.

**Figure 9**

*Classificatory Variables and their Categorization*




The classificatory variables employed in the study are given below.

- Institute
- Course
- Department
- Gender
- Age
- Socio-economic Status

These classificatory variables are substantial for the metaliteracy assessment among the students.

### ❖ Institute

The different educational institutes have various unique factors like institutional culture, resources, faculty expertise, and curriculum design that play a role in shaping the extent to which various literacy skills of students are developed and integrated into the learning experience. This variation underscores the importance of considering the institutional context when assessing metaliteracy among students, as well as the potential for collaboration and sharing of best practices across educational institutions to enhance multiple literacy education.

### ❖ Department

Every academic department or discipline, such as Engineering, Technology, Science, and Social Science, can exhibit notable variations in the metaliteracy level due to different information needs, research practices, and other related factors. These departmental differences may play a significant role in contributing factors to the metaliteracy of students.

### ❖ Course

The courses of students across the institute or in the same institute may vary due to differences in course content, objectives, and instructional methods. Some courses focus on skill set building, and others have limited emphasis on the skills, prioritizing subject-specific content instead. The extent of the level of metaliteracy can vary widely among courses throughout a student's academic journey.

### ❖ Gender

An analysis of existing literature suggests that gender has been identified as a notable factor influencing individuals' proficiency across various literacy types. In a financial literacy study, Çera and Tuzi (2019) pinpointed disparities in financial literacy based on gender among young individuals. Therefore, gender may have significant differences in students' metaliteracy levels.

❖ **Age**

The different age groups have different life experiences and exposures to emerging technology and other resources. The younger groups have grown up in the digital age and often show comfort and familiarity with digital technologies and online information sources. However, older individuals may bring valuable critical thinking skills and life experiences (Stahl, 2020). Therefore, age can significantly impact metaliteracy factors, with variations may be observed among different age groups.

❖ **Socioeconomic Status**

The findings from a conference paper, *'Scientific literacy in School' showed* a significant influence of socioeconomic factors in shaping the knowledge base that each individual carries (Dragoş & Mih, 2015). The influence of socioeconomic background has a difference in better access to educational resources, technology, and information-rich environments of individuals. So, studying the extent of metaliteracy level of students from diverse socioeconomic backgrounds is substantial.

### 3.4.2.2 Study variables.

The study's primary aim is to assess students' awareness of the multifaceted concept of "metaliteracy," a comprehensive approach that unifies various literacies to facilitate knowledge acquisition, creation, and sharing in collaborative online settings. It embraces emerging technologies and includes visual, digital, media, and transliteracy while emphasizing metacognitive reflection. Metaliteracy enables active engagement in online communities, encouraging both the creation and sharing of information in a participatory environment (Mackey & Jacobson, 2014). Due to the multifaceted nature of metaliteracy, this study identified fourteen factors for quantitative data analysis through exploratory factor analysis. Metaliteracy has been evaluated by employing these 14 constituent factors, which represent the study variables as follows:

- ❖ ***Lifelong Learner***: As an integral part of metaliteracy, being a lifelong learner who evaluates and adapts information in the digital age and learning in a rapidly changing information landscape through continuing education (O'Brien et al., 2017).

- ❖ ***Informed Prosumer***: An informed prosumer is an individual who actively engages in producing and consuming information. This term combines "*producer*" and "*consumer*" to describe someone who not only consumes content but also participates in its creation, making informed choices as both a producer and consumer in various domains, including media, technology, and other information landscapes (Borges, 2023).

- ❖ ***Metalearner***: A metalearner is highly skilled in learning, effectively adapting, and applying learning strategies across different contexts and cognizant of one's learning process (Pelser & Swanepoel, 2022).

- ❖ ***Collaborator***: A metaliterate collaborator is an individual who actively engages in collaborative efforts, often within digital and networked environments, to evaluate, create, and share information collectively.

- ❖ ***Value-oriented*** means prioritizing ethical principles, integrity, and responsible information use in digital and other information environments.

- ❖ ***Active & Critical Evaluator***: This role involves not only passive consumption but also active and thoughtful scrutiny of information sources, reliability, and context, with an emphasis on making informed judgments and decisions in the information landscape (Witek & Grettano, 2014).

- ❖ ***Digitally Literate***: Being digitally literate means having the skills and knowledge to effectively use digital technology and information in today's digital-centric world.

- ❖ ***Affective***: In metaliteracy, "*affective*" pertains to understanding and managing emotional responses to information, including ethical and emotional considerations in digital interactions.

- ***Ethical & Responsible Engagement***: It emphasizes the importance of ethical awareness and responsibility when navigating digital and information environments.

- ***Metacognition***: Metacognition is the practice of self-awareness and self-monitoring in thinking, learning, and problem-solving. It enables individuals to enhance their cognitive processes, set goals, evaluate progress, and adjust for more effective learning and decision-making.

- ***Inquisitiveness***: Inquisitiveness is a curiosity-driven eagerness to learn and explore, marked by asking questions and a desire to gain knowledge about the world.

- ***Adaptable:*** Metaliteracy involves adaptability, which means accepting the ambiguity surrounding the potential value of different information in the consumption and creation modes. Individuals with adaptable characteristics can exhibit mental flexibility and creativity and recognize when sufficient information has been required to fulfill the information task.

- ***Metaknowledge:*** Metaknowledge in metaliteracy refers to higher awareness and understanding of how one acquires, evaluates, and utilizes information. It involves an individual's knowledge about their own learning process, the strategies they employ when engaging with information, and their ability to reflect on and adapt their approaches.

- The diffident describes someone shy and lacking in self confidence. Metaliterate is the one who does not have the diffident characters.

## 3.5 Sampling design

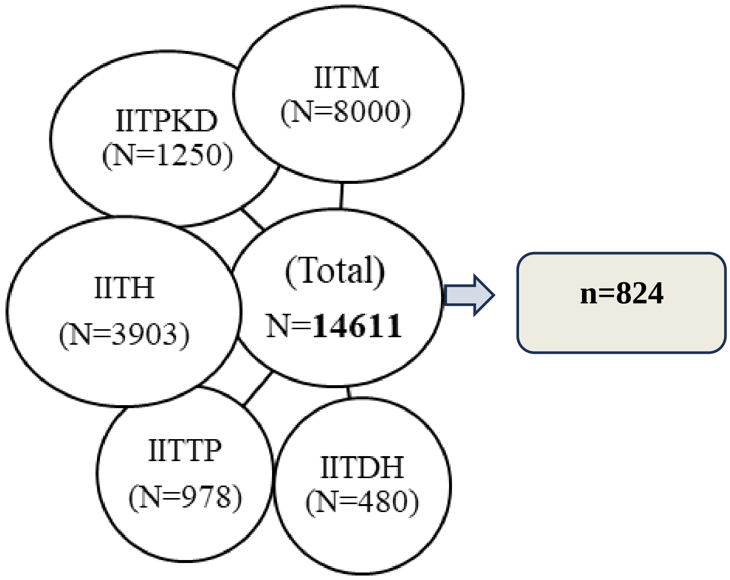
Sampling design is a crucial aspect of any research that involves collecting data from a sample of individuals or units from a larger population (Singh & Masuku, 2014). The sampling design determines how the sample is selected and how it represents the population.

### 3.5.1 Population

The target population are the students from IITs in South India. As per the student statistics for the academic year 2022-2023, a total of 14,611 students are studying in the five IITs of south India, which is considered the population of the study, illustrated in figure 10.

**Figure 10**

*Population of the Study*




### 3.5.2 Sampling Techniques

Although the research findings have universal applicability, it is not practical to analyze the entire population in order to make generalizations. The sampling process makes it possible to draw valid inferences or generalizations based on careful observation of variables within a relatively small proportion of the population (Belloni et al., 2014). Sampling is the act, process, or technique of selecting a suitable sample or a representative part of a population to determine the parameters or characteristics of the whole population. According to Neyman's sample representation, there are two aspects: random and purposive selection (Neyman, 1934). This study initially planned to use quota sampling, where the five institutes were designated as 'quotas,' and researchers would select a sample based on specific characteristics of each quota, distribution of questionnaires accordingly. However, due to the COVID-19 pandemic, which restricted physical access to participants, quota sampling became impractical. Consequently, the study adopted a convenience sampling technique through online mode (Google Form survey) for the quantitative study and used data saturation levels for the structured in-depth interviews in the qualitative analysis. Data collection took place from August 2022 to March 2023.

### 3.5.3 Sample Size

A small sample size may result in the study failure and statistical analysis being ineffective; however, a large sample size may result in statistically significant results with unnecessary subjects and costs (Kemal, 2020). Various researchers have proposed different sample size recommendations for exploratory factor analysis. Gorsuch (2014) advocated for a minimum of 100 participants, while Comrey and Howard (2013) suggested a sample size of at least 500 and introduced a scale to evaluate sample quality, where 100 corresponds to poor, 200 to fair, 300 to good, 500 to very good, and 1000 to excellent. Other than these expert opinions, in order to solve the statistical adequacy in the sample size, power analysis is also used to determine the exact number of sample size and minimize the Type I and Type II errors in the hypotheses (Cohen, 1992). G*Power is software recommended for sample size and power calculations for its ease of use and features in social sciences. Establishing research goals and hypotheses, selecting appropriate statistical tests, selecting one of five possible power analysis methods, and inputting the required variables comprise the sample estimation process (Kang, 2021). Using the G*Power software (*version-3.1.9.7*), the researcher conducted a power analysis to determine the sample size with the following a priori settings:

Effect size (f)=0.5.

Alpha error probability=0.05,

Power level=0.95.

A minimum sample size of **170** was estimated to be required to achieve the desired power. In addition, the researcher reviewed various related studies to understand the sample size used. Although G Power was utilized to compute the sample size, its representation appears relatively small. In order to achieve an optimal sample, the researcher chose to include 5 percent from each of the institutes' representations; that will be **739**. Since data collection was done online through a single Google form, the researcher could not halt responses once a sufficient sample was obtained from any particular institute. This data collection process was extended to 6–9 months to ensure equal representation from all the selected IITs. Meanwhile, certain IITs may have exceeded their target percentage within the given timeframe. Therefore, a total of 824 responses were received during the data collection period, which is slightly higher than the 5 percent of the population for some institutes. So, **824** is considered the final sample of the quantitative study.

### 3.5.4 Breakup of the Sample

The final sample of 824 responses is broken down across various classificatory variables, including institution, department, course, gender, age groups, and socio-economic groups. The detailed institution-wise response rate and sample breakup are provided in the section below.

### 3.5.5 Response Rate

**Table 2**

*Institution-wise Response Rate*

| Name of the institution | Population size | Sample size | Percentage (%) of population size |
|---|---|---|---|
| IITM | 8000 | 403 | 5 |
| IITH | 3903 | 203 | 5.2 |
| IITTP | 1250 | 99 | 7.9 |
| IITPKD | 978 | 81 | 8.2 |
| IITDH | 480 | 38 | 7.9 |
| Total | 14611 | 824 | 5.6 |

Table 2 outlines population size, sample size, and the percentage of the population represented against each institution's response. The population size is highest at IIT Madras, followed by IIT Hyderabad, IIT Tirupati, IIT Palakkad, and IIT Dharwad in descending order. In terms of percentage representation, IIT Palakkad has the highest, followed by IIT Dharwad, IIT Tirupati, IIT Hyderabad, and IIT Madras. The final sample size and its variable-wise breakdown are displayed in Table 3 below.

### 3.5.7 Variable-wise Sample Breakup

**Table 3**

Variable-wise Sample Breakup

| Variable | Category | Sample size | Percentage |
|---|---|---|---|
| Institute | IIT Madras (IITM) | 403 | 48.9 |
| | IIT Hyderabad (IITH) | 203 | 24.6 |
| | IIT Tirupati (IITTP) | 99 | 12 |
| | IIT Palakkad (IITPKD) | 81 | 9.8 |
| | IIT Dharwad (IITDH) | 38 | 4.7 |
| Department | Engineering &Technology | 654 | 79.36 |
| | Science | 122 | 14.80 |
| | Humanities & Social Science | 48 | 5.82 |
| Course | Ph.D. | 247 | 29.9 |
| | Postgraduate (PG) | 225 | 27.4 |
| | Undergraduate (UG) | 352 | 42.7 |
| Gender | Male | 627 | 76 |
| | Female | 197 | 24 |
| Age group | Below 20 | 220 | 26.69 |
| | 21-30 | 533 | 64.68 |
| | 31 Above | 71 | 8.62 |
| Socioeconomic Status | Lower | 68 | 8.25 |
| | Middle | 684 | 83 |
| | Upper | 72 | 8.75 |

Table 3 demonstrates that IIT Madras has the largest representation in terms of sample, followed by IIT Hyderabad and IIT Tirupati. IIT Palakkad and IIT Dharwad are smaller due to their relatively small population. Undergraduate is the most prominent category in the course category, followed by Ph.D. and Postgraduate. In gender-wise, there are more males than females in the sample. In terms of age group, the largest sample falls in the '20-30' age range, followed by the 'Below 20' and '31-above’ age groups. The 'middle' has the highest sample representation compared to the 'lower' and 'upper' socioeconomic statuses.

## 3.6 Tools for the Data Collection

In quantitative descriptive survey research, data is necessary to test hypotheses or to get the answer to the research questions of the study. The proper tools must be used to collect the data from the sample subjects appropriately. The tool should be highly reliable, valid, and suitable in the Indian context. Keeping all these things in view, the researcher has constructed a metaliteracy scale (MS) for the present study for the quantitative data collection.

### 3.6.1 Response Setting

The scale allows students to respond to each statement using one of five options: Not at all, Slightly, High, Very much, and Extremely. Students can indicate their choice by selecting the option in the Google form or marking a tick (✔) next to the appropriate option. The scale consisted of two sections containing Likert-scale questions; the first section dealt with questions related to four domains and goals of metaliteracy. The second section of the scale was intended to collect information about the demographic details of the students. The metaliteracy scale is provided in Appendix I for reference.

### 3.6.2 Scoring of Scale

The scale consists of 56 statements, predominantly positive, with only one negative statement. Responses are measured using a five-point Likert scale, ranging from 1 to 5, with the following options: Not at all (NA), Slightly (S), Moderately

(M), Very much (V), and Extremely (E). The scoring process involves assigning corresponding weights to each response. For the negative item, reverse scoring is applied. The total possible score ranges from 56 to 280.

## 3.7 Statistical Techniques and Other Methods Used

Various statistical techniques and other methods were used for the data interpretation across three sub-studies. The collected data were analyzed using SPSS (version 28) and R software (version 4.2.1) to perform the following statistical techniques and other methods.

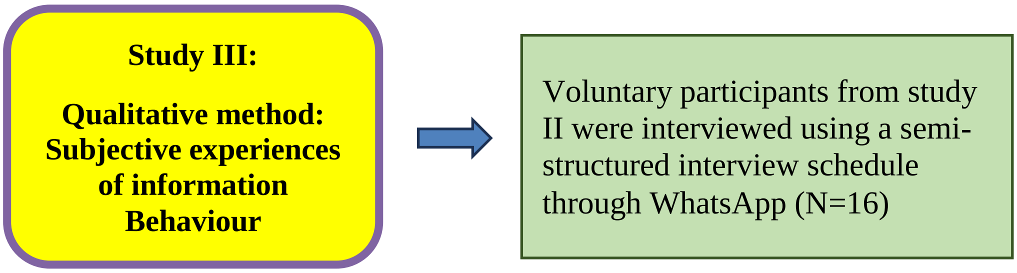
3.7.1 Arithmetic Mean
3.7.2 Standard Deviation
3.7.3 Analysis of Variance (ANOVA)
3.7.4 Scheffe Test
3.7.5 F-Test
3.7.6 Correlation
3.7.7 Regression
3.7.8 Exploratory Factor Analysis
3.7.9 Confirmatory Factor Analysis and
3.7.10 Thematic Analysis

## 3.8 Study III: Qualitative Study: Interview

Apart from the data collected through the metaliteracy scale, qualitative data is necessary for the hypotheses testing. The female researcher has conducted a qualitative study among the students of IITs in South India as part of her Ph.D. program. The researcher works as a library professional in one of the IITs and has more than eight years of experience in librarianship and teaching library and information science. This section elucidates the qualitative research methodology, including the design and approach used in the study.

**Figure 11**

*Research Design of Study III*




This qualitative exploratory study used a semi-structured interview through WhatsApp to understand students' perceptions on metaliteracy. The 32-item COREQ (COnsolidated Criteria for REporting Qualitative Research) checklist is used to ensure the quality of the research. It is a set of guidelines used to ensure transparent and comprehensive reporting of qualitative research studies. This guideline is important because it helps researchers assess the adequacy of the sample size, data collection methods in the study, and whether the data collected were sufficient to address the research question (Braun & Clarke, 2021). A qualitative study is not contingent on the number of interviews conducted; the saturation principle and pragmatic considerations are the criteria for qualitative data collection. A saturation point in data collection is when no new information appears to be obtained (Vasileiou et al., 2018). In order to obtain data saturation, there are different opinions on finalizing the minimum sample size (Braun & Clarke, 2013). The sample unit is a student studying in any one of the IITs in South India. There are several types of research methods, like historical, descriptive, experimental, etc. In the present study, a combination of exploratory type and descriptive were used for qualitative and quantitative studies, respectively.

The researcher approached students via email once she received permission to collect data from the Dean-Students of all five selected IITs in South India. A group email was sent to students who had already participated in the quantitative data collection, inviting them to voluntarily participate in the interview and request to share their telephone contact for the execution of the interview. The participant's selection has been made based on the willingness received through mail communication. WhatsApp offers a convenient and accessible platform for conducting instant messenger interviews in youth research. It makes reaching participants easier and conducting interviews timely and cost-effectively (Gibson, 2022). The researcher clearly explained the aim of the research via WhatsApp after receiving the respondents' willingness to interview participation. The researcher priorly solicited a free and comfortable time slot of 30-45 minutes for the interview procedure. An interview schedule is a structured plan of questions to ensure consistency and coverage of relevant topics during interviews with various participants (Sherrill & Kovacs, 2000). An interview schedule was prepared based on the metaliteracy framework that Trudi E. Jacobson and Thomas P. Mackey proposed. The questions in the interview schedule are constructed based on the roles and objectives of the metaliteracy framework, where quantitative data is insufficient to substantiate study objectives. The interview was conducted using convenience sampling, a cost-effective non-probability sampling technique where the researcher uses accessibility and convenience to determine which participants make up the research sample (Winton & Sabol, 2022).

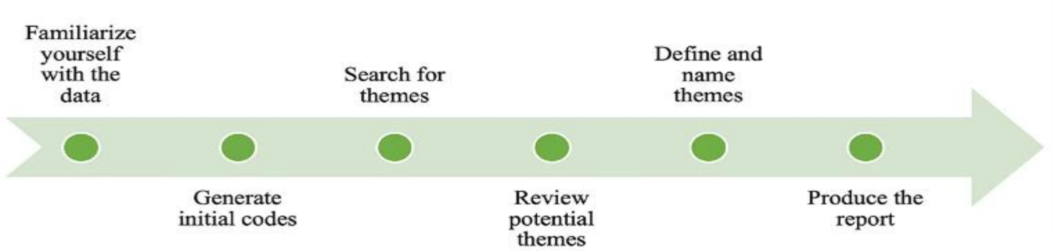
Participants are free to respond in the form of voice or text messages. Interviews were carried out until data saturation was reached that was pertinent to the goals and objectives of the study. Finally, after excluding two partial responses, a total of 16 respondents participated in the study. The interview process was concluded once data saturation was reached. The voice message responses are transcribed using WhatsApp transcript software into English text. The detailed step-by-step process is given below.

### 3.9 Methods of Qualitative Data Analysis

Thematic analysis was used to find recurring themes or patterns in students's narratives. It facilitated detailed descriptions and interpretations of how various data components fit together. The analysis sought to provide the reader with an accurate and detailed thematic description of the entire data set. This approach to data analysis was essential for metaliteracy in the Indian context because it is an underresearched area. The six phases of thematic analysis used in the analysis are shown in Figure 5 and were explained by Braun and Clarke (2021). Moreover, *the 'One Sheet Of Paper' (OSOP)* technique is also used to organise the participants' responses into logical groups and themes.

**Figure 12**

*Six-phase Thematic Analytic Process (adapted from Braun & Clarke, 2021)*




### *3.9.1 Familiarize Yourself with the Data.*

The researcher transcribed collected data from all focus groups using WhatsApp Transcriber, noting the transcript's accuracy by repeatedly listening to the voice recordings and text messages. Then, the transcribed data underwent multiple readings to become familiar with the data. It helps to develop a holistic understanding of the data, identifying patterns, recurring words, and noteworthy elements (Vaismoradi et al., 2016). After this phase, building on the notes and ideas generated through transcription and data immersion is the coding phase.

### *3.9.2 Generate Initial Codes.*

Initial code generation involves systematically labeling or tagging specific data sections relevant to the research objectives. These initial codes are often short, descriptive labels that capture the essence of the content. The purpose of this phase is to break down the data into manageable, meaningful segments that can later be grouped into broader themes. Initial coding serves as the groundwork for the subsequent stages of analysis, enabling to start organizing and making sense of the data.

### *3.9.3 Search for Themes*

Search for themes by scrutinizing the coded segments to identify patterns, recurring ideas, or concepts that emerge from the data. Themes are the central, underlying concepts that encapsulate and make sense of the data. These overarching themes by looking for connections and relationships among the codes. This stage is crucial for recognizing the key insights and narratives within the dataset, as it helps identify the main storylines or findings the research aims to convey.

***Review Potential Themes.***

In this phase, the researcher critically assesses the coded data to discern recurring patterns, connections, and concepts that could potentially form the basis of thematic groupings. This review ensures that the identified themes accurately represent the content and are meaningful and relevant to the research objectives. It allows for deeper data exploration to extract overarching themes that provide valuable insights and contribute to the overall understanding.

### **3.9.4** *Define and Name Themes.*

Defining and naming themes is a pivotal aspect of thematic analysis. This phase involves clearly articulating the main patterns and concepts that have emerged from the coded data. Themes are named in a way that succinctly captures the essence of each concept, providing a descriptive and meaningful label. This process helps shape a coherent and organized structure for the analysis, making communicating the key findings and insights derived from the research easier.

### *3.9.5 Produce the Report.*

In the final stage of thematic analysis, the research findings are synthesized into a comprehensive report summarizing the identified themes, supported by data and interpretations. This report communicates the research findings and their implications for the topic under study.

## 3.10 Ethical considerations

Ethical considerations were followed in this study. Prior to commencing data collection, formal consent for the data collection from the Dean of the institute is obtained from the five IITs and are provided in *Appendix VI*. The data collection is carried out through the proper channel. The researcher approached higher authority to circulate the mail containing the Google Form link. The researcher adhered to several ethical measures, including providing participants with a clear understanding of the research objectives, addressing any questions or concerns, assuring the confidentiality and academic use of their data, and anonymizing all data to protect individuals' identities. Consent from the students was obtained for collecting qualitative survey responses and qualitative data through interviews conducted via WhatsApp. The consent form is provided in *Appendix IV*. The study received approval from the University of Calicut for conducting the study.

## 3.11 Conclusion

This chapter provides a detailed account of the research methodology for the mixed design study, ensuring a comprehensive and methodical approach to both quantitative and qualitative data collection and analysis. The main study is divided into three studies and given in sub-sections; the chapter begins with a thorough explanation of the first study, consisting of the stepwise process of scale development. This includes item generation, item analysis, and validation to ensure the scale's reliability and validity. The second section detailed the quantitative study, which meticulously organized the research design, detailing the study variables, sample design, and specific methods used for quantitative data collection. This encompasses the overall design, types of variables, sampling techniques, and the instruments employed for data gathering. The third section focuses on qualitative data analysis methods, emphasizing structured procedures for data representation and processing, including data collection, transcription, coding, and thematic analysis. Ethical considerations are also addressed. This chapter ensures a comprehensive and methodical approach to quantitative and qualitative data collection and analysis by maintaining research integrity.

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# CHAPTER IV

# ANALYSIS AND INTERPRETATIONS



*This chapter aims to structure the developmental process of the metaliteracy scale, its assessment by analyzing survey responses from students at five IITs (IITM, IITH, IITP, IITPKD, and IITDH), and explore their subjective experiences through thematic analysis. It includes data analysis and interpretation using various statistical techniques, with six independent variables: institution, department, course, age groups, gender, and socioeconomic status as well as fourteen metaliteracy factors.*

## 4.1 Introduction

This chapter presents the data analysis and interpretations, which is the paramount phase in research, necessitating a meticulous examination of collected data to understand the relationships between variables (Gavin, 2008). The following section outlines the mixed methods used in this research, consisting of three studies, including quantitative and qualitative data sets, to address the research objectives. The first study starts with the development of a scale, followed by a quantitative survey of metaliteracy assessment, which involves scrutinizing numerical data suitable for statistical analysis, whereas finally, the qualitative research involves gathering data to understand the subjective experiences, examine purposes, and finding recurring topics through thematic analysis. In summary, combined findings from these three studies are presented in Chapter 5.

## 4.2 Study I: Development of Metaliteracy Scale

This section focuses on the metaliteracy scale's developmental process according to the Boateng et al. (2018) scale construction model, in which the process consists of three overarching phases composed of nine steps. The initial phase is item development, involving two key steps: identifying and generating relevant items and carefully considering content validity. Moving on to the second phase, scale development focuses on refining individual items into a construct through pre-testing, sampling, administering the survey, reducing items, and extracting the factors. Finally, the third phase, scale evaluation, encompasses three critical steps to assess the scale's dimensionality, reliability, and validity. These three phases and their steps form the structured process of creating and validating a scale.

### Phase I: Item Development

### 4.2.1 Identification of the Domain(s) and Item Generation (Selecting which items to ask)

A domain or construct is the concept, attribute, or unobserved behavior that constitutes the focal point of the study. A defined domain facilitates understanding the study's subject, sets limits, and simplifies item creation and content validation (Haynes et al., 1995). The researcher has reviewed the scholarly literature on metaliteracy and its related literacy types for insights into the theoretical conceptualization and operationalization of the construct. A thorough check has been conducted to know the availability of scales for evaluating metaliteracy among students and to understand the criteria necessary for constructing the items. As of 2024, no studies were available that effectively served the intended purpose, to the best of the researcher's knowledge. Based on the theoretical aspects of the metaliteracy framework developed by *Thomas P. Mackey* and *Trudi E. Jacobson*, the researcher has decided to construct the items in alignment with the Metaliteracy Goals and Learning Objectives of this framework, which are categorized into four domains: metacognitive, cognitive, behavioral, and affective. Some statements overlap across multiple domains, analyzing the behaviour multi-dimensionally.

Once the domain is fixed, the next step is item generation, which employs the deductive method used for this study to create a construct from a theoretical base. Some parameters should be addressed to develop simple and precise statements, such as item content, phrasing, sequencing, and layout. During the content development of statements, several critical questions were considered: whether the scale serves a practical purpose, whether respondents have the required information, whether greater specificity is needed, the potential for bias, and the likelihood of truthful responses. The statements were created from the goals and objectives of the metaliteracy framework, covering as many aspects as possible. In *item phrasing*, statements were crafted with concise, single-focused sentences, avoiding negativity and using precision. In *item sequencing,* each statement within the metaliteracy scale received meticulous attention to ensure the scale's effectiveness and response quality. Due to their sequential arrangement, the statements were crafted to reduce ambiguity, organized sequentially to elicit desired respondent attitudes, and aligned with metacognitive, cognitive, behavioral, and affective dimensions. In *item layout,* items were logically structured for clarity and simplicity, ensuring concreteness. Smooth transitions between statements were maintained, and potential low-response statements were avoided. Initially, a pool of 62 items was developed.

### 4.2.2 **Content Validity** (Assessing if the items adequately measure the domain)

Expert evaluation was employed to assess content validity. It refers to the "adequacy with which a measure assesses the domain of interest." This emphasizes the importance of content relevance and representation, ensuring that items effectively capture the pertinent experiences of the target population under investigation (Boateng et al., 2018). A preliminary draft scale shared via Google Docs comprising 62 items under four dimensions has been sent to the subject experts for evaluation. The researcher sought feedback from the two developers of the metaliteracy framework, including *Thomas P. Mackey, Ph.D.*, a Professor of Arts and Media at SUNY Empire State College, and *Trudi E. Jacobson*, Distinguished Librarian Emeritus at the University at Albany. Additionally, consulted with Professor *Florent Michelot,* an education expert within the Administration, Arts, and Human Sciences sector at the Université de Moncton. Apart from these international experts, many educators from universities in India were also consulted. Moreover, consulted with four IITH students for the draft scale's final evaluation. Finally, these expert's opinions are considered based on their feedback and suggestions; certain statements were removed, some underwent restructured, and ambiguous items were re-edited for clarity. After necessary changes were made as suggested by the experts. The expert's comments, suggestions, and the items removed based on these recommendations are provided in Appendix V. The final version of the Metaliteracy Scale (MS) consists of 56 statements in English.

**Phase II: Scale Development**

### 4.2.3 **Pre-testing Questions** (Ensuring the questions and answers are meaningful)

Pre-testing is a critical step that ensures items are comprehensible to the target population, minimizing misunderstandings and potential measurement errors. Additionally, it helps eliminate poorly worded items, reduces the cognitive load on participants, and involves the target population in providing valuable insights for survey development (Colbert et al., 2019). Pre-testing through cognitive interviews plays a crucial role in ensuring that survey items are easily understood by participants, thus minimizing misunderstandings and enhancing the accuracy of collected data. This process involves conducting four cognitive interviews with students from IITH of multiple rounds, during which respondents articulate their thoughts while answering survey questions. By observing these cognitive processes, researchers can identify potential confusion or ambiguity in the questions and make necessary modifications to ensure alignment with the study objectives. This approach ensures that participants comprehend the survey items accurately and respond accordingly, improving the data quality.

### 4.2.4 **Survey administration and sample size** (Gathering enough data from the right people)

To conduct exploratory factor analysis and confirmatory factor analysis effectively, it's essential to administer potential scale items on a sample that reflects a diverse range of target populations, utilizing appropriate data collection methods. The recommended sample size is typically ten respondents per survey item, with an overall range of observations between 200 and 300 (Fink, 2003). Comrey and Howard (2013) suggested a sample size of at least 500 is a good number for scale development. The survey administration has been done across five IITs in South India. The sampling size was calculated using G*Power software, and the final sample size was estimated as 170 for a total population of 14611. However, the optimum representation from each institute is confined to a sample size of 739, ensuring a five percent proportional representation. Data collection was conducted online via a single Google form, preventing the researcher from stopping responses once enough were received from any specific institute. To ensure equal representation from all selected IITs, the process was extended to 6-9 months, resulting in a total of 824 responses are taken for the cross-sectional analysis of the metaliteracy assessment. The factor analysis ensures a comprehensive understanding of the relationships between variables at a specific time. The factor analysis approach was used to identify underlying factors or dimensions within the data set, facilitating the development of robust measurement instruments and insights into the phenomena under investigation. The data collection procedure has been completed from August 2022 to March 2023. The researcher approached the higher authority of the five IITs for data collection permission. The IIT Madras, IIT Tirupati, IIT Dharwad, and IIT Palakkad shared an email provided by the researcher through the institute's student email system. As the researcher is affiliated with IIT Hyderabad, the researcher was directly approached via institutional e-mail once the authority approval is received.

### 4.2.5 Item Reduction Analysis (Ensuring Scale is parsimonious)

The item reduction analysis is to obtain a concise, effective, and internally consistent set of items by eliminating or modifying them as per the relatedness to the domain (Morgado et al., 2017). The item discrimination index was also calculated for the items, and no item was removed after the preliminary draft of the metaliteracy scale, which consisted of 56 items.

### 4.2.6 Extraction of Factors (Exploring the number of latent constructs that fit observed data)

In this phase, the ideal number of factors (or domains) for an item is determined using factor analysis, a type of regression model. In this model, observed standardized variables are regressed on latent (unobserved) factors. Factor analysis helps uncover the internal (latent) structure of a group of items and the consistency of associations between them. This is done by extracting latent factors that represent the common variance among the items. The focus is on the number of factors, the significance of factor loading estimates, and the relative magnitude of the remaining difference (Boateng et al., 2018). Since the study developed the underlying model for the scale, there were no prior hypotheses about the individual items of students' metaliteracy. Therefore, exploratory factor analysis (EFA) was the appropriate initial step in the analysis, followed by confirmatory factor analysis (CFA). Prior to applying factor analysis, a descriptive analysis needs to be conducted on survey responses from 824 samples to ensure their suitability for the factor analysis. Factor analysis has two types: EFA and CFA. EFA is used when there is no prior research on how items should be organized to assess a phenomenon. CFA is used when previous research indicates that measurement should be done using a scale with multiple subscales. Since collecting multiple datasets at different times was impractical, a split-data strategy was employed (Backhaus et al., 2023). The total sample was randomly divided into two equal halves: one for EFA (N=412) and the other for CFA (N=412).

The first assumption for conducting the parametric test is that the data is normally distributed. To verify this, descriptive statistics were calculated, and the normality of the data was assessed using skewness, kurtosis, and the Shapiro-Wilk test following Field (2009). Once the data were confirmed to be normally distributed, both factor analyses were conducted using SPSS software.

**Table 4**

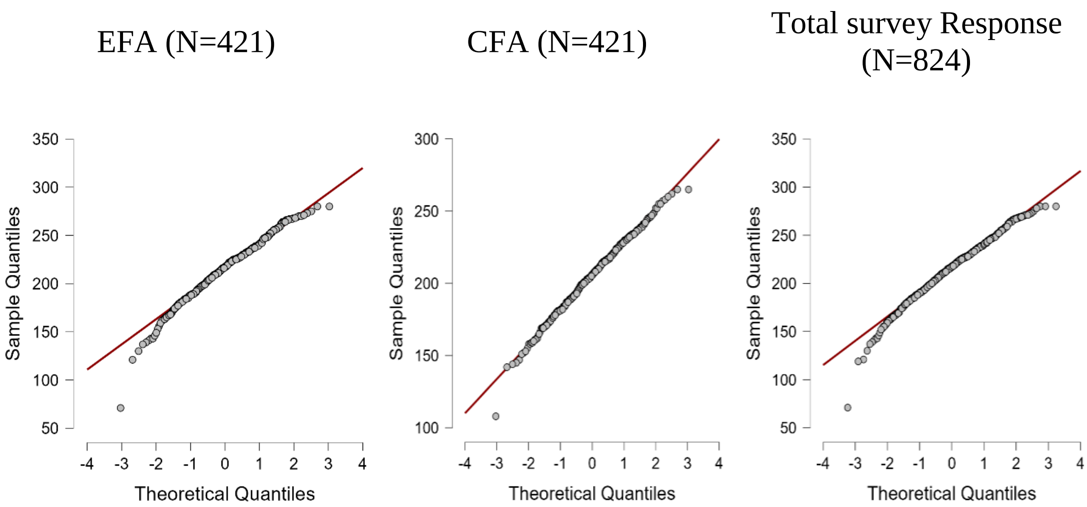
*Normality Score*

| Scale | Valid | Mean | Std. Deviation | Skewness | Std. Error of Skewness | Kurtosis | Std. Error of Kurtosis | Shapiro-Wilk | *p* value of Shapiro-Wilk |
|---|---|---|---|---|---|---|---|---|---|
| Metaliteracy Scale (MS) | 824 | 215.757 | 26.517 | -0.473 | 0.085 | 1.171 | 0.17 | 0.986 | 0.104 |
| | 412 | 215.068 | 28.669 | -0.576 | 0.12 | 1.415 | 0.24 | 0.98 | 0.101 |
| | 412 | 216.447 | 24.19 | -0.257 | 0.12 | 0.311 | 0.24 | 0.994 | 0.131 |

For psychometric purposes, skewness and kurtosis values between -2 and +2 are considered acceptable (George & Mallery, 2010). As shown in Table 4, the skewness and kurtosis values fall within this range, indicating that the data is normal and the basic assumption for parametric testing is fulfilled. An acceptable value for the Shapiro-Wilk test is typically a *p* value greater than .05, indicating that the data is normally distributed.

**Figure 13**

*Q-Q Plot of Distribution of Responses*



Exploratory factor analysis assists in conceptualization by accurately summarizing how variables are interrelated (Trendafilov & Hirose, 2023). It categorizes the components within the theoretical construct among the items for the data analysis. Before conducting EFA, it's essential to check sample adequacy to ensure the dataset is sufficient for data analysis. Two tests were used to check it, such as Kaiser-Meyer-Olkin (KMO) for a measure of sampling adequacy and Bartlett's test of sphericity. Table 5 below represents the KMO and Bartlett's Test.

i) **Bartlett's Test of Sphericity**: Bartlett's test of sphericity helps to decide whether the results for factor analysis are worth considering and whether a researcher should continue analyzing the research work. Bartlett's test of sphericity is significant to a significance level of less than .05. Here, the value is less than zero (<**.000),** showing a high correlation between variables, making it adequate to apply factor analysis and interpret its results.

ii) **Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy:** The KMO measure is an index that defines sampling adequacy by examining the partial correlation strength among variables and how much the factors explain each other. Its value closer to 1.0 is ideal, and below .05 isn't acceptable. The KMO test value is **0.907,** which can be used to conduct data reduction techniques and analysis and can be considered acceptable and valid.

**Table 5**

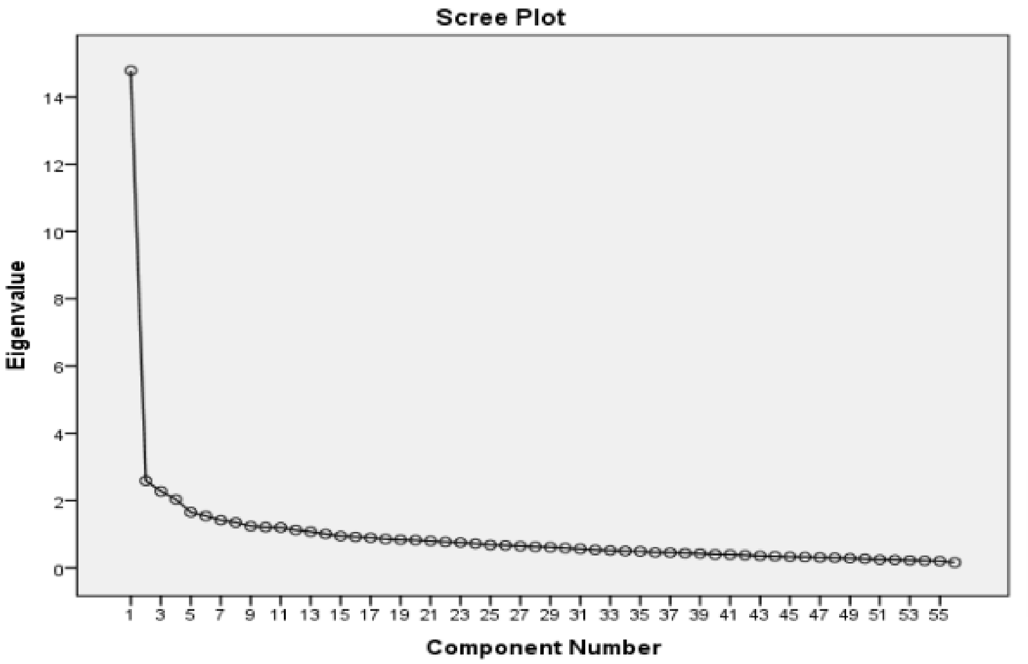
*KMO and Bartlett's Test Score*

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | **0.907** |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 6983.522 |
| | Df | 1540 |
| | Sig. | < **.000** |

In EFA, eigenvalue is a measure that helps to know how much variance each factor explains. These eigenvalues against components are shown below using the X-Y graph scree plot shown in Figure 14; Eigenvalue values are represented as values higher than 1.0, which is considered stable.

**Figure 14**

*Scree plot*




This scree plot shows the scale items on the X-axis and the corresponding Eigenvalues of 3.887, 3.506, 3.163, 1.945, 2.295, 2.67, 2.475, 2.211, 1.91, 1.607, 1.496, 1.834, 0.744, and 0.809 are on Y-axis. The highest eigenvalue of 3.887 indicates the most significant factor, emphasizing its importance relative to the other factors. Each of the fourteen factors identified has an eigenvalue greater than one, signifying their relevance in the overall analysis. Though varying in significance, these factors share a minimum variance, making them essential for the study's interpretation. After determining the factor loadings, the next critical step involves factor rotation, which enhances the clarity and interpretability of these factors. The rotated component matrix for all factors is detailed in Table 6.

**Table 6**

*Rotated Component Matrix*

| Sl. No | Variables | Rotated Loading | Name of Factor | Sum of Eigen Value | % Variance |
|---|---|---|---|---|---|
| 1 | I am aware that there is so much more to know than what I know. | 0.706 | Lifelong Learner | 3.887 | 26.399 |
| | I understand that learning is a lifelong process. | 0.661 | | | |
| | I share my knowledge with others while working in teams. | 0.591 | | | |
| | I can learn from others while working collaboratively. | 0.564 | | | |
| | I understand adaptability and flexibility are important in lifelong learning. | 0.484 | | | |
| | The more I know the better I can think critically about new content. | 0.461 | | | |
| | I see myself as both a learner and a teacher when I collaborate with others. | 0.42 | | | |
| 2 | I can thoroughly evaluate frequently changing content online. | 0.742 | Informed Prosumer | 3.506 | 4.621 |
| | I am able to identify open licensed content (i.e. content that can be reused) | 0.687 | | | |
| | I am able to differentiate and produce original information and reproduce openly licensed content. | 0.585 | | | |
| | I can distinguish between personal and public information to make decisions about whether to share it or not. | 0.537 | | | |
| | I can verify the credibility of information from a source. | 0.495 | | | |
| | I produce information as well as consume it. | 0.46 | | | |
| 3 | I utilize resources beyond my curriculum for lifelong learning. | 0.718 | Metalearner | 3.163 | 4.066 |
| | I seek information from a wide range of reliable information | 0.669 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | sources. | | | | |
| | When I read news, I consider different viewpoints. | 0.583 | | | |
| | I effectively use new technologies for learning. | 0.472 | | | |
| | I consider perspectives other than my own perspective. | 0.38 | | | |
| | I am able to differentiate the facts versus the opinions of others on social media platforms. | 0.341 | | | |
| 4 | I can communicate and collaborate in the classroom and understand multiple perspectives. | 0.727 | Collaborator | 1.945 | 3.638 |
| | I work well in groups. | 0.632 | | | |
| | I participate responsibly in groups. | 0.586 | | | |
| 5 | I think well before I do something. | 0.67 | Value Oriented | 2.295 | 2.95 |
| | When I commit, I keep up to it. | 0.639 | | | |
| | I share my knowledge by teaching others. | 0.524 | | | |
| | I learn from my mistakes. | 0.462 | | | |
| 6 | I am aware information content is not always produced for legitimate reasons | 0.737 | Active & Critical Evaluator | 2.67 | 2.756 |
| | I am able to identify bias in the content that I come across. | 0.599 | | | |
| | I am able to identify my own bias. | 0.57 | | | |
| | I consider perspectives other than my own perspective. | 0.396 | | | |
| | I am able to distinguish between a research article and content from popular media. | 0.368 | | | |
| 7 | As an informed, self-directed learner, I broaden my worldview through the use of social media | 0.632 | Digitally Literate | 2.475 | 2.53 |
| | I build upon the exciting ideas of others in an ethical way. | 0.529 | | | |
| | I critically assess user-generated sources (e.g. Wikipedia) while writing my assignments. | 0.513 | | | |
| | I often use social media for professional networking. | 0.44 | | | |
| | I often try to represent theoretical | 0.361 | | | |

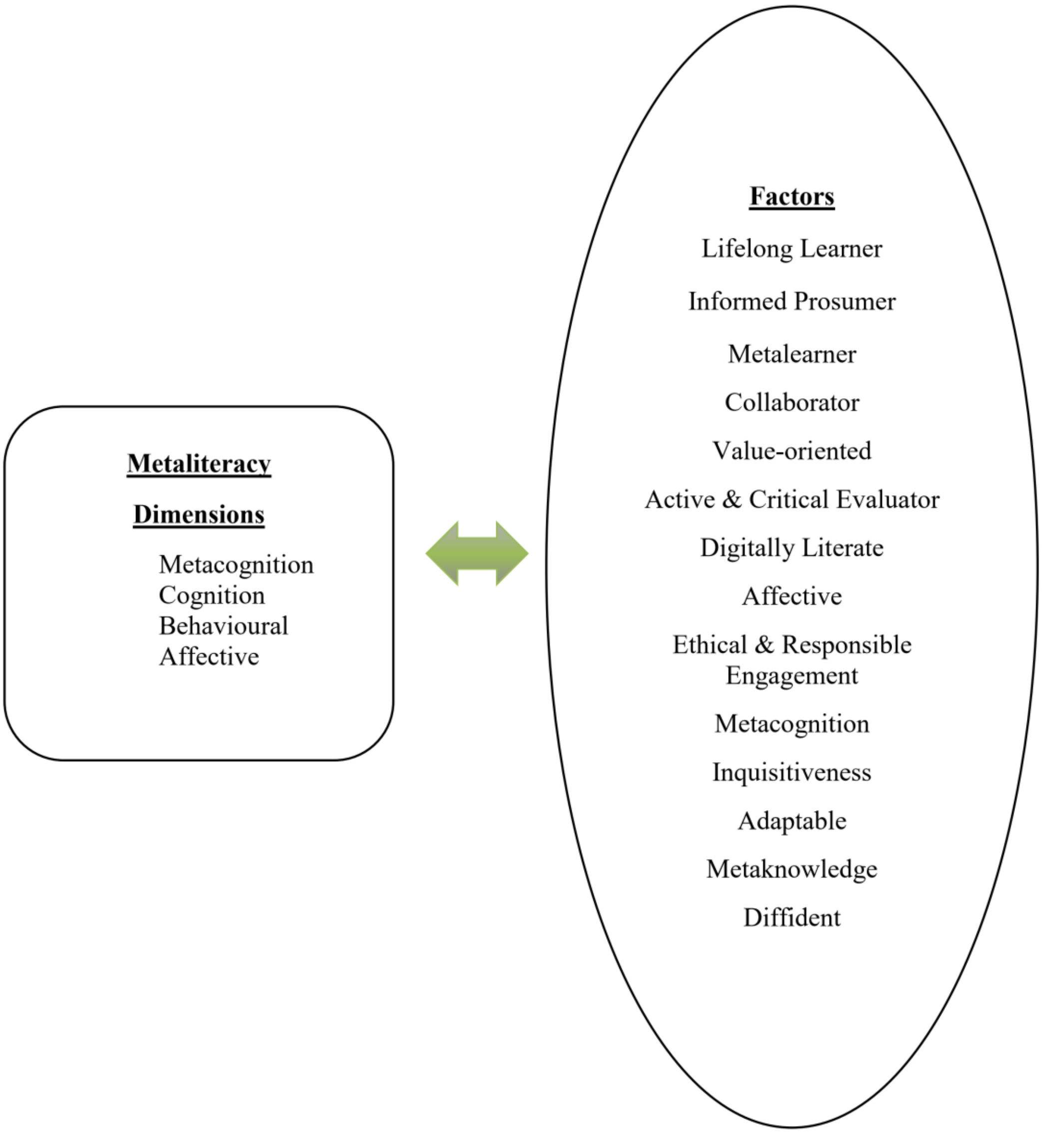
| | | | | | |
|---|---|---|---|---|---|
| | knowledge in different formats like ppts, flowcharts etc. | | | | |
| 8 | I am inspired by what I learn from others in a group setting. | 0.684 | Affective | 2.211 | 2.409 |
| | I am aware that my feelings influence the information I seek. | 0.638 | | | |
| | I am aware about how I feel about the information I get. | 0.514 | | | |
| | I allow myself to get excited about the things I do. | 0.375 | | | |
| 9 | I am aware how information helps me to consider multiple perspectives on a piece of information. | 0.655 | Ethical & Responsible Engagement | 1.91 | 2.214 |
| | I know how to ethically integrate someone else's intellectual property into my own work. | 0.472 | | | |
| | To be ethical, I remember to cite the references of the materials that I use for an assignment. | 0.446 | | | |
| | I can identify gaps in the literature through my research. | 0.337 | | | |
| 10 | I am confident in explaining my knowledge strengths to others. | 0.712 | Metacognition | 1.607 | 2.161 |
| | Thinking about my thought process helps me to improve my learning. | 0.54 | | | |
| | I often monitor my own thoughts about my learning. | 0.355 | | | |
| 11 | I seek new learning opportunities in social settings and online communities. | 0.6 | Inquisitiveness | 1.496 | 2.142 |
| | I'm enthusiastic about new learning and new situations. | 0.479 | | | |
| | I am willing to take a task/assignment that no one else wants to do. | 0.417 | | | |
| 12 | I take measures to secure my personal privacy online. | 0.743 | Adaptable | 1.834 | 2.009 |
| | I effectively communicate using appropriate methods when producing and sharing information for specific audiences. | 0.409 | | | |
| | Sometimes, reflecting on my | 0.384 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | mistakes provides me with insights about my learning. | | | | |
| | I recognize when my attitude is negative. | 0.298 | | | |
| 13 | I am aware of my existing knowledge and the things I don't know. | 0.744 | Metaknowledge | 0.744 | 1.917 |
| 14 | I procrastinate (delay things/ waste) because I worry, I won't succeed. | 0.809 | Diffident | 0.809 | 1.799 |

Finally, following the rotation process, fourteen distinct factors were identified and labeled based on the nature of the items in the scale. The factors were meticulously identified and labeled according to the specific nature and characteristics of the items within the scale. This labeling process involved a detailed examination of the items linked to each factor, ensuring that the labels accurately captured the underlying themes or constructs they represented. The weighted approach was utilized for score calculation, ensuring that each factor's contribution was accurately represented in further analysis and interpretation. The total variance associated with each item and its respective factor is provided in Appendix III, while Figure 15 offers a visual representation of four metaliteracy domains and these fourteen factors: 1***) Lifelong Learner, (2) Informed Prosumer, (3) Metalearner, (4) Collaborator, (5) Value-oriented, (6) Active and Critical Evaluator (7) Digitally Literate, (8) Affective, (9) Ethical and Responsible Engagement, (10) Metacognition (11) Inquisitiveness, (12) Adaptable, (13) Metaknowledge and (14) Diffident*.**

**Figure 15**

*Dimensions and Factors of Metaliteracy Scale*



**Phase III: Scale Evaluation (**Testing if the latent constructs are as hypothesized)

### 5.2.7 Tests of Dimensionality

Tests of dimensionality involve evaluating the hypothesized factor's structure derived from a prior model, either in a distinct time frame within a longitudinal study or, ideally, on a fresh set of data from a new sample. Many researchers opted for a split data strategy because of the impracticability of the collection of fresh data. It assesses whether item measurement, factors, and functionality remain consistent across two samples (Brown, 2015). To address on the latent structure of scale items and their underlying relationship to validate whether the previous hypothetical structure fits the items. Confirmatory factor analysis has been carried out to validate the hypothetical factor structure.

#### 5.2.7.1 Confirmatory Factor Analysis (CFA)

CFA is used to confirm or validate a proposed factor structure by specifying a model with a predetermined number of factors and pattern of loadings and then assessing how well this model fits the observed data.

**Table 7**

*CFA-Overall Model Fit Indices*

| CFA-Model Fit Indices | | | |
|---|---|---|---|
| Fit Index | Threshold Value | Calculated Value | Adequacy |
| Goodness of Fit Index (GFI) | ≥ 0.90 | GFI=0.840 | Acceptable |
| Tucker-Lewis Index (TLI) | ≥ 0.90 | TLI=0.803 | Acceptable |
| Normed Fit Index (NFI) | ≥ 0.90 | NFI =0.758 | Marginal |
| Incremental Fit Index (IFI) | ≥ 0.90 | IFI =0.823 | Acceptable |
| Relative Fit Index (RFI) | 0 to 1 | RFI =0.730 | Acceptable |
| Parsimony-Adjusted Normed Fit Index (PNFI) | > 0.50 | PNFI=0.680 | Acceptable |
| Standardized Root Mean Square Residual (SRMR) | ≤ 0.08 | SRMR=0.051 | Good |
| Root Mean Square Error of Approximation (RMSEA) | < 0.05 good, Closer to zero | RMSEA=0.049 | Good |

Table 7 displays the CFA fit indices which reveals a mixed picture of the model's goodness of fit. While the SRMR and RMSEA indicate a good fit with values of 0.051 and 0.049, respectively, other indices such as the NFI and RFI fall somewhat acceptable threshold of 0.90, with values of 0.758 and 0.730. The GFI and IFI are marginally acceptable at 0.840 and 0.823, while the TL at 0.803 suggests an acceptable but suboptimal fit. Overall, the model demonstrates an adequate fit within acceptable bounds; therefore, the model is considered appropriate and validated. However, there are certain areas that could be improved to meet higher standards of model fit.

**5.2.7.2. Scoring Scale Items**: Scale scores can be calculated using either unweighted or weighted procedures. The unweighted method sums item scores or calculates the mean, while the weighted approach employs statistical software for computation. This study used an unweighted method that evaluated using a five-point Likert scale starting from 'not at all, slightly, high, very much and extremely' against each statement. Scoring is determined by assigning weights to the responses; the scoring pattern is outlined in Table 8.

**Table 8**

*Data Scoring Pattern*

| Scoring Pattern | NA | S | M | V | E |
|---|---|---|---|---|---|
| Positive | 1 | 2 | 3 | 4 | 5 |
| Negative | 5 | 4 | 3 | 2 | 1 |
| Scale used | Very little extent | Little extent | Some extent | Great extent | Very great extent |
| Overall Score range | 56 | 57-112 | 113-168 | 169-224 | 225-280 |
| Interpretation | Very low | Low | Moderate | High | Extremely |

In this study, a five-point Likert scale represents the degree of agreement or intensity, with "Not at all" indicating the lowest level and "Extremely" representing the highest level. All these factors are positive, with one to five scoring, except diffident, with a negative score from five to one. The maximum score will be 280, and the minimum score will be 56 for all the statements.

### 5.2.8 Tests of Reliability (Establishing if responses are consistent when repeated)

Reliability refers to the degree of consistency observed when a measurement is repeated in identical conditions (Porta, 2014). In this study, the reliability of the Metaliteracy Scale (MS) was determined through the following two methods:

#### 5.2.8.1 Spearman-Brown Coefficient

The Spearman-Brown formula is used for tests with Likert scale items to estimate test reliability by calculating it "n" times through the split-half method. This formula determines the entire test's self-correlation coefficient based on the half-test's reliability (Schmidt & Hunter, 1996).

Spearman and Brown formula is: $r_{tt} = \frac{2r_{hh}}{1 + r_{hh}}$

Where,

$r_{tt}$ = Reliability of a total test estimated from the reliability of one of its halves (Reliability coefficient of the whole test)

$r_{hh}$ = Pearson correlation of scores in two half tests (Reliability coefficient of the half test)

Table 9 shows the reliability coefficients derived from the Split-Half method using the Spearman and Brown formula for the MS, computed with SPSS software.

**Table 9**

*Reliability Coefficients of MS by Split-Half Method*

| | | |
|---|---|---|
| Part I | No of items | 28 |
| Part II | No of items | 28 |
| Total no. of items | | 56 |
| Spearman and Brown Coefficient | | **0.914** |

The Spearman and Brown Coefficient value is 0.914, ranging from 0 to 1, with higher values reflecting greater internal consistency. So, the scale is considered as reliable.

### 5.2.8.2 Cronbach's Alpha (α)

Cronbach's alpha is a statistical measure used to assess the internal consistency or reliability of a set of items on a scale. It quantifies how closely related the items or factors each other, indicating the extent to which they measure the same underlying construct or concept (Vaske et al., 2017). Cronbach's alpha was used in this study to measure reliability and the formula is as follows.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_{yi}^{2}}{\sigma_{i}^{2}}\right)$$

k is the number of items (questions) in the test.

σi2 is the variance associated with each item.

variance associated with the total score

The alpha coefficient ranges from 0 to 10, with higher values indicating higher internal consistency. This study measured reliability by calculating Cronbach's alpha: total overall variance and item-factor variance. These are metrics employed to assess the internal reliability or uniformity of the test.

**Table 10**

*Cronbach's Alpha Inter-rater Reliability*

| Cronbach's alpha | Number of Items |
|---|---|
| 0.945 | 56 |

It is clear from Table 10 that the reliability of overall variance has been calculated in SPSS; Cronbach's alpha value is 0.945, indicating a very high level of consistency between the items on the scale. This is a relatively high value, close to 1, which suggests that the items on the scale are highly reliable and consistent with each other. It indicates that the items measure the same underlying construct effectively, and the responses obtained from participants are consistently related.

**Table 11**

*Cronbach's Alpha Inter-factor Reliability*

| Cronbach's alpha | Number of Items | Factor's No & Name | |
|---|---|---|---|
| .801 | 7 | 1. | Lifelong Learner |
| .819 | 6 | 2. | Informed Prosumer |
| .772 | 6 | 3. | Metalearner |
| .747 | 3 | 4. | Collaborator |
| .713 | 4 | 5. | Value-oriented |
| .718 | 5 | 6. | Active & Critical Evaluator |
| .693 | 5 | 7. | Digitally Literate |
| .693 | 4 | 8. | Affective |
| .616 | 4 | 9. | Ethical & Responsible |
| .550 | 3 | 10. | Metacognition |
| .665 | 3 | 11. | Inquisitiveness |
| .619 | 4 | 12. | Adaptable |
| -- | 1 | 13. | Metaknowledge |
| -- | 1 | 14. | Diffident |

Table 11 represents the reliability statistics of inter-factorial, where the alphas ranged from 0.550 to 0.819 for the individual factors. All factors have Cronbach's alpha value except factors 13 and 14, as a minimum of two items are required to calculate. The correlation of the factors is high and positive. Therefore, it can be concluded that the MS is highly reliable.

### 5.2.9 Tests of Validity

Scale validity assesses how well an instrument measures the intended construct. It typically includes content and criterion validity (Mason et al., 2024). For the MS scale, content validity was ensured through face validity, with expert evaluations conducted before its administration. Experts in the field of metaliteracy, including both international and national authorities, reviewed the scale to ensure comprehensive coverage of the construct. Criterion validity, assessed post-survey, involves different validation techniques (Catalano, 2018). A follow-up study will examine the criterion validity of the post-survey by comparing it with a similar scale using new data to be conducted at an advanced research level. The descriptive statistics for each survey response are presented in Table 12.

**Table 12**

*Descriptive Statistics of Survey Responses.*

| Question | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q_1 | 824 | 1 | 5 | 3.8592 | .88023 |
| Q_2 | 824 | 1 | 5 | 3.9769 | .83117 |
| Q_3 | 824 | 1 | 5 | 3.6104 | 1.01863 |
| Q_4 | 824 | 1 | 5 | 4.0752 | .89913 |
| Q_5 | 824 | 1 | 5 | 4.0898 | .89236 |
| Q_6 | 824 | 1 | 5 | 3.5607 | 1.11052 |
| Q_7 | 824 | 1 | 5 | 4.0085 | 1.08281 |
| Q_8 | 824 | 1 | 5 | 3.5886 | 1.04314 |
| Q_9 | 824 | 1 | 5 | 4.7282 | .63620 |
| Q_10 | 824 | 1 | 5 | 4.0971 | .90646 |
| Q_11 | 824 | 1 | 5 | 4.2524 | .77279 |
| Q_12 | 824 | 1 | 5 | 4.4163 | .74942 |
| Q_14 | 824 | 1 | 5 | 3.4345 | 1.16993 |
| Q_15 | 824 | 1 | 5 | 3.6553 | .96104 |
| Q_16 | 824 | 1 | 5 | 3.4818 | 1.11421 |
| Q_17 | 824 | 1 | 5 | 4.2427 | .81410 |
| Q_18 | 824 | 1 | 5 | 4.3665 | .79589 |
| Q_19 | 824 | 1 | 5 | 3.6942 | .98280 |
| Q_20 | 824 | 1 | 5 | 4.7160 | .62116 |

| | | | | | |
|---|---|---|---|---|---|
| Q_21 | 824 | 1 | 5 | 3.9417 | 1.00739 |
| Q_22 | 824 | 1 | 5 | 3.6942 | .97535 |
| Q_23 | 824 | 1 | 5 | 3.7342 | .95258 |
| Q_24 | 824 | 1 | 5 | 3.8180 | .96896 |
| Q_25 | 824 | 1 | 5 | 4.1007 | .93445 |
| Q_26 | 824 | 1 | 5 | 3.9903 | .93138 |
| Q_27 | 824 | 1 | 5 | 3.3265 | 1.05912 |
| Q_28 | 824 | 1 | 5 | 3.4150 | 1.08791 |
| Q_29 | 824 | 1 | 5 | 3.2816 | 1.13204 |
| Q_30 | 824 | 1 | 5 | 3.9697 | .93289 |
| Q_31 | 824 | 1 | 5 | 4.0898 | .90989 |
| Q_32 | 824 | 1 | 5 | 3.5061 | 1.01745 |
| Q_33 | 824 | 1 | 5 | 4.2779 | .77425 |
| Q_34 | 824 | 1 | 5 | 3.8058 | 1.00360 |
| Q_35 | 824 | 1 | 5 | 3.6930 | 1.05344 |
| Q_36 | 824 | 1 | 5 | 2.8070 | 1.27996 |
| Q_37 | 824 | 1 | 5 | 3.5777 | 1.04749 |
| Q_38 | 824 | 1 | 5 | 3.7476 | 1.00030 |
| Q_39 | 824 | 1 | 5 | 3.9551 | .98429 |
| Q_40 | 824 | 1 | 5 | 3.8956 | .94889 |
| Q_41 | 824 | 1 | 5 | 3.4405 | 1.24959 |
| Q_42 | 824 | 1 | 5 | 3.8532 | 1.00135 |
| Q_43 | 824 | 1 | 5 | 4.0400 | .88985 |
| Q_44 | 824 | 1 | 5 | 3.7488 | 1.01687 |
| Q_45 | 824 | 1 | 5 | 3.7913 | .95468 |
| Q_46 | 824 | 1 | 5 | 3.8738 | .93200 |
| Q_47 | 824 | 1 | 5 | 3.9235 | 1.00435 |
| Q_48 | 824 | 1 | 5 | 3.6663 | .93483 |
| Q_49 | 824 | 1 | 5 | 3.5655 | 1.05641 |
| Q_50 | 824 | 1 | 5 | 4.1189 | .87932 |

| | | | | | |
|---|---|---|---|---|---|
| Q_51 | 824 | 1 | 5 | 3.9393 | .98775 |
| Q_52 | 824 | 1 | 5 | 3.2633 | 1.30139 |
| Q_53 | 824 | 1 | 5 | 3.9830 | .92866 |
| Q_54 | 824 | 1 | 5 | 4.0206 | .86701 |
| Q_55 | 824 | 1 | 5 | 4.0704 | .86368 |
| Q_56 | 824 | 1 | 5 | 4.0667 | .88961 |
| Valid N (listwise) | | | 824 | | |

The descriptive statistics for each question in the survey include the number of respondents (N=824), the minimum and maximum values of responses, the mean (average) score, and the standard deviation (a measure of the dispersion of scores around the mean. This data provides insights into the distribution and variability of responses for each question in the survey, helping to understand the central tendency and spread of participant responses. The quantitative data from the survey responses and their statistical analysis are presented in the following section.

### 4.3 Study II: Assessment of students' metaliteracy- Quantitative Analysis

In the quantitative data analysis phase, statistical software IBM® SPSS was used for the data analysis. This study utilizes the suggestion by the '*American Psychological Association's Task Force on Statistical Inference'* to use minimal sufficient statistics to avoid more complex analysis when the simpler one can explain it (Westen & Rosenthal, 2003). This study's data analysis and interpretation focus on fourteen metaliteracy factors generated through exploratory factor analysis representing overall metaliteracy, detailed in the following section. Hypotheses were formulated to assess the impact of the classificatory (independent) variables: *(1) Institution, (2) Department, (3) Course, (4) Age, (5) Gender, and (6) Socioeconomic status,*

The variance is measured using Analysis of Variance (ANOVA), Scheffe Test, and T-test, each factor's level was calculated based on the dispersion of *Mean Score* and *Standard Deviation*, rated with the mean score ranging from 1 to 5, with higher values reflecting greater and vice versa. Then, the calculated *p value* and t-value are used to determine the degree of significance of the observed differences. The obtained *p value* determines the significance level at the 0.05 or 0.01 threshold. Table 13 shows the rating of the mean score and *p value*—finally, correlation and regression analysis are used to assess the relationships between variables or factors.

**Table 13**

*Rating of Mean score and p value*

| Mean Score Range | Rating (positive) 1 to 13 factors | Mean Score Range | Rating (negative) $14^{th}$ factor | *p value* Range | Rating |
|---|---|---|---|---|---|
| 0.01 -1.00 | Poor | 0.01 -1.00 | Very High | Less than .05/.01 | Statistical difference between groups |
| 1.01-2.00 | Low | 1.01-2.00 | High | | |
| 2.01-3.00 | Moderate | 2.01-3.00 | Moderate | Greater than .05 | No statistical difference between groups |
| 3.01-4.00 | High | 3.01-4.00 | Low | | |
| 4.01-5.00 | Very High | 4.01-5.00 | Poor | | |

In-depth data analyses are conducted on 824 sample responses across the fourteen metaliteracy factors, considering classificatory variables such as institution, department, course, age, gender, and socio-economic status, and in the following section. To compare students' metaliteracy across the institution, ANOVA (Analysis of Variance) and T-test are conducted among the five IITs in South India, examining fourteen metaliteracy factors. Each of the factors and their association with the institutes are detailed below.

### 4.3.1 Influence of Institutions (IITs) on *Lifelong Learners*

IITs are considered one of India's premier educational institutions and often contribute significantly to fostering lifelong learning. Lifelong learner skills help students to evaluate and adapt information in the digital age and learn in a rapidly changing information landscape (Buyukgoze, 2023). There is no doubt that educational institutions play an important role in encouraging lifelong learning, and the global education community has addressed the implications of lifelong learning for higher education (Yang et al., 2015). Table 14 displays the lifelong learner skills of the students across the five IITs, including its mean score, standard deviation, F and *p value*s.

**Table 14**

*Lifelong Learner- Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 4.4719 | .45670 | 1.160 | .327* |
| IITH | 203 | 4.4721 | .50251 | | |
| IITTP | 99 | 4.3603 | .61386 | | |
| IITPKD | 81 | 4.4527 | .50979 | | |
| IITDH | 38 | 4.5000 | .44519 | | |
| Total | 824 | 4.4579 | .49425 | | |

* The mean difference is significant at the .05 level (p≤.05).

The lifelong learner skills across selected IITs vary between 4.36 and 4.50 on a scale where the minimum and maximum scores are one and five, respectively. The average mean score is 4.45, with a standard deviation of 0.49. It denotes that a very high level of lifelong learning skills exists in the five IITs of South India. IIT Dharwad exhibits the highest level of lifelong learner skills, with a mean score of 4.50, followed by IIT Hyderabad and IIT Madras, with a mean score of 4.47 for each. IIT Palakkad and IIT Tirupati have mean scores of 4.45 and 4.36, respectively. The high mean score reveals that lifelong learning is high across all selected IITs.

Lifelong learning tends to be higher among IIT students due to several reasons. The educational environment, academic culture, access to resources, emphasis on problem-solving, and continuous skill development might contribute to fostering a mindset of lifelong learning among IIT students. The diverse and challenging academic programs often instil a deep-seated motivation to acquire new skills and knowledge beyond formal education continually (Jamison et al., 2014). These IITs offer different programs online, which will help inculcate lifelong learning skills throughout one's lifetime. Moreover, the library's pivotal role is to provide resources even to alumnus.

The *p value* for the lifelong learning factor across these IITs is .327, suggesting no significant difference in lifelong learning scores among these institutes as the *p value* is greater than the significance level. These institutes uphold identical standards, and the uniform structure might be the reason for the lack of variation in lifelong learning among them.

### 4.3.2 Influence of Institutions (IITs) on *Informed Prosumer*

Informed prosumer is one of the core roles of the metaliteracy. This term combines "producer" and "consumer" to describe someone who not only consumes content but also participates in its creation, making informed choices as both a producer and consumer in various domains, including media and technology (Borges, 2023). An informed prosumer is an individual who is actively engaged in both production and consumption of information.

**Table 15**

*Informed Prosumer - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.6250 | .65467 | 1.926 | .104 |
| IITH | 203 | 3.7023 | .70285 | | |
| IITTP | 99 | 3.6017 | .66734 | | |
| IITPKD | 81 | 3.4533 | .84055 | | |
| IITDH | 38 | 3.6090 | .68527 | | |
| Total | 824 | 3.6236 | .69128 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 15 reveals the ability to be an informed prosumer across the five IITs. The mean scores for informed prosumer fall within the range of 3.45 to 3.70, which shows that students in all IITs possess a high level of informed prosumer skills. Notably, the highest mean score for informed prosumer is observed among students at IIT Hyderabad (3.70), and IIT Palakkad represents the lowest score (3.45) among these IITs. Students enrolled in these institutes have high academic achievement, well-training, curiosity, and motivation to excel. Many IIT programs focus on technology and engineering. Moreover, the library has a role in encouraging students to seek information actively and engage in informed consumption. The analysis of variance indicates that the variation in informed prosumer skills among students from different IITs is not statistically significant at the five percent level, with a *p value* of .104. The lack of differences across these institutions could be due to their homogeneity.

### 4.3.3 Influence of Institutions (IITs) on *Metalearner*

The prefix 'meta' denotes something about itself or beyond itself i.e. self-referential (Jacobson & Mackey, 2015). A metalearner is adept at mastering diverse learning methods and strategies of how to learn effectively and is good at self-regulation (Jebur et al., 2022). Being a metalearner, adapt to different teaching styles, understand complex concepts from various perspectives, and efficiently manage the rigorous workload.

**Table 16**

*Metalearner- Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.9201 | .61625 | 1.138 | .337 |
| IITH | 203 | 3.9448 | .65922 | | |
| IITTP | 99 | 3.8424 | .66534 | | |
| IITPKD | 81 | 3.8617 | .73051 | | |
| IITDH | 38 | 4.0737 | .61058 | | |
| Total | 824 | 3.9182 | .64483 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The metalearner characteristics of students across the five IITs are given in Table 16. The mean score for metalearner falls between 3.84 and 4.07, indicating a range from high to very high. The multifaceted nature of academics and diverse skill sets may be a reason that IIT students are adept at learning how to learn and synthesize information. The highest level of metalearner skill is observed among students at IIT Dharwad, who achieved a mean score of 4.07. but students from IIT Madras and IIT Hyderabad have almost equal metalearner proficiency, with a mean score of 3.9 plus. IIT Palakkad and IIT Tirupati show nearly identical levels of metalearner competency, with a mean score of 3.86 and 3.84. The *p value* of .337 from the significance test reveals that the difference in metalearner among students from various institutions lacks statistical significance at the five percent threshold. The uniform nature of institutes might lack variation in metalearning practices across them.

### 4.3.4 Influence of Institutions (IITs) on *Collaborator*

A metaliterate collaborator is an individual who actively engages in collaborative efforts, often within digital and networked environments, to evaluate, create, and share information collectively (Jacobson & Mackey, 2015). The collaborative work among students promotes a holistic learning experience beyond the mere transmission of knowledge, empowering them with the skills necessary for success in their academic and professional lives. The collaborative students have the skills for in-depth learning and collaborative knowledge construction (Griesbaum et al., 2023). The collaborative skills of students across five IITs are shown in Table 17.

**Table 17**

*Collaborator - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.8031 | .77400 | .997 | .408 |
| IITH | 203 | 3.8571 | .85716 | | |
| IITTP | 99 | 3.8424 | .66534 | | |
| IITTP | 99 | 3.7071 | .85750 | | |
| IITDH | 38 | 3.7456 | .76498 | | |
| Total | 824 | 3.7909 | .80673 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The mean scores for collaboration across each IIT are relatively similar, with a high level and an average mean score of 3.79. The collaboration may be due to the interactive and team-based approach to learning within their curriculum. A case study by Nungu et al. (2023) at the University of Rwanda revealed a strong online collaboration among STEM students, and the various electronic multimedia tools enhanced collaborative learning activities. However, there is no institution-wise difference in the collaborative skills as the *p value* (.408) is greater than the significance level.

### 4.3.5 Influence of Institutions (IITs) on *Value-oriented*

Being a metaliterate, the value-oriented role lies in the ethical considerations in information handling in a connected world (Oladokun et al., 2023). Higher education institutions hold a critical responsibility to shape the next generation for a bright future. It not only provides quality learning but also cultivates ethical, moral, and social values amongst the student fraternity (Liu, 2023).

**Table 18**

*Value-oriented - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.9361 | .65490 | 2.133 | .075 |
| IITH | 203 | 4.0111 | .67133 | | |
| IITTP | 99 | 3.7980 | .74973 | | |
| IITPKD | 81 | 3.8302 | .82899 | | |
| IITDH | 38 | 3.8553 | .66686 | | |
| Total | 824 | 3.9238 | .69194 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 18 indicates a high level of value-oriented activities among students of the five IITs across South India, as the mean scores reach the 3.79 to 4.01 range. Among these, IITH has a high level of value-oriented trait with a score of 4.01, almost similar level possessed by the students of IITM (3.93), followed by IITDH (3.85), IITPKD (3.83) and IITP (3.79). The obtained *p value* (.75) from the ANOVA test exceeds .05, considered not significant at the .05 level. So, there is a lack of difference among these IITs in handling ethical principles, integrity, and responsible information use in digital and information environments.

### 4.3.6 Influence of Institutions (IITs) on *Active and Critical Evaluator*

Metaliteracy's goal is to actively assess content while also considering and evaluating one's own biases ( Jacobson & Mackey, 2015). This role involves the consumption and active and thoughtful scrutiny of information sources, reliability, and context, emphasizing making informed judgments and decisions in the information landscape (Witek & Grettano, 2014).

**Table 19**

*Active and Critical Evaluator - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.8938 | .60020 | 1.405 | .231 |
| IITH | 203 | 3.8798 | .66521 | | |
| IITTP | 99 | 3.7515 | .67859 | | |
| IITPKD | 81 | 3.7778 | .72664 | | |
| IITDH | 38 | 3.8053 | .78429 | | |
| Total | 824 | 3.8578 | .64904 | | |

* The mean difference is significant at the .05 level (p≤.05).

Table 19 highlights the institute-wise results comparing students' active and critical evaluation skills. The cumulative mean score (3.85) shows a high level of proactive engagement of IIT students in information handling while applying critical thinking skills to assess, analyze, and make informed judgments about it. All five IITs have almost similar mean scores; among these, a slightly high by IITM with a mean score of 3.89 and the least by IITTP with a mean score of 3.75. A one-way statistical test ANOVA shows that the *p value* (.231> .05) not significant at the 0.05 level. Thus, it can be concluded that there is no significant association between active and critical evaluator skills among the students of five IITs.

### 4.3.7 Influence of Institution (IITs) on Digitally Literate

Metaliteracy emphasizes the multiple literacy types to empower individuals to be responsible digital citizens and effectively use information in a digitally interconnected world (Mackey & Jacobson, 2019). Digital literacy is a major one, mainly focusing on the skill sets required to handle digital media platforms. Table 20 below provides the digital literacy of the students across these five IITs.

**Table 20**

*Digitally Literate- Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.3519 | .74190 | .968 | .424 |
| IITH | 203 | 3.4424 | .74805 | | |
| IITTP | 99 | 3.3333 | .73623 | | |
| IITPKD | 81 | 3.3284 | .89516 | | |
| IITDH | 38 | 3.2263 | .71004 | | |
| Total | 824 | 3.3638 | .75763 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The students from selected IITs in South India possess a high level of digital literacy, with an average mean score of 3.36, all with almost similar mean score values. In a study, Inan Karagul et al., (2021) reported high to high levels of digital literacy among students during online education amidst the COVID-19 pandemic. This underscores the fact that living reality of our digital era, integrated training on these skills by the libraries, curriculum-based instruction, and use of technology in daily life. Many researchers have reached similar results for the medium to high level of digitally literate students (Abbas et al., 2019; Atkinson, 2019; Latip et al., 2022). In contrast, few studies have shown low digital literacy skills among certain student categories (Alakrash & Razak, 2021; Dashtestani & Hojatpanah, 2022). In fact, there is a lack of statistically significant differences between these institutes and digital literacy as the *p value is* .424, which is greater than the five percent level.

### 4.3.8 Influence of Institution (IITs) on *Affective*

The affective dimension of metaliteracy encompasses feelings, attitudes, motivations, and values associated with how individuals engage with information in a digital environment. It involves understanding emotions related to information consumption, ethical considerations, and information use of personal and social implications in a digitally connected world (Greer, 2023).

**Table 21**

*Affective - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 4.0230 | .59481 | .994 | .410 |
| IITH | 203 | 4.0135 | .67404 | | |
| IITTP | 99 | 4.0556 | .62633 | | |
| IITPKD | 81 | 3.8951 | .69582 | | |
| IITDH | 38 | 3.9276 | .70209 | | |
| Total | 824 | 4.0076 | .63420 | | |

* The mean difference is significant at the .05 level (p≤.05).

Table 21 presents data related to affective (emotional) aspects across different IITs. All of them show high to very high, with IITTP having the top mean score for affective aspects among the listed IITs (Mean = 4.05), followed closely by IITM (Mean = 4.02) and IITH (Mean = 4.01). ITDH has a slightly lower mean score (mean = 3.92), followed by IITPKD (Mean = 3.89). The *p value* (0.410) suggests that the differences in mean scores among the listed IITs for affective aspects are not statistically significant. Hence, there is no significant association between the affective domain of metaliteracy of students across the five institutions.

#### 4.3.9 Influence of Institution (IITs) on *Ethical and Responsible*

It emphasizes the importance of ethical awareness, responsible navigation, and participation of communities in digital information environments (Cobourn et al., 2022). Ensuring ethical and responsible information handling among IIT students involves respecting intellectual property, citing sources accurately, avoiding plagiarism, and upholding ethical standards in research and academic work. The ethical and responsible behaviour of students across the five IITs is depicted in Table 22.

**Table 22**

*Ethical and Responsible- Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.8009 | .67692 | 1.707 | .146 |
| IITH | 203 | 3.8571 | .74829 | | |
| IITTP | 99 | 3.7020 | .63152 | | |
| IITPKD | 81 | 3.6574 | .76694 | | |
| IITDH | 38 | 3.8553 | .61411 | | |
| Total | 824 | 3.7913 | .69779 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

A high level of ethical and responsible engagement of information by the students of five IITs in South India in which IITDH and IITH have similar mean scores such as 3.85, IITM has a slightly lower (mean = 3.80) followed by IITPKD and IITTP with mean scores (around 3.65 and 3.70, respectively). Since the *p value* (.146) is higher than 0.05, it indicates that the differences in mean scores among the listed IITs for ethical and responsible engagement are not statistically significant.

### 4.3.10 Influence of Institution (IITs) on *Metacognition*

Metacognition, a core foundation of metaliteracy, involves thinking about thinking. Self-reflection and critical learning are crucial for becoming more self-directed in a rapidly changing information ecosystem. It connects affective, cognitive, and behavioral learning domains, emphasizing the need for individuals to understand their involvement in assessing and creating content and the necessity to continually update their understandings and abilities to keep pace with evolving information opportunities (Fulkerson et al., 2017). When students develop metacognitive skills, they become more aware of how they learn and what can enhance their ability to set goals, self-monitor, and self-regulate their learning. This awareness can also help students identify gaps in their knowledge and employ strategies to fill them effectively. Table 23 shows the metacognitive thinking of metaliteracy across various IITs in South India.

**Table 23**

*Metacognition - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.8296 | .65973 | .575 | .681 |
| IITH | 203 | 3.8966 | .67383 | | |
| IITTP | 99 | 3.8620 | .73926 | | |
| IITPKD | 81 | 3.7819 | .74379 | | |
| IITDH | 38 | 3.8947 | .68051 | | |
| Total | 824 | 3.8483 | .68192 | | |

* The mean difference is significant at the .05 level (p≤.05).

The students consistently demonstrate a high level of metacognitive awareness across all institutions, achieving an average score near 3.8. This similarity may be due to the likeness of fundamental skills, which might be uniform across students who the individual himself solely determines. It may result in a similar high level of possession of metacognitive skills amongst students of these institutions. The ANOVA test indicates a *p value* of .681, which is relatively higher than the five percent significance level and suggests that there isn't a significant association between metacognition and all institutes under consideration.

### 4.3.11 Influence of Institution (IITs) on *Inquisitiveness*

This factor evaluates the curiosity or eagerness for inquiry within the context of metaliteracy. It gauges the students' inclination toward asking questions, seeking knowledge, and engaging in critical inquiry. Higher scores indicate a greater propensity for curiosity and an eagerness to explore various subjects or concepts.

**Table 24**

Inquisitiveness - Institute-wise

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.7386 | .77199 | 2.205 | .067 |
| IITH | 203 | 3.8785 | .74130 | | |
| IITTP | 99 | 3.6970 | .69838 | | |
| IITPKD | 81 | 3.6255 | .89657 | | |
| IITDH | 38 | 3.6754 | .61750 | | |
| Total | 824 | 3.7540 | .76523 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 24 shows that the mean scores for inquisitiveness slightly vary across different IITs, and overall, they show a high level with a mean score of 3.75. Even though a slighter difference, IITH has a high mean inquisitiveness score (Mean = 3.87), followed by IITM (Mean = 3.73), IITTP (Mean = 3.69), IITDH (Mean = 3.67), and IITPKD (Mean = 3.62). The obtained *p value* (.067) implies that there might not be a statistically significant difference in mean scores among the listed IITs for inquisitiveness, as it exceeds .05.

### 4.3.12 Influence of Institutions (IITs) on *Adaptable*

The adaptable factor assesses the ability to adjust or adapt to different situations, environments, or learning methodologies within the context of metaliteracy. It reflects the agility and flexibility of individuals in accommodating diverse learning approaches or adapting to new information environments effectively (Jacobson, Mackey, & O'Brien, 2021). The adaptability of students across the five IITs is given in Table 25.

**Table 25**

*Adaptable - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.9659 | .58238 | .648 | .628 |
| IITH | 203 | 3.9631 | .64283 | | |
| IITTP | 99 | 3.8687 | .64715 | | |
| IITPKD | 81 | 3.9167 | .67662 | | |
| IITDH | 38 | 3.8947 | .56840 | | |
| Total | 824 | 3.9454 | .61415 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The mean scores vary between 3.86 and 3.96 across IITs, showing high adaptability among the students across various platforms. All these IITs have more or less similar mean score values, with which IITTP displays the lowest mean score (3.86), and IITM has the highest mean score (3.96); the rest of them are in between by suggesting high levels of adaptability across them. The *p value* (.628) indicates a lack of significant difference among these institutes regarding adaptability of the students across these IITs.

### 4.3.13 Influence of Institutions (IITs) on *Metaknowledge*

Metaknowledge involves understanding one's own knowledge and learning processes and being aware of how to acquire, assess, and apply knowledge effectively. It includes self-reflection on one's learning strategies, awareness of gaps in understanding, and the ability to self-assess and improve one's learning methods (Fulkerson et al., 2017). The student's metaknowledge across five IITs is presented in Table 26.

**Table 26**

*Metaknowledge - Institute-wise*

| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.9851 | .83146 | | |
| IITH | 203 | 3.9409 | .80620 | | |
| IITTP | 99 | 4.0505 | .87334 | 1.447 | .217 |
| IITPKD | 81 | 3.8395 | .84346 | | |
| IITDH | 38 | 4.1842 | .80052 | | |
| Total | 824 | 3.9769 | .83117 | | |

* The mean difference is significant at the .05 level (p≤.05).

The students' metaknowledge has shown a variation of mean scores between 3.83 and 4.05. Out of them, IITDH and IITTP have a very high level of metaknowledge with a mean score of 4.18 and 4.05, showing high levels by ITM (3.98), IITH (3.94), and IITPKD (3.83). Since the *p value* (.217) is greater than the significance level, it is assumed that there is no statistical significance in terms of metaknowledge among these institutes.

### 4.3.14 Influence of Institutions (IITs) on *Diffident*

Diffident evaluates the degree of hesitancy or lack of confidence within the context of metaliteracy. Higher scores suggest a more pronounced sense of uncertainty or timidity among individuals when engaging with information or expressing their thoughts. It could indicate a lack of confidence in one's abilities or reluctance to participate actively in learning or knowledge-sharing processes. The diffidence is a negative factor in which reverse scoring is considered. Table 27 displays the diffidence of students across the five IITs.

**Table 27**

*Diffident - Institute-wise*

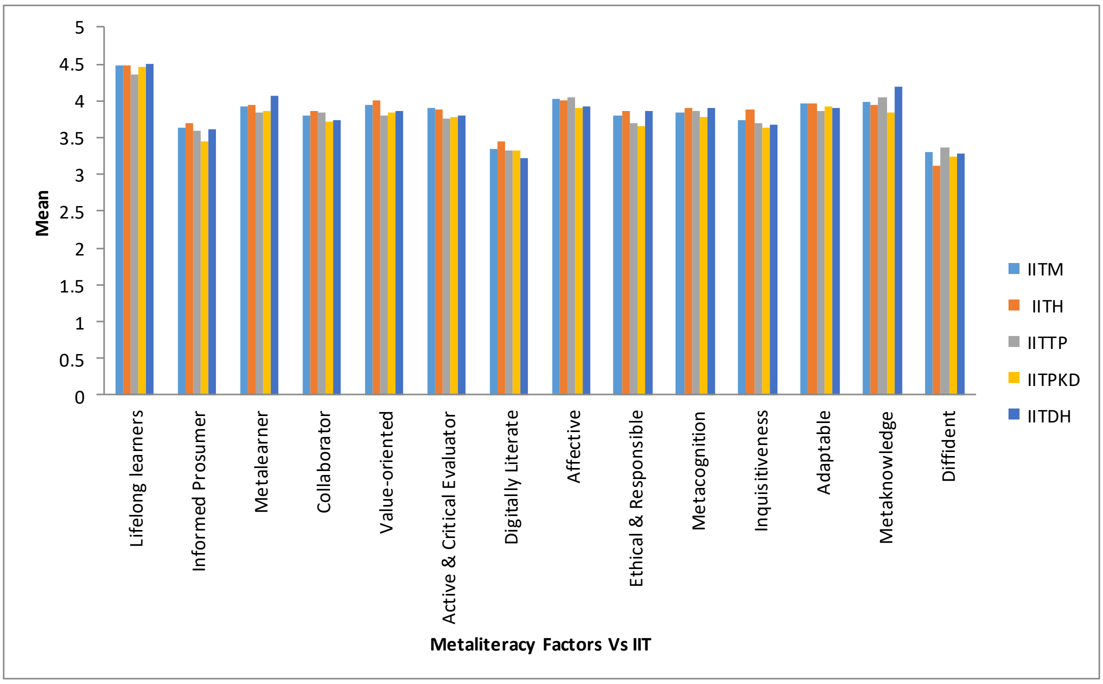
| Name of the IIT | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.3077 | 1.29853 | .891 | .469 |
| IITH | 203 | 3.1232 | 1.33112 | | |
| IITTP | 99 | 3.3737 | 1.27444 | | |
| IITPKD | 81 | 3.2469 | 1.27995 | | |
| IITDH | 38 | 3.2895 | 1.29255 | | |
| Total | 824 | 3.2633 | 1.30139 | | |

* The mean difference is significant at the .05 level (p≤.05).

The mean scores range from 3.12 to 3.37 across five IITs, indicating a relatively consistent range of scores for diffidence. The average mean score shows a low level of diffidence with a mean score of 3.26. The IITTP shows a comparatively low level, followed by IITM, IITDH, IITPKD, and IITH. The low level signifies the high level of metaliteracy. The *p value* (.469) indicates no significant difference among these five institutes concerning diffidence levels of students.

**Figure 16**

*Institute-wise Metaliteracy.*




The metaliteracy assessment across institutes are carried out by analyzing fourteen factors. It is clear from Figure 15 that the overall institute-wise analysis highlights that among the fourteen factors of metaliteracy, two factors—*lifelong learners* and *affective*—are notably present at a very high level, indicating extreme proficiency in these areas. The remaining factors exhibit a high level, except *diffidence*, which is at a low level. Overall, this suggests that students across these institutes possess a high level of metaliteracy. This observation underscores the consistency in metaliteracy levels among the five South Indian IITs. Despite variations in individual factors, the overall pattern indicates uniformity in the metaliteracy skills across these institutions. The similar scores may indicate that the educational environments in these institutions are likely similar as these institutes maintain common standards or come under the same category. Furthermore, the p value s associated with all factors indicate a lack of statistical significance across these five IITs.

To accurately test the tenability of the hypothesis, the investigator conducted an ANOVA by aggregating the mean scores of all fourteen individual factors. These factors were then combined into a single comprehensive measure, representing overall metaliteracy competency. This approach allowed the investigator to assess whether there were statistically significant differences in metaliteracy competency across various institutes within the study, providing a more holistic evaluation to check the hypothesis. Further analysis of the overall metaliteracy is provided in the subsequent section.

#### 4.3.15 Influence of Institutions (IITs) on Overall *Metaliteracy*

Following the analysis of institutions' influence on fourteen factors, the investigation proceeds to confirm the significant association between metaliteracy and institution for the hypothesis testing. This confirmation is achieved by examining the total metaliteracy scores across the five IITs. Table 28 presents the overall metaliteracy scores across these institutions.

**Table 28**

*Overall Metaliteracy-Institution-wise*

| Name of IIT | N | Mean | Std. Deviation | F value | *P value** |
|---|---|---|---|---|---|
| IITM | 403 | 3.8276 | .41122 | | |
| IITH | 203 | 3.8531 | .47215 | | |
| IITTP | 99 | 3.7801 | .48117 | 1.239 | .293 |
| IITPKD | 81 | 3.7338 | .54795 | | |
| IITDH | 38 | 3.8181 | .39905 | | |
| Total | 824 | 3.8185 | .44994 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

There is a minimal variance of metaliteracy level among these institutes in which three of the IITs (IITM, IITH, and IITDH) have almost similar mean scores, and the remaining (IITPKD & IITP) both have an almost equal mean score. Overall analysis shows that all the IITs in south India demonstrate high metaliteracy across institutes with an average mean score of 3.81. For institution-wise comparison, ANOVA is conducted, and the test results reveal that *p value* is .293, which is greater than 0.05, F-value is not significant, hence accepting the null hypothesis and concluding that there is no significant institutional difference in the metaliteracy level of students across these five IITs in South India. This suggests that any differences observed in metaliteracy levels are not statistically significant and may be attributed to factors other than institutional differences. The uniform nature of institutes may contribute to the lack of significant variation in their metaliteracy levels.

### 4.5 Effect of Department on Factors of Metaliteracy

The following section explains the effect of the department on fourteen metaliteracy components as well as the total metaliteracy. It refers how different disciplines or departments influence the development and application of metaliteracy skills among students. In this study, departments are broadly divided into three categories:

1) Engineering and Technology,
2) Science, and
3) Humanities and Social Science.

The data analysis of these departments against the fourteen factors and overall metaliteracy are given in the following section.

#### 4.5.1Effect of Department on *Lifelong Learners*

Metaliteracy embodies lifelong learning by fostering adaptable and evolving skills necessary to navigate the complexities of the information age. It's about getting facts and knowing how information is made, shared, and used in different situations (Jacobson et al., 2021). Preparing for lifelong learning entails providing students with a structure to develop their capacity for *'learning how to learn'* utilizing their intellectual abilities for reasoning and critical thinking (Dolan & Martorella, 2003). This section examines how the lifelong learning component influences different fields of study across the three departments.

**Table 29**

*Lifelong Learner - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 4.4439 | .50343 | 2.104 | .123 |
| Science | 122 | 4.5423 | .44975 | | |
| Humanities & Social Science | 48 | 4.4340 | .46221 | | |
| Total/ Average | 824 | 4.4579 | .49425 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Data presented in Table 29 reveals that department-wise mean scores of lifelong learning vary in the ranges of 4.43 to 4.54. Students from different disciplines have very high level of lifelong learning, as there is a slight difference in their mean scores, with Science being slightly higher compared to Engineering & Technology and Social Science categories. However, the statistical significance test shows that the *p value* .123 is not significant at the five percent level. It shows that the department's category does not significantly differ with lifelong learning.

### 4.5.2 Effect of Department on *Informed Prosumer*

Metaliteracy is a holistic model focusing on gaining information skills while encouraging people to take charge of learning strategies and goals. It helps learners become smart users and information creators. Therefore, checking the informed prosumer element of metaliteracy may show variations across the various departments.

**Table 30**

*Informed Prosumer - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.6014 | .68888 | 1.967 | .141 |
| Science | 122 | 3.6827 | .70574 | | |
| Humanities & Social Science | 48 | 3.7768 | .67259 | | |
| Total/ Average | 824 | 3.6236 | .69128 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 30 demonstrates that the mean scores of informed prosumers are nearly identical across different departments, with high mean scores ranging from 3.60 to 3.77. Humanities and Social Science are slightly higher than Science and Engineering and Technology. An average score of 3.62 reveals a high level of informed prosumer character among the students in various department categories. Nevertheless, the statistical significance test reveals a non-significant *p value* of .141 at the five percent level. This *p value* indicates that the differences in mean scores related to informed prosumers across department categories are not statistically significant.

### 4.5.3 Effect of Department on *Metalearner*

Table 31 depicts the department-wise data reveals that a subtle rise in the mean scores ranging from 3.89 to 4.10. This progress signifies high to high metalearner adeptness, which is observed among students of three disciplines. Metalearner competency is high among Humanities & Social Science students and at a high level among Science and Engineering and Technology students.

**Table 31**

*Metalearner - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.8985 | .63049 | 2.543 | .079 |
| Science | 122 | 3.9492 | .74103 | | |
| Humanities & Social Science | 48 | 4.1083 | .54727 | | |
| Total/ Average | 824 | 3.9182 | .64483 | | |

* The mean difference is significant at the .05 level (p≤.05).

The obtained *p value* of .079 from the analysis of variance is not statistically significant at a five percent significance level. Therefore, there is no significant difference in the level of metalearner among these three departments.

### 4.5.4 Effect of Department on *Collaborator*

Table 32 illustrates department-wise collaborative skills. Humanities and Social Science students and Science students show almost similar mean scores of 3.91 and 3.94, representing a high level of collaboration among students, and followed closely by the Engineering and Technology students with a slightly lower score of 3.75. The students from each of these departments demonstrate high collaborative skills.

**Table 32**

*Collaborator - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.7564 | .80184 | 2.933 | .054 |
| Science | 122 | 3.9153 | .85125 | | |
| Humanities & Social Science | 48 | 3.9444 | .71899 | | |
| Total/ Average | 824 | 3.7909 | .80673 | | |

* The mean difference is significant at the .05 level (p≤.05).

In this case, the *p value* is close to .05 but slightly above the typical significance level. So, it concludes that there is no statistical significance between the departments and the collaborative skills of the students.

### 4.5.5 Effect of Department on *Value-oriented*

Table 33 presents data regarding value orientation across different departments. Surprisingly, each of these departments has almost a similar mean score, indicating a high inclination towards value-oriented traits. Science (3.98) has a slight increase when compared to other departments, such as Engineering & Technology (3.91) and Humanities & Social Science (3.95).

**Table 33**

*Value-oriented - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.9102 | .69706 | .657 | .519 |
| Science | 122 | 3.9857 | .70366 | | |
| Humanities & Social Science | 48 | 3.9531 | .58722 | | |
| Total/ Average | 824 | 3.9238 | .69194 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The p value , which stands at .519 and exceeds the conventional significance level of 0.05, indicates that there is no significant difference observed across these departments concerning the value-oriented aspect of metaliteracy.

### 4.5.6 Effect of Department on *Active and Critical Evaluators*

Table 34 showcases that the departmental data reflects a slight rise in mean scores, ranging from 3.83 to 4.0. This progression suggests a high level of proficiency in active and critical evaluation skills for engineering and humanities students. In summary, students at IIT exhibit high active and critical evaluation proficiency across three departments, and the average mean score is 3.85. Among them, a higher level of active and critical evaluator skills was possessed by the students from the Department of Humanities & Social Science (4.0), followed by Science (3.90), and then Engineering & Technology (3.83). The *p value* comes as the border level with a slight increase. Therefore, it is inferred that there is no significant difference in the level of active and critical evaluation skills of students across three departments in IITs.

**Table 34**

*Active and Critical Evaluator - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.8388 | .65127 | 1.781 | .169 |
| Science | 122 | 3.9016 | .67162 | | |
| Humanities & Social Science | 48 | 4.0042 | .53870 | | |
| Total/ Average | 824 | 3.8578 | .64904 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* from the analysis of variance is .169; there is no statistically significant difference observed among these three departments in terms of active and critical evaluation, as the *p value* is greater than a 5% significance level.

### 4.5.7 Effect of Department on *Digitally Literate*

Table 35 presents the statistical data on digital literacy levels across three departments. The mean scores for all departments are nearly identical, indicating a consistently high level of digital literacy throughout. Humanities & Social Science has the slightly highest mean score (3.52), followed by both the Engineering & Technology and Science departments, which have a similar mean score of 3.35 plus.

**Table 35**

*Digitally Literate - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.3538 | .76164 | 1.214 | .297 |
| Science | 122 | 3.3525 | .78501 | | |
| Humanities & Social Science | 48 | 3.5292 | .61262 | | |
| Total/ Average | 824 | 3.3638 | .75763 | | |

* The mean difference is significant at the .05 level (p≤.05).

The comparison between departments indicates no statistically significant difference in digital literacy levels, as evidenced by the obtained *p value* of .297, which is above the 0.05 threshold.

### 4.5.8 Effect of Department on *Affective*

Table 36 shows the affective aspects of students categorized by different academic departments. The Science department has the highest mean score for affective aspects (mean = 4.11), followed closely by Humanities & Social Science (mean = 4.04) and then Engineering & Technology (mean = 3.98). All these departments exhibit a very high level of the affective component based on the average mean score.

**Table 36**

*Affective- Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.9851 | .62847 | 2.229 | .108 |
| Science | 122 | 4.1148 | .68269 | | |
| Humanities & Social Science | 48 | 4.0417 | .56336 | | |
| Total/ Average | 824 | 4.0076 | .63420 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* (.108) suggests that the differences in mean scores among the listed departments for affective aspects are not statistically significant at a conventional significance level since the *p value* is higher than .05.

### 4.5.9 Effect of Department on *Ethical & Responsible*

Table 37 presents data on students' ethical and responsible engagement across three academic departments. The Humanities & Social Science department has the highest mean score for ethical and responsible engagement (mean = 4.09) among the listed departments, followed by Science (mean = 3.90) and then Engineering & Technology (mean = 3.74). Overall, the ethical and responsible engagement nature is higher among the students from the Humanities & Social Science than among science and Engineering & Technology students.

**Table 37**

*Ethical and Responsible - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.7466 | .69364 | 7.900 | **.000** |
| Science | 122 | 3.9098 | .72162 | | |
| Humanities & Social Science | 48 | 4.0990 | .58287 | | |
| Total/ Average | 824 | 3.7913 | .69779 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (.000) indicates statistically significant differences in ethical and responsible engagement among the listed three departments. So, the post hoc Scheffe test is conducted to identify the pairwise comparisons of ethical and responsible engagement between three academic departments, given in Table 38 below.

**Table 38**

*Ethical and Responsible Engagement – Department-wise- Scheffe*

| Department | Engineering & Technology | Science | Humanities & Social Science |
|---|---|---|---|
| Engineering & Technology | 1 | .058 | **.003** |
| Science | .058 | 1 | .308 |
| Humanities & Social Science | **.003** | .308 | 1 |

*The mean difference is significant at the 0.05 level.

Considering the Engineering and Technology department, the value of .058 indicates that the mean difference in ethical and responsible engagement between the Engineering & Technology and Science departments is not statistically significant. Where there is a statistically significant difference in ethical and responsible engagement between Engineering & Technology and Humanities and Social Science as the *p value* is .003, indicating significance at the .05 level and vice versa. Moreover, the pair Humanities and  Social Science and Science having a *p value* of.308 represents there is no statistically significant difference in ethical and responsible engagement between them.

### 4.5.10 Effect of Department on *Metacognition*

The ANOVA result from Table 39 reveals the metacognition of the students from various departments, showing that the average mean score is 3.84, suggesting a high level of metacognition exists among them. Each department has more or less the same mean score, starting with 3.8. Hence, it is inferred that a high level of metacognition exists across all three departments.

**Table 39**

*Metacognition - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.8537 | .68094 | .313 | .731 |
| Science | 122 | 3.8060 | .72327 | | |
| Humanities & Social Science | 48 | 3.8819 | .58946 | | |
| Total/ Average | 824 | 3.8483 | .68192 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value is* .731. The *p value* is higher than a typical significance level (.05), indicating no significant difference in the metacognition level among these three departments.

### 4.5.11 Effect of Department on *Inquisitiveness*

**Table 40**

*Inquisitiveness - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.7253 | .77312 | 2.402 | .091 |
| Science | 122 | 3.8443 | .76803 | | |
| Humanities & Social Science | 48 | 3.9167 | .60923 | | |
| Total/ Average | 824 | 3.7540 | .76523 | | |

* The mean difference is significant at the .05 level (p≤.05).

Table 40 shows that inquisitiveness levels demonstrate a slight upward trend from Engineering and Technology (3.72) to Science (3.84) and further to Humanities and Social Sciences (3.91). All three departments exhibit high inquisitiveness, indicating the inclination towards questioning, seeking knowledge, and engaging with intellectual pursuits. The *p value* (.091) is higher than a typical significance level (.05), suggesting no significant difference in the inquisitiveness of students among these three departments.

### 4.5.12 Effect of Department on *Adaptable*

Table 41 data indicates that the adaptability of students is nearly identical for Engineering & Technology and Science departments with a score of 3.92 and 3.98. The Humanities and Social Science students also have a very high score (4.14) in adaptability. Students demonstrate high level of adaptive characteristics across all three departments, showing their ability to adapt to changing information landscape and evolving environments.

**Table 41**

*Adaptable - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.9232 | .61184 | | |
| Science | 122 | 3.9857 | .64146 | 3.265 | **.039** |
| Humanities & Social Science | 48 | 4.1458 | .54047 | | |
| Total/ Average | 824 | 3.9454 | .61415 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

There is a significant difference among these departments regarding the adaptive nature as the *p value* comes to .03, which is less than the significant level (0.05). Hence, the Scheffe test determined the difference among these three department categories, and the result is shown in Table 42.

**Table 42**

*Adaptable – Department-wise- Scheffe*

| Department | Engineering & Technology | Science | Humanities & Social Science |
|---|---|---|---|
| Engineering & Technology | 1 | .586 | **.053** |
| Science | .586 | 1 | .308 |
| Humanities & Social Science | **.053** | .308 | 1 |

The result of the Scheffe indicates the borderline of *p value* received against the engineering and technology and humanities and social science departments. However, there is no significant difference between the pairwise comparisons, specifically Engineering & Technology vs. Science and Science vs. Humanities & Social Science and Engineering & Technology vs. Humanities & Social Science, as their *p value* exceeds the significance level of .05.

### 4.5.13 Effect of Department on *Metaknowledge*

Table 43 displays metaknowledge across the three departments, indicating a mean score range of 3.96 to 4.04, showcasing a high level of metalearner competence prevalent among these departments. The Science and Humanities and Social Science departments show higher levels of metaknowledge than the Engineering and Technology departments.

**Table 43**

*Metaknowledge - Department-wise*

| **Department** | **N** | **Mean** | **Standard Deviation** | **F value** | ***p value**** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.9602 | .82733 | .659 | .518 |
| Science | 122 | 4.0492 | .87057 | | |
| Humanities & Social Science | 48 | 4.0208 | .78522 | | |
| Total/ Average | 824 | 3.9769 | .83117 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* is .518 that is slightly higher than the significant level (.05). It is assumed that there is no significant difference between the department and the student's metaknowledge.

### 4.5.14 Effect of Department on *Diffident*

Table 44 demonstrates the diffident character across three departments and showcases a mean score range of 3.22 to 3.77, indicating a prevailing low level of diffidence among these departments. The Engineering and Technology department displays lower levels than Science, Humanities, and Social Science. The low diffidence underscores a high confidence and assertiveness within the academic environment of these departments.

**Table 44**

*Diffident - Department-wise*

| Department | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.2202 | 1.31332 | 4.076 | **.017** |
| Science | 122 | 3.2951 | 1.26418 | | |
| Humanities & Social Science | 48 | 3.7708 | 1.13437 | | |
| Total/ Average | 824 | 3.2633 | 1.30139 | | |

* The mean difference is significant at the .05 level (p≤.05).

As the *p value* of .017 is significant statistically. It shows that there is a significant difference among these departments regarding the diffidence. A Scheffe test was carried out to check the group-wise difference among these departments, and the result is given in Table 45.

**Table 45**

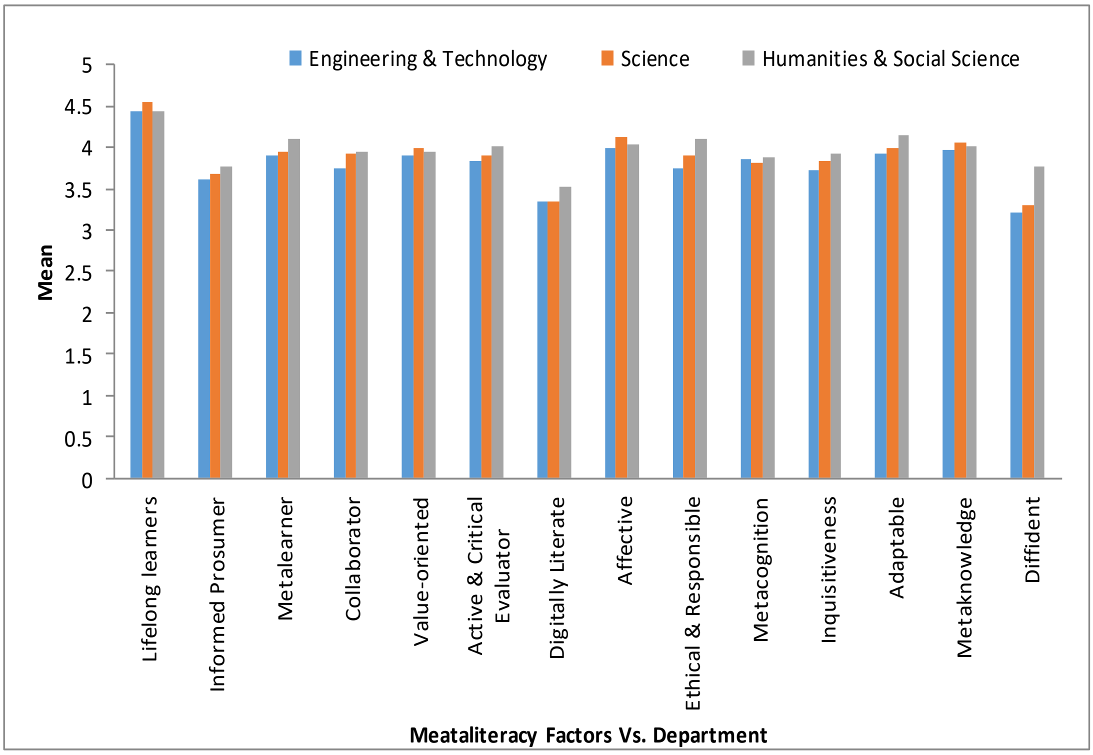
*Diffident – Department-wise- Scheffe*

| Department | Engineering & Technology | Science | Humanities & Social Science |
|---|---|---|---|
| Engineering & Technology | 1 | .842 | **.018** |
| Science | .842 | 1 | .099 |
| Humanities & Social Science | **.018** | .099 | 1 |

The comparison between the pair Engineering & Technology and Humanities & Social Sciences reveals a notable difference, as indicated by a *p value* of 0.018 below the chosen significance level. However, when examining the remaining pairs, such as Engineering & Technology versus Science and Science versus Humanities & Social Sciences, lack the differences among them, as the *p value* is greater than the significance level. Further, an analysis was conducted to determine whether a significant association exists between students' departments and their overall metaliteracy levels. The results of the test of significant related data are given in Table 46.

**Figure 17**

*Department-wise Metaliteracy*




The overall analysis of the effect of departments on its fourteen associated factors reveals that a few factors demonstrate a high level of proficiency. At the same time, the majority exhibit a high level among students across three distinct departments. Notably, the *lifelong learner* role has the highest level of possession by students across all three departments. Humanities and Social Science students exhibit particularly strong proficiency in certain factors such as *metalearning, active and critical evaluation, ethical* and *responsible engagement, adaptability,* and *metaknowledge*. Similarly, Science students also demonstrate excellent proficiency in *affective* awareness and *metaknowledge*. Significant differences among departments are observed in factors such as *ethical and responsible engagement* and *adaptability*. An ANOVA analysis was carried out to tackle uncertainty in hypothesis validation. This involved aggregating mean scores of fourteen factors into an overall metaliteracy measure. Details regarding the overall metaliteracy analysis are provided below.

**Table 46**

*Overall Metaliteracy-Department -wise*

| Department | N | Mean | Std. Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Engineering & Technology | 654 | 3.7963 | .44636 | 4.610 | **.010** |
| Science | 122 | 3.8781 | .48513 | | |
| Humanities & Social Science | 48 | 3.9696 | .36276 | | |
| Total | 824 | 3.8185 | .44994 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The comparison of students' metaliteracy across departments reveals that Humanities & Social Science students exhibit a slightly higher level of metaliteracy (mean=3.96) compared to Science (3.87). Engineering & Technology students (mean=3.79). Overall, a high level of metaliteracy is observed across these departments. The *p value* is .010, indicating statistical significance among these three departments, as it falls below the significance level of .05. Hence, it was again tested using the Scheffe test to identify the association between these three departments.

**Table 47**

*Overall Metaliteracy-Department-wise- Scheffe*

| Department | Engineering & Technology | Science | Humanities & Social Science |
|---|---|---|---|
| Engineering & Technology | 1 | .181 | **.036** |
| Science | .181 | 1 | .487 |
| Humanities & Social Science | **.036** | .487 | 1 |

The outcomes of a Scheffe test conducted to analyze the overall metaliteracy that is represented in Table 47, mean scores among various departments indicate a lack of significant differences in most cases. However, a notable exception is observed in the comparison between the Engineering and Technology versus Humanities & Social Science departments, where a significant difference is evident, with a value of .036. This finding suggests that there exists a meaningful distinction between the metaliteracy levels of students in these two departments.

### 4.3 Effect of Course on Factors of Metaliteracy.

Students relying heavily on cognitive learning may struggle to adapt to an educational system mainly focusing on information transfer through lectures. This emphasis can hinder students from taking proactive roles, leading to emotional reactions when disrupting their familiar cognitive patterns (Havenga et al., 2023). The roles and skills may differ across various courses. However, metaliteracy encourages individuals to engage with the emotional aspect of learning. The following section explains the effect of the course on fourteen metaliteracy components and the total metaliteracy. The impact of a course on metaliteracy refers to how the different courses influence the development and application of metaliteracy skills among students. This study categorizes courses into three main groups:

**1)** Undergraduate (UG)

**2)** Postgraduate (PG)

**3)** Ph.D.

Each factor within metaliteracy is measured, providing insights into how students across various academic levels engage with these skill sets.

### 4.4.1 Effect of Course on *Lifelong Learners*

Lifelong learning makes individuals aware of what they need to learn and how they want to learn. It is not just about memorizing but also about understanding the nature of knowledge. It allows people to keep self-learning independent and flexible for self-development or further education, both formally and informally (Aspin & Chapman, 2012). The lifelong learning skills across five IITs are given in Table 48.

The lifelong learning across various courses has been observed in which Ph.D. students demonstrate the highest engagement in lifelong learning skills (4.52), followed by postgraduates (4.43) and undergraduates (4.29). The same result fit, however, in recent research conducted by Van Nieuwenhove and De Wever (2023) compared psychosocial beliefs about lifelong learning across educational levels and found that individuals with greater education levels statistically experience a significantly higher degree of lifelong learning than those with less education.

**Table 48**

*Lifelong Learners - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 4.2913 | .52684 | 18.008 | **.000** |
| PG | 220 | 4.4539 | .52716 | | |
| Ph.D. | 246 | 4.5279 | .41506 | | |
| Total/ Average | 824 | 4.4053 | .50637 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Since the obtained *p value* (0.00) is significant at the 0.05 level, the analysis indicates a significant variation in lifelong learner features among student groups. This significant difference emphasizes varying levels of engagement in lifelong learning skills across these UG, PG, and Ph.D. student categories. The data undergoes additional analysis through the Scheffe test to determine the extent of variation among students' course-wise comparison to one another. The findings of the Scheffe test are outlined in Table 49.

**Table 49**

*Lifelong Learner-Course-wise -Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | **.001** | **.000** |
| PG | **.001** | 1 | .474 |
| PhD | **.000** | .474 | 1 |

** The mean difference is significant at the .05 level ($p \leq .05$).*

The Scheffe analysis reveals that the lifelong learning level of the UG students is significantly different from that of PG students and Ph.D. scholars, and vice versa, as their *p value* is less than one percent significance level. As far as PG is concerned, the variation is not significant with Ph.D., as their *p value* is higher than a one percent significance level. Similarly, a study by Salleh et al. (2019) in Malaysia utilized a five-point Likert-type Lifelong Learning Scale to examine the connection between self-directed learning and social networking sites (SNS) impact on lifelong learning. The results indicated a significant and positive influence of lifelong learning among graduates and Ph.D. students.

### 4.4.2 Effect of Course on Informed Prosumer

An informed prosumer is a person who actively produces and consumes data in an informed way and recognizes the importance of data to make a conscious decision of consumption and creation (Schüller et al., 2023). Metaliteracy supports individuals in becoming active knowledge producers. Emphasizing one's role as a producer in metaliteracy allows extending learning opportunities based on real-world situations. This section analyzes how students in a particular educational course actively participate in consuming and producing information effectively.

As per the data in Table 50, the average mean score of informer prosumer is 3.62, indicating a high level of informed prosumer skills among all students across the courses in selected IITs. Interestingly, all students' categories exhibit nearly identical mean scores, with Ph.D. scholars having a slightly higher mean score of 3.81, followed by postgraduate students (mean score=3.64) and undergraduates (mean score=3.47).

**Table 50**

*Informed Prosumer - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.4792 | .69254 | 18.311 | **.000** |
| PG | 220 | 3.6416 | .69215 | | |
| Ph.D. | 246 | 3.8177 | .64000 | | |
| Total/ Average | 824 | 3.6236 | .69128 | | |

* The mean difference is significant at the .05 level (p≤.05).

When examining the *p value*, obtained as a result of variance analysis for students across different courses, it is evident that variation is indeed significant at the one percent level, with a *p value* of zero. The data is subject to additional analysis using Scheffe test results presented in Table 51, aiming to assess the extent of variation when comparing students across different courses.

**Table 51**

*Informed Prosumer- Course-wise -Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | **1** | **.020** | **.000** |
| PG | **.020** | 1 | **.020** |
| PhD | **.000** | **.020** | 1 |

The comparison of all three groups shows a significant difference in informed prosumer skills among them, as the *p value* is under the threshold level of 0.05. This implies notable variations in informed prosumer skills across each pair of courses (UG-PG, UG-PhD, PG-PhD). It can be inferred that the varying degrees of competence across the courses in utilizing information as both consumers and producers. It might signify the influence of different curriculum structures, content, or teaching methodologies specific to each educational level (Stone & Wang, 2019).

### 4.4.3 Effect of Course on Metalearner

Table 52 illustrates that the analysis based on courses indicates a slight increase in the mean scores for metalearner skills, ranging from 3.82 to 4.01, showcasing a progression to high metalearner proficiency as students from undergraduates to Ph.D. scholars. Overall, students from all categories have a high level of metalearner competency. On the other hand, students in different communities have varying levels of metalearning skills. A study called "*My System of Learning*" by Żak-Skalimowska (2020) found that pedagogy students have low metalearning competence.

**Table 52**

*Metalearner - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.8274 | .60662 | | |
| PG | 220 | 3.9591 | .71689 | | |
| Ph.D. | 246 | 4.0138 | .61516 | 6.793 | **.001** |
| Total/ Average | 824 | 3.9334 | .6462 | | |

* The mean difference is significant at the .05 level (p≤.05).

The test of significance indicates that the *p value* of .001 is significant at five percent level, which means that there is significant variation among these three student's course groups. So, a Scheffe test is conducted to elucidate the nature of the variance, as shown in Table 53.

**Table 53**

*Metalearner-Course-wise -Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | .057 | **.002** |
| PG | .057 | 1 | .654 |
| PhD | **.002** | .654 | 1 |

The metalearning competence of PG and Ph.D. students is a significant association as the *p value* is .002, and there is no significant difference between other pairs such as UG and PG, UG, and Ph.D. as the *p value* is greater than the .05 level of significance. Metalearning is essential for students as it allows them to think and manage their own learning process. Many universities across the globe implemented metalearning development programs urging students to inculcate their metalearning skills (Wisker et al., 2004). In various modes, such as creating discipline-sensitive learning inventory or developing a web-based tool to provide insights to students regarding their learning approaches (Jackson, 2004).

### 4.4.4 Effect of Course on *Collaborator.*

It is visible from Table 54 that. as a metaliterate collaborator at varying academic levels of course, shows a progression in collaborative skills when it comes to lower to higher. The UG students showed a high level of means score (3.63), PG (3.85) and Ph.D. (3.96). Overall, all the students from all three levels exhibit a high level of collaborative skills, with undergraduate students having less than the other two courses and Ph.D. scholars having higher among them.

**Table 54**

*Collaborator - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.6313 | .79368 | 13.799 | **.000** |
| PG | 220 | 3.8576 | .88101 | | |
| Ph.D. | 246 | 3.9634 | .70952 | | |
| Total/ Average | 824 | 3.7909 | .80673 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value is* .000, suggesting a significant difference in collaborative skills among students across these three levels of courses, which is significant at the 0.05 level. The Scheffe test has been conducted to determine specific differences between these three-course levels. The results are as follows in Table 55.

**Table 55**

*Collaborator - Course -wise- Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | **.004** | **.000** |
| PG | **.004** | 1 | .357 |
| PhD | **.000** | .357 | 1 |

The pairwise comparisons between different academic levels show that UG and PG comparison has a *p value* of .004, suggesting a significant difference in collaborative skills between the undergraduate and postgraduate categories. Similarly, the UG vs. PhD comparison has a *p value* of .000, indicating a significant difference in collaborative skills between undergraduate and Ph.D. students. The comparison between PG and PhD has a *p value* of .357, which might not be significant, suggesting the lack of difference in collaborative skills between postgraduate and Ph.D. students.

### 4.4.5 Effect of Course on *Value-oriented*

Table 56 reveals that IIT students possess a high level of value-oriented component as the mean score ranges from 3.6 to 4.0 for UG to Ph.D. levels. The positive association between the level of the course into higher grades and the development of positive attitudes toward value-oriented traits among students. It implies that students become more aware and conscious of ethical considerations as the curriculum progresses to more advanced levels.

**Table 56**

*Value-oriented - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.7849 | .67739 | 14.042 | **.000** |
| PG | 220 | 3.9864 | .72845 | | |
| Ph.D. | 246 | 4.0701 | .64199 | | |
| Total/ Average | 824 | 3.9238 | .69194 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (0.00) is significant at the 0.05 threshold; it is assumed that there is a significant association between the course levels and metalearner abilities. So, the Scheffe test was done because statistical analysis underscores the significant differences among the educational levels and the pairwise comparisons shown in Table 57.

**Table 57**

*Value-oriented – Course wise-Scheffe*

| | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | **.003** | **.000** |
| PG | **.003** | 1 | .416 |
| PhD | **.000** | .416 | 1 |

The pairs comparing UG with PG students and UG with Ph.D. students demonstrate statistical significance, with p value s of 0.003 and 0.000, respectively. On the other hand, no significant association was observed between PG and Ph.D. students, as the *p value* exceeded the significance level. Incorporating ethical perspectives, integrity, and responsible information practices into the learning and content of different courses is essential in the digital age.

### 4.4.6 Effect of Course on *Active & Critical Evaluators*

Table 58 shows that active and critical evaluator skill levels tend to be high across undergraduate, postgraduate, and Ph.D. levels, with mean scores of 3.78, 3.98, and 4.07, respectively. The overall average score of 3.85 indicates a high level of these skills across all three academic levels.

**Table 58**

*Active and Critical Evaluators - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.7849 | .67739 | 2.915 | .055 |
| PG | 220 | 3.9864 | .72845 | | |
| Ph.D. | 246 | 4.0701 | .64199 | | |
| Total/ Average | 824 | 3.8578 | .64904 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The increase in level from lower to higher courses might be due to the knowledge and experience students acquire through learning and research-focused activities. The ANOVA indicates a lack of significant association with the variable, as the *p value* (.055) is on the borderline and exceeds the five percent level.

### 4.4.7 Effect of Course on *Digitally Literate*

Table 59 provides an overview of digital literacy skills across three academic degrees, showing that the digital literacy levels remain consistently high across various courses. The mean scores range from 3.24 to 3.49. Although these scores are generally stable, there is a slight increase in digital literacy as students advance to higher-level courses. It suggests a potential trend of improvement in digital literacy skills as students move to more advanced academic stages.

**Table 59**

*Digitally Literate - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.2475 | .75895 | 8.554 | **.000** |
| PG | 220 | 3.4027 | .75307 | | |
| Ph.D. | 246 | 3.4984 | .73662 | | |
| Total/ Average | 824 | 3.3638 | .75763 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The ANOVA test results indicate a significant relationship between the courses and digital literacy levels, as evidenced by the *p value* of .000, which is less than the threshold of .05. This suggests that the differences in digital literacy levels across the courses are statistically significant. To further explore these associations, a Scheffe test was performed to identify which specific courses differ from each other in terms of digital literacy, providing a more detailed understanding of the variations. The detailed results of this analysis are presented in Table 60.

**Table 60**

*Digitally Literate- Course-wise- Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | .055 | **.000** |
| PG | .055 | 1 | .390 |
| PhD | **.000** | .390 | 1 |

The Scheffe analysis reveals differences in the levels of digital literacy across two courses among the group; a significant difference is observed between UG students and Ph.D. scholars, as indicated by a *p value (0.00)* below the one percent significance level. This suggests a significant difference in digital literacy proficiency between these two groups, with Ph.D. scholars demonstrating notably higher levels of digital literacy than their UG counterparts. When comparing UG and

Ph.D., the p value s associated with these comparisons exceed the significance threshold, indicating a lack of statistically significant differences in digital literacy levels between PG students and their UG or Ph.D. counterparts. Similarly, when comparing Ph.D. and PG students, no significant difference in digital literacy levels is detected. The p value s for these comparisons also surpass the significance threshold, suggesting a comparable level of digital literacy proficiency between Ph.D. and PG students. Overall, these findings highlight the nuanced differences in digital literacy levels across academic course levels, with Ph.D. scholars demonstrating notably higher proficiency compared to UG students, while PG students exhibit similar levels of digital literacy proficiency regardless of comparison to UG or Ph.D. students.

#### 4.4.8 Effect of Course on *Affective.*

Table 61 shows analysis of the affective aspects across different academic courses reveals that among the listed courses, postgraduate (PG) programs exhibit the highest mean score for affective aspects, with a mean score of 4.06, followed closely by Ph.D. courses, with a mean score of 4.03, indicating an almost similar level of affective engagement among Ph.D. students. Meanwhile, undergraduate (UG) courses have the lowest mean score for affective aspects, with a mean score of 3.95, suggesting slightly lower levels of affective engagement among undergraduate students compared to their counterparts in PG and Ph.D. programs.

**Table 61**

*Affective - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.9546 | .61369 | 2.321 | .099 |
| PG | 220 | 4.0625 | .70574 | | |
| Ph.D. | 246 | 4.0356 | .59118 | | |
| Total/ Average | 824 | 4.0076 | .63420 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* (.099) suggests that the differences in mean scores among the listed academic courses for affective aspects are not statistically significant at a significance level of .05. Therefore, this analysis shows no significant association between academic courses and affective engagement levels.

### 4.4.9 Effect of Course on *Ethical & Responsible*

The analysis of ethical and responsible behavior among students across different academic courses are depicted in Table 62. It illustrates that ethical and responsible engagement varies from high to very high levels among Ph.D., postgraduate, and undergraduate students. Furthermore, there is a trend of increasing ethical and responsible engagement as the academic course level progresses. The average mean score (3.79) denoted a high level of ethical, responsible engagement of students in their learning and writing of research work.

**Table 62**

*Ethical and Responsible - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.5649 | .67062 | 51.179 | **.000** |
| PG | 220 | 3.7955 | .70077 | | |
| Ph.D. | 246 | 4.1169 | .60001 | | |
| Total/ Average | 824 | 3.7913 | .69779 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

As the *p value* (.000) indicates that the differences in mean scores among these academic courses for ethical and responsible engagement are statistically significant at the significance level (*p value* < 0.05). Therefore, Table 63 represents the Scheffe post hoc test results for pairwise comparisons of ethical and responsible engagement between different academic courses: Undergraduate (UG), Postgraduate (PG), and Ph.D.

**Table 63**

*Ethical and Responsible – Course wise- Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | **.000** | **.000** |
| PG | **.000** | 1 | **.000** |
| PhD | **.000** | **.000** | 1 |

The comparison between UG and PG shows a *p value* of .000, indicating a statistically significant difference between undergraduate and postgraduate courses. Similar significance (*p value* of .000) is observed for comparisons between UG and PhD and between PG and PhD, signifying significant differences in ethical and responsible engagement across all pairs of courses.

### 4.4.10 Effect of Course on *Metacognition*

It is evident from Table 64 that the metacognition of the students rises according to the course of the study, as the mean score ranged between 3.77 and 3.92 from undergraduate to Ph.D. scholar. Hence, it is visible that a high level of metacognition among the students across different course levels. A comparable result, reported by Aljaberi and Gheith (2015) that students at Petra University in Jordan exhibit high metacognitive thinking. In contrast, some studies found higher levels of metacognitive thinking ability among university students at Kahramanmaras Sutcu Imam University conducted during 2016-2017 (Coşkun, 2018).

**Table 64**

*Metacognition - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.7775 | .67350 | 3.664 | **.026** |
| PG | 220 | 3.8803 | .71251 | | |
| Ph.D. | 246 | 3.9228 | .65838 | | |
| Total/ Average | 824 | 3.7775 | .67350 | | |

* The mean difference is significant at the .05 level (p≤.05).

The variance analysis is performed to examine the significant differences in metacognition with the student's course of study category. It demonstrates that there is significant variation in the level of metacognition and the course of the study since the *p value is* .026. So, it is further analyzed using the Scheffe test to determine the significance of variation among students based on their course category. Table 65 shows the outcome of the Scheffe test.

**Table 65**

*Metacognition-Course-wise-Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | .211 | **.036** |
| PG | .211 | 1 | .797 |
| PhD | **.036** | .797 | 1 |

The pair-wise difference of metacognition across the course revealed that UG is considered only a significant difference with Ph.D. students as the *p value* (0.036) is less than the significance level of 0.05 and not with PG. The rest of the pairs (UG vs. PG, PG vs. Ph.D.) lack significance as the *p value* is greater than the significance level. However, metacognition is a higher level of cognition and one of the most important predictors of academic performance.

### 4.4.11 Effect of Course on *Inquisitiveness*

Table 66 presented that the mean scores for inquisitiveness vary across different courses of study: PG has the highest mean inquisitiveness score (mean = 3.88), followed by Ph.D./PDF (mean = 3.75) and UG (mean = 3.67). This underscores a high level of inquisitiveness among the IIT students of various course categories.

**Table 66**

*Inquisitiveness - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.6704 | .76574 | 5.415 | **.005** |
| PG | 220 | 3.8848 | .78214 | | |
| Ph.D. | 246 | 3.7588 | .73500 | | |
| Total/ Average | 824 | 3.7540 | .76523 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (0.005) indicates a statistically significant difference in mean scores for inquisitiveness among these three courses of study. So, a Scheffe test was carried out to determine the difference across these three courses, and the result is given below in Table 67.

**Table 67**

*Inquisitiveness-course-wise Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | **.005** | .374 |
| PG | **.005** | 1 | .204 |
| PhD | .374 | .204 | 1 |

The pair-wise comparison shows a significant association between undergraduate and postgraduate, as the *p value is .005.* However, none of the other pairs (UG vs. Ph.D., PG vs. UG, PG vs. Ph.D.) show a significant association, indicating that the differences between these levels of courses are not statistically significant.

### 4.4.12 Effect of Course on *Adaptability*

In metaliteracy, "adaptable" refers to a person's ability to effectively navigate and engage with various information sources, formats, and technologies while critically evaluating and applying the information in different contexts (Mackey & Jacobson, 2019). The course of the student may influence of adaptability.

Table 68 presents adaptability levels across various academic courses, revealing that students exhibit higher adaptability depending on their educational stage. The mean adaptability scores are 3.86 for undergraduate (UG) students, 3.96 for postgraduate (PG) students, and 4.04 for Ph.D. students. This indicates that Ph.D. students have very high adaptability, while undergraduate and postgraduate students display high adaptability.

**Table 68**

*Adaptability - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.8631 | .60702 | 6.834 | **.001** |
| PG | 220 | 3.9648 | .66222 | | |
| Ph.D. | 246 | 4.0478 | .56334 | | |
| Total/ Average | 824 | 3.9454 | .61415 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* of .001 from the ANOVA test suggests a statistically significant difference in adaptability levels among the different academic groups (UG, PG, Ph.D.). To pinpoint which specific groups show significant differences in adaptability, a Scheffe post-hoc test was conducted and output given Table 69.

**Table 69**

*Adaptable-Course wise- Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | .151 | **.001** |
| PG | .151 | 1 | .342 |
| PhD | **.001** | .342 | 1 |

The result of the Scheffe test showed a significant variation between undergraduate and Ph.D. scholars, with a *p value* of .001. However, no significant association was found between other groups, like PG vs. UG and PG vs. Ph.D., as their values exceeded the significance level. To succeed amidst challenges and opportunities, adaptability is crucial for students in the ever-evolving information landscape (DePauw, 2019).

### 4.4.13 Effect of Course on *Metaknowledge*

Metaknowledge in metaliteracy involves understanding what information is presented and how it's produced, disseminated, and utilized within different contexts and for various purposes. Table 70 data shows that the mean score ranges from 3.90 to 4.07 across these three-course categories, indicating high to very high metaknowledge among students. The UG and PG students show merely the same level (3.9), whereas Ph.D. students have a slightly higher score of 4.0.

**Table 70**

*Metaknowledge - Course-wise*

| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.9050 | .85138 | 3.151 | **.043** |
| PG | 220 | 3.9818 | .84380 | | |
| Ph.D. | 246 | 4.0772 | .78124 | | |
| Total/ Average | 824 | 3.9769 | .83117 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value is* .043, there is a significant difference among courses concerning metaknowledge. So, the Scheffe test was performed to understand the difference between the groups and represented in Table 71.

**Table 71**

*Metaknowledge-Course-wise-Scheffe*

| Course | UG | PG | PhD |
|---|---|---|---|
| UG | 1 | .558 | **.044** |
| PG | .558 | 1 | .464 |
| PhD | **.044** | .464 | 1 |

Among course-group comparisons, a significant difference exists among UG and Ph.D. students with a *p value* of .044, which is less than the significance level. No differences are observed among the other groups (PG vs. UG, PG vs. Ph.D.) in terms of their metaknowledge.

### 4.4.14 Effect of Course on *Diffident*

Table 72 illustrates that the mean score for the diffident variable ranges from 3.2 to 3.3, indicating a relatively low level of diffidence among students in different courses. Diffidence, reflecting a lack of confidence in self-expression, is characterized by negative scoring, where a low score signifies a positive effect.

**Table 72**

*Diffident - Course-wise*

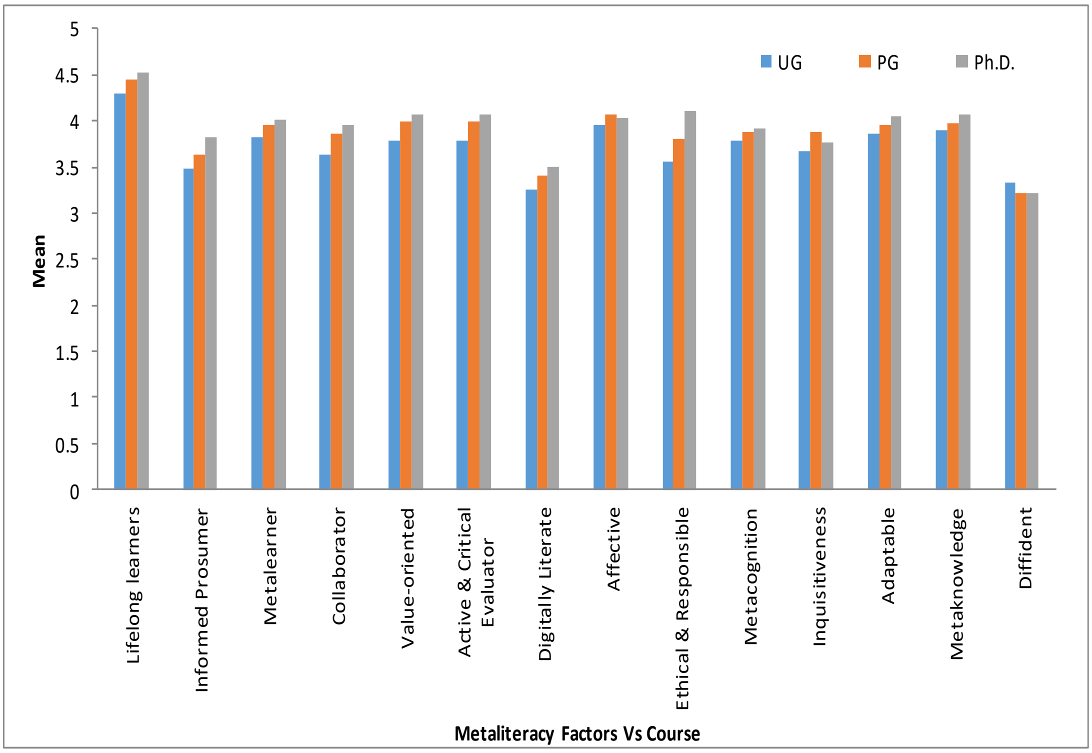
| Course | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| UG | 358 | 3.3268 | 1.28856 | .756 | .470 |
| PG | 220 | 3.2091 | 1.29344 | | |
| Ph.D. | 246 | 3.2195 | 1.32810 | | |
| Total/ Average | 824 | 3.2633 | 1.30139 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* represents a lack of significant difference between the institution and diffident as the *p value* (.470) is greater than the significance level. There could be various reasons for that low diffidence among IIT students. These students are coming through a rigorous selection process and highly competitive examinations and are likely to make confident individuals. In the competitive education environment, collaborative learning also fosters confidence. Moreover, their cultural influences and mentoring could play a role in developing students' self-confidence.

**Figure 18**

*Course-wise Metaliteracy*




The overall analysis of various factors of metaliteracy across different courses shown in figure 18 that reveals that among the fourteen factors examined, *lifelong learning* emerges as the most prominent across all student categories, indicating a strong commitment to continuous learning and skill development among the students in all communities. However, when delving deeper into specific student course categories, certain factors exhibit heightened levels among Ph.D. students.

These factors include *informed prosumer, collaborator, value-oriented, digital literacy, metacognition, inquisitiveness,* and *diffident*. On the other hand, most factors demonstrate high levels across all course categories, indicating a balanced distribution of metaliteracy competencies among students regardless of their academic level. All factors except *active critical evaluation, affective,* and *diffident* exhibit significant differences among the three student course categories, implying variations in specific skill sets and dispositions across different academic levels. To substantiate the tenability of the hypothesis, a statistical test is conducted by consolidating the mean scores of fourteen factors into a collective metaliteracy presented below.

The data presented in Table 73 indicates a gradual increase in metaliteracy levels from lower course levels to higher ones. Specifically, the metaliteracy level is slightly higher among Ph.D. scholars (mean=3.92) compared to PG students (mean=3.85) and UG students (mean=3.72). The gradual increase in the level of metaliteracy from lower to higher courses is likely a result of the cumulative impact of advanced study, specialized research, increased autonomy, and the development of critical thinking skills throughout the academic progression.

**Table 73**

*Overall Metaliteracy-Course-wise*

| Course | N | Mean | Std. Deviation | F value | *P value* |
|---|---|---|---|---|---|
| UG | 358 | 3.7210 | .42119 | 17.053 | **.000** |
| PG | 220 | 3.8546 | .50373 | | |
| Ph.D. | 246 | 3.9281 | .40943 | | |
| Total | 824 | 3.8185 | .44994 | | |

The *p value* is recorded as .000, indicating a significant difference among these courses, as it falls below the one percent significance threshold of .05. Consequently, the Scheffe test has been conducted to identify the variations across these three courses of study.

**Table 74**

*Overall Metaliteracy-Course-wise- Scheffe*

| Course | UG | PG | Ph.D. |
|---|---|---|---|
| UG | 1 | **.002** | **.000** |
| PG | **.002** | 1 | .200 |
| Ph.D. | **.000** | .200 | 1 |

Table 74 presents the Scheffe test result, explaining the pairwise comparisons between courses. When considering the UG course, there is a significant difference between PG and Ph.D, with *p value*s of .002 and .000, which comes under the significance level of .05. Considering the PG course, the *p value* is .002, similar to the UG vs. PG comparison. However, in the case of PG vs. Ph.D., the *p value* is .200, which is greater than the significance threshold of .05. Therefore, there is no significant difference between postgraduate (PG) and Ph.D. courses. When comparing Ph.D. vs. UG, The *p value* is .000, indicating a significant difference between the Ph.D. and undergraduate (UG) courses. However, in the case of Ph.D. vs. PG, the *p value* is .200, implying no significant difference between the Ph.D. and postgraduate (PG) courses. Overall results highlighted those significant differences between UG and PG, UG and Ph.D., and Ph.D. and UG. However, there is no significant difference between PG and Ph. D. students.

Overall, the total metaliteracy level remains high across all three courses, suggesting students attain a baseline level of metaliteracy competency regardless of their course level. This underscores the importance of fostering metaliteracy skills across educational curricula to empower students with the critical thinking, information literacy, and technological proficiency necessary to navigate the digital age's complexities.

### 4.5 Effect of Age groups on Factors of Metaliteracy

The effect of age on metaliteracy refers to how students of different age groups influence the development and application of metaliteracy skills among students. In this study, age groups are broadly divided into three categories:

1) Below 20 age group

2) 21-30 age group

3) 31-above age group

The data analysis of these age groups against metaliteracy and its fourteen factors are given in the following section.

### 4.6.1 Effect of Age on *Lifelong Learners*

Table 75 categorizes lifelong learner skills by age, showing that individuals across all age groups demonstrate a very high level of engagement in lifelong learning; it indicates a tendency for this engagement to increase with age, suggesting that older individuals are even more inclined to pursue lifelong learning activities. Among them, those 31 and above age categories exhibit a higher mean score of 4.57, followed by 21 to 30 strata with a mean score of 4.43, and below 20 groups with a mean score of 4.27.

**Table 75**

*Lifelong Learner – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 4.2799 | .54064 | | |
| 21-30 | 533 | 4.4339 | .49824 | 12.121 | **.000** |
| 31> | 71 | 4.5795 | .35644 | | |
| Total/ Average | 824 | 4.4053 | .50637 | | |

* The mean difference is significant at the .05 level (p≤.05).

Notably, the *p value* of .000 is statistically significant at the five percent level; it is clear that there is a significant difference in the level of lifelong learning skills based on age. The data is subjected to further analysis using the Scheffe test to assess the level of variation when comparing students' age groups. The results of the Scheffe test are presented in Table 76.

**Table 76**

*Lifelong Learner- Age group-wise-Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.001** | **.000** |
| 21-30 | **.001** | 1 | .071 |
| 31> | **.000** | .071 | 1 |

* The mean difference is significant at the 0.05 level

The analysis of lifelong learning skills based on the age groups shows that the age group below 20 exhibits significant variation when compared to the 21 to 30 and 31 above age groups, with a *p value* below the one percent level of significance. When considering the 21-30 age group, there is a noteworthy variation compared to the below-20 group, with a *p value* of less than one percent significance. However, there is no statistical significance in the comparison between the 21-30 group and 31 above age groups, as the *p value* is higher than the five percent level. Analyzing the 31-above age bracket shows a significant variation compared to the below-20 groups, with a *p value* of less than one percent significance. However, there is no statistical significance in the comparison between the 21-30 group and 31 above groups, as the *p value* exceeds the five percent level.

### 4.6.2 Effect of Age group on *Informed Prosumer*

Table 77 categorizes informed prosumer skills by age, revealing that individuals in different age groups exhibit high engagement in these skills, with mean scores ranging from 3.49 to 3.79. Specifically, the 31-above age group demonstrates the highest engagement with a mean score of 3.79. This group is followed closely by the 21-30 age group, which has a mean score of 3.65, and the under-20 age group, with a mean score of 3.49. These results suggest that informed prosumer skills are fairly consistent across age groups but peak during the 31 above age range.

**Table 77**

**Informed Prosumer – Age group-wise**

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.4968 | .68538 | 6.496 | **.002** |
| 21-30 | 533 | 3.6529 | .69354 | | |
| 31> | 71 | 3.7968 | .63689 | | |
| Total/ Average | 824 | 3.6236 | .69128 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

With a statistically significant *p value* of .002 at the five percent level, it can be concluded that there is a significant difference in students' perceptions of the level of informed prosumer skills based on age. The data has undergone additional analysis through the Scheffe test to evaluate the extent of variation when comparing different age groups among students.

**Table 78**

*Informed Prosumer- Age group-wise-Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | .018 | **.006** |
| 21-30 | .018 | 1 | .253 |
| 31> | **.006** | .253 | 1 |

Table 78 displays the variation in the skills of informed prosumers across different age groups. Mainly, the age group under 20 exhibits a significant difference compared to those aged 21-30 and 31 above, with a *p value* falling below the one percent significance level. When examining the 21-30 age group, there is a notable difference compared to the under-20 group, with a *p value* of .018, significant at less than the one percent level. However, there is no statistical significance when comparing it to the 21-30 and 31 above groups, as the *p value* exceeds the five percent level. An analysis of the 31 above age group reveals a significant difference compared to the under-20 group, with a *p value* indicating significance below the one percent level. However, there is no statistical significance when comparing the 21-30 and 31 above groups, as the *p value* exceeds the five percent threshold.

### 4.6.3 Effect of Age group on *Metalearner*

It is clear from the Table 79 that the age-based analysis reveals a high level of metalearner competency with an average mean of 3.90 among students of IITs in South India. The highest mean value, 4.08, is associated with the 31 above age group, followed by the 21–30 years and below 20 years age groups with mean values of 3.92 and 3.79, respectively.

**Table 79**

*Metalearner – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.7970 | .63305 | 6.203 | **.002** |
| 21-30 | 533 | 3.9296 | .65720 | | |
| 31> | 71 | 4.0822 | .54691 | | |
| Total/ Average | 824 | 3.9074 | .64614 | | |

* The mean difference is significant at the .05 level (p≤.05).

According to the significance test, the *p value* of .002 is significant at the 5% level, indicating a significant difference between these age groups. As a result, a Scheffe test is performed to determine the variance among them, which is tabulated in Table 80.

**Table 80**

*Metalearner- Age group wise-Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | .036 | **.005** |
| 21-30 | .036 | 1 | .171 |
| 31> | **.005** | .171 | 1 |

The Scheffe analysis indicates a significant difference in metalearner levels based on age, specifically between individuals below 20 years and those within the 31 above years age group, with a *p value* of .005, which attains significance at the 5% significance level. The rest of the age groups have no significance in between, as the *p value* is greater than the five percent significance level.

### 4.6.4 Effect of Age on *Collaborator*

Table 81 depicts the students' age-wise collaborative skills. The 31 above age group exhibits a very high level of collaborator skills, followed by 21-30 and below 20 groups with high possession. Overall, all of the age groups having high collaborative nature.

**Table 81**

*Collaborator – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.6197 | .80858 | 9.142 | **.000** |
| 21-30 | 533 | 3.8280 | .80479 | | |
| 31> | 71 | 4.0423 | .71919 | | |
| Total/ Average | 824 | 3.7909 | .80673 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (*.000*) shows a significant relationship between age and collaborative skills, as it succeeds the five percent of the significance threshold. Therefore, the Scheffe test was conducted to determine the comparisons among these groups, and the results are shown in Table 82.

**Table 82**

*Collaborator - Age group-wise-Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.005** | **.001** |
| 21-30 | **.005** | 1 | .106 |
| 31> | **.001** | .106 | 1 |

when considering the below 20 age strata, It is visible that the *p value* of 21-30 age agroups and above 30 suggests a relatively statistically significant difference as their *p value*s are.005 and .001 respectively. Similarly, the group 21-30 have a *p value* of 0.005, which shows a statistical significance between below 20 age groups only, rest of them have no significant association with it.While with 30 above age category also significant difference only with below 20, as the *p value* is greater than the significance level and rest of them lacking.

### 4.6.5 Effect of Age group on *Value-oriented*

It is evident from Table 83 that the mean score of the value-oriented factor among the different age categories ranges between 3.77 and 4.18, showing a high to very high level. The 31 above age group offers very high levels, and the below-20 group has fewer. Overall, there is a trend of increasing value-oriented traits with advancing age.

**Table 83**

*Value-oriented – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.7773 | .69641 | | |
| 21-30 | 533 | 3.9498 | .69110 | | |
| 31> | 71 | 4.1831 | .58395 | 10.533 | **.000** |
| Total/ Average | 824 | 3.9238 | .69194 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value* is zero, it is evident that there is a significant difference between these age groups and the value-oriented component. Therefore, the Scheffe test was conducted to identify the significance across these age groups.

**Table 84**

*Value-oriented- Age group-wise- Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.007** | **.000** |
| 21-30 | **.007** | 1 | **.027** |
| 31> | **.000** | **.027** | 1 |

Table 84 highlights that in the case of the below 20 age group, the variation regarding the value-oriented component is significant, with 21-30 and 31 above age groups at five percent levels; their *p value*s are .020 and .000, respectively. As far as the 21-30 groups considered, the variation is significant at a five percent level with below 20 (.007), 31 above (.027). In case of 31 above, it can be found that the variation is significant with below 20 and 21-30 as their respective *p value*s are significant at the five percent level. However, the variation found significant across all age categories.

### 4.6.6 Effect of Age group on *Active and Critical Evaluators*

Table 85 indicates that every age group exhibits a high proficiency in active and critical evaluation skills, with mean scores ranging from 3.79 to 3.97. Notably, the 31 above age group shows the highest mean score; followed by the 21-30 group and below 20 shows the least among these three groups.

**Table 85**

*Active and Critical Evaluators – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.7936 | .66549 | | |
| 21-30 | 533 | 3.8687 | .64564 | | |
| 31> | 71 | 3.9746 | .60938 | 2.308 | .100 |
| Total/ Average | 824 | 3.8578 | .64904 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The ANOVA test results indicate that there is no statistically significant difference in the proficiency of active and critical evaluators across different age groups. This conclusion is drawn from the *p value* of .100, which is higher than the conventional significance level of .05.

### 4.6.7 Effect of Age group on *Digitally Literate*

The age-wise analysis of student's digital literacy is given in Table 86. All of the age groups show a high level of digital literacy, with the 31 above age group showing a slightly high digital literacy mean score (3.67), followed by the 21-30 age group (3.35) and the below-20 age group exhibits the lowest mean score (3.29).

**Table 86**

*Digitally Literate – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.2973 | .78699 | | |
| 21-30 | 533 | 3.3505 | .74890 | | |
| 31> | 71 | 3.6704 | .66168 | 1.314 | .269 |
| Total/ Average | 824 | 3.3638 | .75763 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of .269 suggests that there is no statistically significant difference in digital literacy scores among the different age groups of students, as the *p value* is greater than the conventional threshold of .05.

### 4.6.8 Effect of Age group on *Affective*

As per the Table 87 data, there is an inclination in the mean score of age groups from lower to higher ranges from 3.97 to 4.11, showing high to very high levels. The average mean score shows a high level of affective component among the students of all age groups.

**Table 87**

*Affective – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.9761 | .65624 | | |
| 21-30 | 533 | 4.0061 | .63319 | | |
| 31> | 71 | 4.1162 | .56510 | 1.314 | .269 |
| Total/ Average | 824 | 4.0076 | .63420 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value* of .267 indicates that any observed variations in affective nature across different age groups of the students are not statistically significant, as the *p value* is greater than .05.

### 4.6.9 Effect of Age group on *Ethical & Responsible Engagement*

Table 88 demonstrated that the below 20 age group has the lowest mean score (mean = 3.58), the 21-30 age group shows a slightly higher mean score (mean = 3.82), the 31 above age maintains a very high level of ethical and responsible engagement (mean = 4.16). The data shows a notable trend of increasing ethical and responsible behavior across the age groups, with older age categories demonstrating higher mean scores for ethical and responsible engagement in their learning activities than younger age. Overall, age groups exhibit a high level of ethical and responsible behaviour.

**Table 88**

*Ethical and Responsible Engagement – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.5864 | .66761 | | |
| 21-30 | 533 | 3.8269 | .70740 | | |
| 31> | 71 | 4.1585 | .49864 | 20.983 | **.000** |
| Total/ Average | 824 | 3.7913 | .69779 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* (.000) indicates statistically significant differences in mean scores for ethical and responsible engagement among the listed age groups. Therefore, the Scheffe test was conducted to identify significant associations among these age groups and results shown in Table 89.

**Table 89**

*Ethical and Responsible Engagement – Age group wise-Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.000** | **.000** |
| 21-30 | **.000** | 1 | **.001** |
| 31> | **.000** | **.001** | 1 |

The comparison between Below 20 and 21-30 shows a *p value* of .000, indicating a statistically significant difference in ethical and responsible engagement between these two age groups. Similarly, significant differences (*p value*s less than .05) are observed for other comparisons between age groups, such as below 20 vs.21-30, below 20 vs. 31 above and 21-30 vs. below 20 age groups and with 31 above and vice versa. Overall, all of these three age category pairs showing significant differences as the *p value* is less than .05 level of significance.

### 4.6.10 Effect of Age group on *Metacognition*

The ANOVA test analysed the students' metacognition and age; the outcome is shown in Table 90. Students aged 31 and above have the highest mean metacognition score (mean = 4.05), followed by the 21-30 age group and below 20 age groups with a mean score of 3.86 and 3.72, respectively. Overall, there is a notable trend indicating that metacognition, or the awareness and understanding of one's own thought processes, tends to significantly improve as individuals grow older.

**Table 90**

*Metacognition – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.7288 | .65645 | 7.053 | **.001** |
| 21-30 | 533 | 3.8699 | .69861 | | |
| 31> | 71 | 4.0563 | .56340 | | |
| Total/ Average | 824 | 3.8483 | .68192 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (.001) indicates statistically significant differences in mean scores for metacognition among all age groups. The Scheffe test carried out to determine the significant difference of metacognition and student's age group and the final output is given in Table 91.

**Table 91**

*Metacognition-Age group-wise Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | .034 | **.002** |
| 21-30 | .034 | 1 | .094 |
| 31> | **.002** | .094 | 1 |

The comparison between below 20 and 31 above yields a *p value* of .002 and vice versa, suggesting a statistically significant difference in metacognition between these two age groups. When comparing the rest of the groups, non-significant differences (*p values* greater than 0.05) are observed for most comparisons between age groups in the table, indicating no statistically significant difference in metacognition scores between these age brackets.

### 4.6.11 Effect of Age group on *Inquisitiveness*

Table 92 illustrates the inquisitiveness levels across various age groups, with mean scores ranging from 3.69 to 3.80, indicating a high level of inquisitiveness among the participants. Notably, the age group of 31 and above demonstrates the highest level of inquisitiveness, with a mean score toward the upper end of this range. This suggests that individuals in this age group exhibit a greater curiosity and eagerness to learn compared to their younger counterparts. Following closely are the other age groups, which also display high levels of inquisitiveness, though slightly lower than the 31 and above group. This overall trend suggests a consistent and strong inclination towards inquisitiveness across all age groups, with minor variations that do not significantly differentiate the groups in terms of their inquisitive nature.

**Table 92**

*Inquisitiveness – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.6924 | .77822 | 1.039 | .354 |
| 21-30 | 533 | 3.7724 | .77171 | | |
| 31> | 71 | 3.8075 | .66824 | | |
| Total/ Average | 824 | 3.7540 | .76523 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* of .354 from the statistical analysis indicates that there is no significant difference in the inquisitive nature among students based on age. This suggests that, despite some variations in mean scores across age groups, these differences are not statistically significant. Therefore, age does not appear to be a determining factor in the level of inquisitiveness exhibited by the participants in this study.

### 4.6.12 Effect of Age group on *Adaptable*

Table 93 presents mean scores ranging from 3.86 to 4.03 across different age groups, revealing high to very high levels of adaptability among the student participants. Notably, the age group of 31 above stands out with the highest mean score, indicating a relatively greater degree of adaptability compared to other age cohorts. This suggests that individuals in their thirties might possess a particular capacity to adjust to new situations and challenges. Conversely, the mean scores for the remaining age groups hover around a similar range, suggesting a generally high level of adaptability across these groups. While there might be slight differences, they do not appear significant enough to delineate clear distinctions in adaptability levels among these age cohorts.

**Table 93**

*Adaptable – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.8682 | .60554 | | |
| 21-30 | 533 | 3.9653 | .62882 | 2.790 | .062 |
| 31> | 71 | 4.0352 | .50231 | | |
| Total/ Average | 824 | 3.9454 | .61415 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The obtained *p value* of .062 from the statistical analysis indicates that there is no statistically significant difference in adaptability levels among the various student age groups. This implies that despite variations in mean scores, these differences are not substantial enough to infer meaningful disparities in adaptability based on age only. Therefore, age does not seem to be a decisive factor influencing the level of adaptability demonstrated by the students.

### 4.6.13 Effect of Age group on *Metaknowledge*

Table 94 provides an overview of metaknowledge levels across different student age groups, with mean scores ranging from 3.84 to 4.16, indicating varying levels of metaknowledge among the participants. Notably, the highest mean score of 4.16 is observed in the age group of 31 and above, suggesting that these students possess the highest level of metaknowledge. This might be due to their greater experience and exposure to diverse learning environments and challenges. Following closely is the 21-30 age group with a mean score of 4.00, indicating a similarly high level of metaknowledge. Students in this age group are likely to be in the midst of their academic and professional development, which contributes to their advanced metaknowledge skills. The 20 and below age group has a mean score of 3.84, which, while still high, is lower compared to the older age groups. This score suggests that younger students may not yet have fully developed their metaknowledge skills to the same extent as their older peers. The differences in mean scores among these age groups highlight a trend where metaknowledge appears to improve with age and experience, reflecting the progressive development of higher-order thinking skills and self-awareness in learning among older students.

**Table 94**

*Metaknowledge – Age group-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.8455 | .85674 | 5.014 | .007 |
| 21-30 | 533 | 4.0056 | .82601 | | |
| 31> | 71 | 4.1690 | .73652 | | |
| Total/ Average | 824 | 3.9769 | .83117 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* of .007 from the statistical analysis indicates a significant difference in metaknowledge levels among the various student age groups. This suggests that age plays a notable role in determining metaknowledge proficiency among students. To observe the specific significance of these differences, a Scheffe test is employed, offering further insights into the comparative metaknowledge levels across age groups and tabulated in Table 95.

**Table 95**

*Metaknowledge-Age group-wise -Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.005** | **.017** |
| 21-30 | **.005** | 1 | .295 |
| 31> | **.017** | 295 | 1 |

Table 95 highlights the value-oriented component across different age groups, revealing potential variations. Specifically, when examining the age group below 20, the analysis indicates that a significant variation is observed in the value-oriented component compared to the 21-30 and  31 aboveage groups. This suggests a uniformity in the value-oriented aspect across these age cohorts, regardless of their demographic differences. Similarly, when focusing on the 21-30 age group, the analysis reveals no statistically significant variation in the value-oriented component compared to the below 20 and no statistical difference with 21-30 and 31 above age groups. When considering above 31, there is significant difference with below 20 and not significant with others. However, there is no significant difference when comparing the 31+ age group with the 21-30 age group. Overall, these findings underscore the distinctive value-oriented perspectives of the youngest age group while indicating a notable alignment in values among the older cohorts.

### 4.6.14 Effect of Age group on *Diffident*

Table 96 examines diffidence across distinct age brackets, with diffidence being the sole negative aspect measured through reverse scoring, where lower scores signify higher levels of diffidence. Mean scores span from 3.16 to 3.38 among the different age groups, suggesting that participants within these demographics generally demonstrate relatively low levels of diffidence.

**Table 96**

*Diffident – Age group-wise*

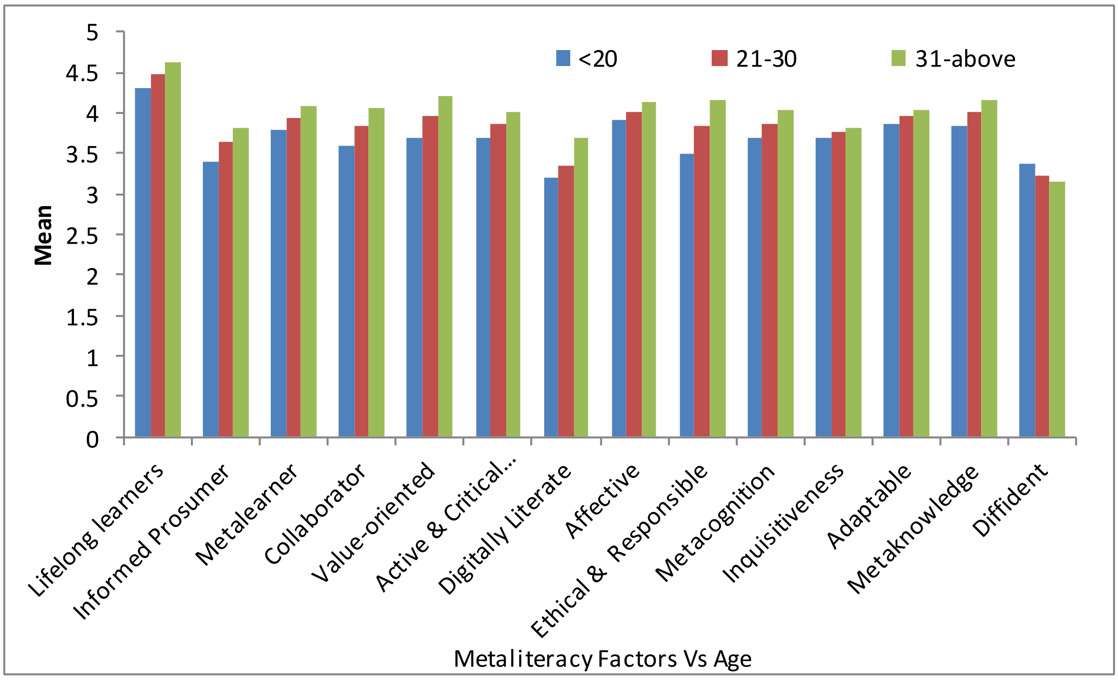
| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 3.3818 | 1.28555 | 1.307 | .271 |
| 21-30 | 533 | 3.2270 | 1.29888 | | |
| 31> | 71 | 3.1690 | 1.36262 | | |
| Total/ Average | 824 | 3.2633 | 1.30139 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Further statistical analysis, indicated by the *p value* of .271, reveals that there is no significant association between the levels of diffidence observed among students across the various age groups. This suggests that the variation in diffidence among the different age groups is not significant, and the participants generally exhibit a similar level of diffidence regardless of their age. This implies that differences in age do not appear to be correlated with variations in levels of diffidence among students, suggesting that other factors may play a more prominent role.

**Figure 19**

*Age-wise Metaliteracy*




The overall analysis of age groups regarding the factors of metaliteracy across all age categories displayed in the figure 19, *lifelong learning* and *affective* stands out as the most prominent factor, indicating a very strong inclination towards irrespective of age. However, a few factor levels are very high among certain age groups when delving deeper into specific age brackets. Particularly in the 31 above age group, eight factors exhibit very high levels, including *lifelong learner, metalearner, collaborator, value-orientedness, active and critical evaluation, ethical and responsible engagement, metacognition, adaptability,* and *metaknowledge.* Also, the 21-30 age group showcases strength in three factors: *lifelong learner, affective* and *metaknowledge*. Similary below 20 groups exhibits high proficiency in affective and lifelong learner. Despite these variations across different age groups, the overall average mean score of all factors, remains at a high level across all age brackets. This suggests that certain factors may vary in prominence depending on age. The variation in certain factors may make it difficult to substantiate the hypothesis. Therefore, further analysis is carried out on the overall metaliteracy level among the age categories.

**Table 97**

*Overall Metaliteracy-Age-wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| <20 | 220 | 4.3364 | .52992 | 11.192 | **.000** |
| 21-30 | 533 | 4.4881 | .48587 | | |
| 31> | 71 | 4.6080 | .35085 | | |
| Total/ Average | 824 | 4.4579 | .49425 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 97 shows a gradual increase in the mean scores of metaliteracy across different age brackets, with scores progressing from 4.33 in the under-20 age group to 4.48 for the 21-30 age group and reaching 4.60 for the 31 and above age group. Despite these variations, the overall metaliteracy level remains very high across all age groups. The *p* value of .000, which is less than the conventional significance level of 0.05, indicates a statistically significant difference in metaliteracy levels among the various age groups. This suggests that age plays a notable role in shaping students' metaliteracy abilities.

To pinpoint where these differences lie within the age groups, further post hoc tests (Scheffe) were conducted. The outcomes of these tests are presented in Table 98, providing a deeper understanding of how metaliteracy levels vary across different age demographics.

**Table 98**

*Overall Metaliteracy-Age group-wise- Scheffe*

| Age Group | <20 | 21-30 | 31> |
|---|---|---|---|
| <20 | 1 | **.001** | **.000** |
| 21-30 | **.001** | 1 | .152 |
| 31> | **.000** | .152 | 1 |

While comparing the below-20 age group with others, Table 98 indicates that there is a statistically significant difference between this group and both the 21-30 and 31-above age groups. The p value s for these comparisons (.001 and .000, respectively) are less than the significance level of 0.05, confirming that the differences are statistically significant. When examining the 21-30 age group, the data reveals a statistically significant difference when compared to the below-20 age group, as indicated by a *p value* below .05. However, there is no significant difference between the 21-30 age group and the 31 above age group, as the p value s for these comparisons exceed the .05 threshold. Similarly, for the 31-above age group, there is a statistically significant difference with the below-20 age group, supported by a *p value* below .05. However, no significant differences are observed when comparing the 31 above age group with the 21-30 age group, as indicated by p value s above the .05 significance level. In summary, the below-20 age group exhibits significant differences in metaliteracy levels when compared to the 21-30 and 31-above age groups. The 21-30 age group shows a significant difference only with the below-20 age group, while the 31 above age group also shows significant differences only with the below-20 age group. These findings suggest that the most notable variations in metaliteracy levels occur between the youngest age group and the older age groups.

## 4. 7 Effect of Gender on Metaliteracy

Many global initiatives and organizations work toward achieving gender equality in education. Even though inclusive educational programs promote equal access to technology and a safe online environment for individuals of all genders. Research has shown gender disparities in various literacy types. So, gender can play a role in how individuals' approach and engage with information, including their metaliteracy skills. The following section addresses the gender association with the factors of metaliteracy, categorising two genders such as male and female. The '*transgender*' option was provided in the survey instrument, but no response was received against it, so the category was omitted during the data analysis.

### 4.7.1 Effect of Gender on Lifelong Learners

Lifelong learning proficiency for students spans various disciplines and is crucial for continual growth, adaptability, and success in their academic and professional endeavors. Table 99 provides a clear insight into gender-based variations of lifelong learning among the IIT students. Both the male and female categories have a mean score of 4.44 and 4.49, which shows a higher level of lifelong learning skills. In another study, Gündüz, (2023) found a high level of lifelong learning and perceptions of 21st-century skills among pre-service teachers specializing in computer education and instructional technologies at a state university in Turkey.  Both genders show a high level, which is a bit higher in females than males. There may be different reasons, such as exposure to technology, the educational environment, access to resources, and the career aspirations of these students, collectively contributing to their inclination and ability to maintain high levels of lifelong learning.

**Table 99**

*Lifelong Learner – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 4.4468 | .49974 | -1.150 | .251 |
| Female | 197 | 4.4932 | .47584 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value* of *.251* is not statistically significant at the five percent level (0.05), it is reasonable to assume that there is no significant difference in the perceptions of male and female students regarding the level of lifelong learning skills in the South Indian IITs. Another study reveals a comparable result; Karabulut and Sivrikaya, (2023) investigated the levels of lifelong learning among prospective special schoolteachers studying at Bolu Abant İzzet Baysal University. They found no significant differences between female and male participants in their study. Similarly, the result unveiled in a journal article showed no significant difference in the lifelong learning traits concerning gender among geography students (Chen, 2023). In another study, Deveci (2015) noted that gender did not significantly impact students' attitudes toward lifelong learning from the state university Department in Turkey. Students must realize that embracing metaliteracy necessitates continuous lifelong learning for future professionals as informed, responsible citizens.

### 4.7.2 Effect of Gender on *Informed Prosumer*

Metaliteracy expands IL by recognizing that the learner is also an informed consumer, producer, and disseminator of information in collaborative spaces using emerging technologies (Pinheiro, 2023). The analysis aims to understand if there are any differences in informed prosumer competency between genders within the student community. Table 100 showcases how students engage as prosumers—blending their roles as producers and consumers—while considering gender-specific perspectives. Interestingly, both genders have an almost similar mean score (3.6), indicating highly informed prosumer competency.

**Table 100**

*Informed Prosumer – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.6200 | .68817 | -.271 | .787 |
| Female | 197 | 3.6352 | .70273 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value (.787)* does not fall within the significant level, it is assumed that there is no significant difference between gender and informed prosumer skills among the student community.

### 4.7.3 Effect on Gender on Metalearner

The metalearning refers to the process of understanding and managing one's own learning. It involves becoming aware of learning strategies, adapting approaches to different learning situations, and developing skills to learn more effectively and efficiently. It's learning about how you learn. Table 101 presents the distribution of metalearner skills across genders. The gender-wise data reveals that the mean scores are 3.92 to 3.85 for males and females, showing high metalearner skills among both genders.

**Table 101**

*Metalearner– Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.9229 | .65768 | 1.233 | .218 |
| Female | 197 | 3.8579 | .60688 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value of .218*, resulting from the variance analysis, doesn't hold statistical significance at a five percent level. Therefore, there is no significant difference in the level of metalearner among the genders.

#### 4.7.4 Effect of Gender on *Collaborator*

Table 102 depicts collaborative skills categorized by gender. Both genders exhibit high collaborative skills, with mean scores of 3.76 and 3.86. Notably, there is a slight increase in the female category. Similar findings were observed in a study indicating that female Palestinian English Major students at Hebron University's English Department favored collaborative activities more than male students (Farrah, 2011).

**Table 102**

*Collaborator – Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.7677 | .82584 | -1.473 | .141 |
| Female | 197 | 3.8646 | .73983 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value is* .141, which is above the significance level of 0.05, so it was concluded that there is no significant difference in the students' gender and their collaborative skills.

#### 4.7.5 Effect of Gender on *Value-oriented*

The T-test has been carried out to check the relationship between value orientation and gender and results are depicted in Table 103. The mean score is 3.90 and 3.98 for males and females; there is very slight variation among genders, and both indicate a high inclination towards value-oriented traits.

**Table 103**

*Value-oriented – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.9059 | .70677 | -1.329 | .184 |
| Female | 197 | 3.9810 | .64083 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value is* .184 (greater than 0.05), suggesting there is a lack of a significant difference between genders and value-oriented traits.

### 4.7.6 Effect of Gender on *Active and Critical Evaluators*

Table 104 showcases the gender-wise data, with almost similar mean scores of 3.85 and 3.87. It suggests a high level of proficiency in active and critical evaluation skills among both genders. However, a contradictory result from another study indicated that male students exhibited greater dominance in critical thinking than females (Alhowail & Albaqami, 2024).

**Table 104**

*Active and Critical Evaluators – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.8539 | .64295 | -.304 | .761 |
| Female | 197 | 3.8701 | .66958 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* obtained from the analysis of variance is .761, indicating a lack of statistical significance at a 5% significance level. Consequently, no statistically significant differences between males and females regarding active and critical evaluation skills are observed.

### 4.7.7 Effect of Gender on *Digitally Literate*

Table 105 provides insights into digital literacy statistics for both males and females. The mean score for males is recorded at 3.31, while females exhibit a slightly higher mean score of 3.53. These scores indicate that both genders possess a high level of digital literacy, although females appear to have a slightly higher digital proficiency compared to males.

**Table 105**

*Digitally Literate – Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.3104 | .77216 | -3.641 | **.000** |
| Female | 197 | 3.5340 | .68386 | | |

* The mean difference is significant at the .05 level (p≤.05).

A gender-wise analysis of variance (ANOVA) was conducted to explore potential differences in digital literacy levels between males and females. The *p value* of .000 is significant as it falls well below the conventional threshold of significance (usually set at .05). This indicates a statistically significant difference in digital literacy levels between genders.

### 4.7.8 Effect of Gender on *Affective*

Table 106 displays the affective aspects categorized by gender, with males exhibiting a mean score of 3.97 and females scoring slightly higher at 4.09. These scores suggest that both genders possess high to very high levels of affective components.

**Table 106**

*Affective – Gender- wise*

| Age groups | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.9793 | .64273 | -2.293 | **.022** |
| Female | 197 | 4.0977 | .59892 | | |

* The mean difference is significant at the .05 level (p≤.05).

The statistical analysis reveals a *p value* of .022, which indicates that the observed differences in mean scores for affective aspects between males and females are statistically significant as it is lower than (.05) conventional threshold of significance.

### 4.7.9 Effect of Gender on *Ethical & Responsible*

The ethical and responsible engagement categorized by gender is outlined in Table 107, in which the mean score falls at 3.75 and 3.92 for males and females, respectively. A high level of ethical and responsible engagement is present among both genders.

**Table 107**

*Ethical and Responsible – Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.7500 | .69987 | -3.043 | **.002** |
| Female | 197 | 3.9226 | .67624 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of *.002*, reveals a significant difference regarding ethical and responsible information behavior among males and females.

### 4.7.10 Effect of Gender on *Metacognition*

Table 108 also presents the metacognition competency, in which the mean scores of males (3.87) and females (3.75) exhibit a high level of metacognition among these two genders.

**Table 108**

*Metacognition – Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.8761 | .69437 | 2.094 | **.037** |
| Female | 197 | 3.7597 | .63427 | | |

* The mean difference is significant at the .05 level (p≤.05).

As the *p value is .037*, it is evident from the ANOVA result that there is a significant difference in the metacognition among these genders. In contrast, the findings of another study align with the notion that metacognitive skills among female students did not exhibit significant differences compared to their male counterparts in high school students (Gula et al., 2024).

### 4.7.11 Effect of Gender on *Inquisitiveness*

Table 109 data shows that inquisitiveness levels demonstrate almost the same range, with the males having a mean score of 3.74 and females 3.79. It represents the high level of inquisitive nature among these genders.

**Table 109**

*Inquisitiveness – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.7427 | .78867 | -.760 | .448 |
| Female | 197 | 3.7902 | .68592 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value (.448)* is higher than a typical significance level (.05), suggesting no significant difference in inquisitiveness between the genders.

### 4.7.12 Effect of Gender on *Adaptable*

The data presented in the Table 110 indicates the levels of adaptability among males (3.91) and females (4.03), suggesting a high to high degree of adaptable nature within both genders. The slight increase towards females.

**Table 110**

*Adaptable – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.9167 | .62571 | -2.402 | **.017** |
| Female | 197 | 4.0368 | .56771 | | |

* The mean difference is significant at the .05 level (p≤.05).

Since the *p value* of .017 comes under the significance threshold of .05, it implies a significant difference in adaptable nature among males and females.

### 4.7.13 Effect of Gender on *Metaknowledge*

Table 111 data reveals metaknowledge levels among males at 3.96 and females at 4.01, indicating a high to high degree of metaknowledge in both genders. There's a slight inclination towards higher metaknowledge among females compared to males.

**Table 111**

*Metaknowledge – Gender -wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.9649 | .84901 | -.741 | .459 |
| Female | 197 | 4.0152 | .77247 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of *.459*, crossing the significance level of .05, suggests no significant difference in metaknowledge skills among both genders.

### 4.7.14 Effect of Gender on *Diffident*

Table 112 shows that both males (3.26) and females (3.25) exhibit similarly low levels of diffidence, with higher scores representing less diffidence.

**Table 112**

*Diffident – Gender -wise*

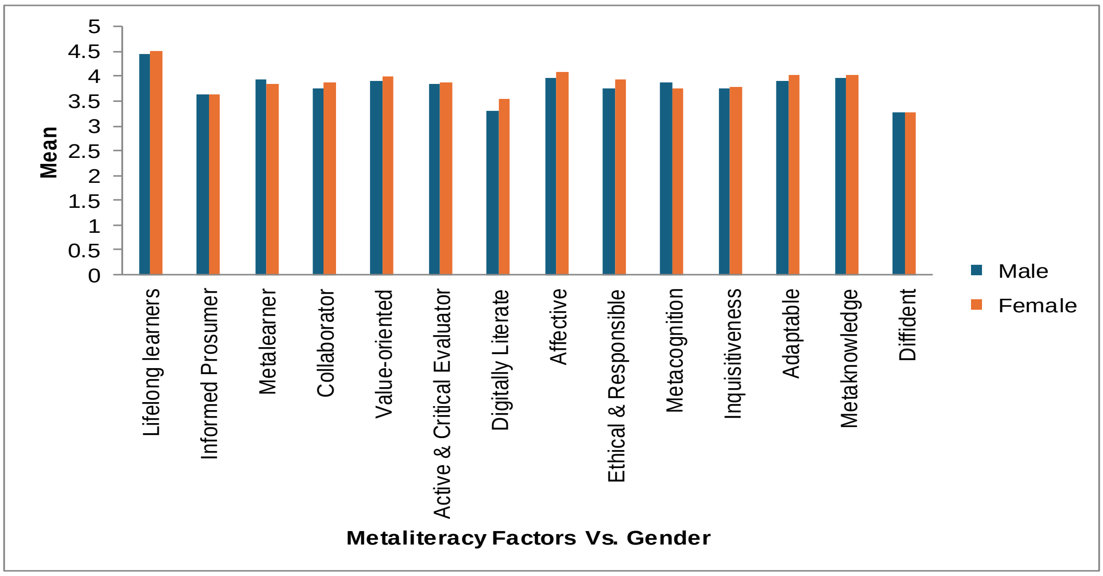
| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.2648 | 1.32803 | .055 | .956 |
| Female | 197 | 3.2589 | 1.21596 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of .956 suggests a non-significant difference in diffidence characteristics between males and females, as it exceeds the significance level of .05.

**Figure 20**

*Gender-wise Metaliteracy*



Upon conducting a comprehensive gender group-wise analysis focusing on all metaliteracy factors, it becomes evident from figure 20 that regardless of age categories, *lifelong learning* emerges as the predominant factor. This suggests a robust inclination towards continuous learning irrespective of gender. However, among female students, certain factor levels, such as *affective, adaptable*, and *metaknowledge*, are notably high. Despite these variations, all other factors demonstrate a high level of possession. This indicates that while specific factors may exhibit differences in prominence based on gender, therefore further analysis is carried out to check the total metaliteracy across gender for the confirmation of the tenability of the hypothesis.

**Table 113**

*Overall Metaliteracy– Gender- wise*

| Gender | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Male | 627 | 3.805 | 0.45628 | -1.548 | .122 |
| Female | 197 | 3.862 | 0.42849 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Table 113 data reveals that both males and females exhibit a similar range of collective metaliteracy levels, with males mean score 3.8. This indicates a high level metaliteracy across both genders. The *p value* of .122, which surpasses the significance threshold of .05, implies that there isn't a significant difference in metaliteracy between males and females. Despite minor variations in mean scores, these differences are not substantial enough to conclude that gender has a significant impact on metaliteracy levels.

## 4.8 Effect of Socioeconomic status on Factors of Metaliteracy

The influence of socioeconomic status on metaliteracy is crucial because it shapes student's ability to navigate and critically engage with digital information. Higher socioeconomic status often means better access to technology, quality education, and diverse information resources, contributing to developing strong metaliteracy skills. Recognizing these disparities is essential for addressing the digital divide and ensuring that everyone, regardless of socioeconomic background, has equal opportunities to thrive in today's information-driven society. The next section aims to examine how socioeconomic status influences various factors of metaliteracy.

### 4.8.1 Effect of Socioeconomic Status on Lifelong Learners

Table 114 represents mean scores ranging from 4.44 to 4.53 across various socioeconomic groups., indicating consistently high levels of lifelong learning skills across all socioeconomic groups.

**Table 114**

*Lifelong Learner – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.5270 | .50422 | 1.849 | .158 |
| Middle | 684 | 4.4430 | .49513 | | |
| Upper | 72 | 4.5347 | .46969 | | |
| Total/Average | 824 | 4.4579 | .49425 | | |

* The mean difference is significant at the .05 level (p≤.05).

With a *p value* of *.158*, which is not significant at the one percent level, it can be concluded that the difference in lifelong learning skills based on socioeconomic status is not statistically significant. Therefore, it can be concluded that socioeconomic status does not have a significant impact on lifelong learning skills.

### 4.8.2 Effect of Socioeconomic Status on Informed Prosumer

It is clear from the Table 115 that the mean scores across diverse student categories with various socioeconomic statuses range from 3.59 to 3.80, showing high informed prosumer skills among all groups. Specifically, the upper layer demonstrates a slightly higher mean score when compared to the lower and middle layers.

**Table 115**

*Informed Prosumer – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.7647 | .74324 | 4.807 | **.008** |
| Middle | 684 | 3.5902 | .68055 | | |
| Upper | 72 | 3.8075 | .70605 | | |
| Total/Average | 824 | 3.6236 | .69128 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of *.008* indicates statistical significance at the .05 level and a significant association between the variables. Table 116 shows the outcome of the Scheffe test, which determines the significance of socioeconomic level with the informed prosumer skills.

**Table 116**

*Informed Prosumer- Socioeconomic status-wise- Scheffe*

| Socio-economic status | Lower | Middle | upper |
|---|---|---|---|
| Lower | 1 | .138 | .934 |
| Middle | .138 | 1 | **.039** |
| Upper | .934 | **.039** | 1 |

*The mean difference is significant at the 0.05 level.

When considering the lower stratum, there is a lack of significance with middle and upper-class cohorts, as indicated by a *p value* exceeding .05. As far as the middle class is concerned, there is a significance with the upper class as the *p value* is .039, which is less than the significance level. No significant association is observed with the lower class. Conversely, in the upper-class category, no statistically significant association is evident with the lower class. Still, a noteworthy association is identified with the middle class, as the *p value* is .039.

### 4.8.3 Effect of Socioeconomic Status on Metalearner

It is clear from Table 117 that, across all socioeconomic groups, there is a consistent demonstration of high to very high metalearner skills, as evidenced by mean values ranging between 3.88 to 4.12. Specifically, the upper class exhibits the highest mean score of 4.12, indicating a relatively stronger proficiency in metalearning compared to other socioeconomic groups. Following closely behind, the lower class demonstrates a mean score of 4.06, indicating a similarly strong performance in metalearner skills. Conversely, the middle class displays the lowest mean score of 3.88, suggesting a slightly weaker proficiency in metalearning compared to the other groups.

**Table 117**

*Metalearner– Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.0618 | .71592 | 6.543 | **.002** |
| Middle | 684 | 3.8822 | .63364 | | |
| Upper | 72 | 4.1250 | .63106 | | |
| Total/Average | 824 | 3.9182 | .64483 | | |

* The mean difference is significant at the .05 level (p≤.05).

An analysis of variance was executed to evaluate the statistical significance of the mean values for metalearner skills. The variation was found to be significant at a one percent level, with a *p* value of .002. Subsequently, a Scheffe test was performed to further ascertain the variance's significance.

**Table 118**

*Metalearner- Socioeconomic status -wise Scheffe*

| Socio economic status | Lower | Middle | Upper |
|---|---|---|---|
| Lower | 1 | .089 | .843 |
| Middle | .089 | 1 | **.010** |
| Upper | .843 | **.010** | 1 |

Table 118 distinctly illustrates the metalearner levels across different socioeconomic statuses. When the lower class is considered, there is no significance difference with the middle and upper class as the *p value* exceeds the significance level. However, in the case of the middle class, it exhibits significance with the upper class, as the *p value* of .010 and there is no significant association with the lower group. While upper stratum is considered, there is a lack of significant association between lower class status, but it is significant with the middle group as the *p value* comes as .010., which is greater than the five percent of significance level.

### 4.8.4 Effect of Socioeconomic Status on *Collaborator*

It is evident from the Table 119 that the collaborative skills of students show a marginal rise across socioeconomic groups, moving from lower to upper, despite all these groups demonstrating a high level of collaborative nature.

**Table 119**

*Collaborator – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.7353 | .84751 | 2.507 | .082 |
| Middle | 684 | 3.7753 | .80428 | | |
| Upper | 72 | 3.9907 | .77312 | | |
| Total/Average | 824 | 3.7909 | .80673 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* of .082 might suggest that there's some variance between socioeconomic groups; *it's* not significant at a conventional significance level of 0.05. This suggests that while there may be slight differences in collaborative skills among socioeconomic groups, these differences are not statistically significant.

### 4.8.5 Effect of Socioeconomic Status on *Value-oriented*

Based on the findings presented in Table 120, it is evident that each socioeconomic group exhibits a high to high level of proficiency in active and critical assessment abilities, with mean scores spanning from 3.89 to 4.09. the lower and upper classes have shown a higher level of proficiency in value-oriented traits than that of middle-class students.

**Table 120**

*Value-oriented – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.0919 | 4.0919 | 3.061 | **.05** |
| Middle | 684 | 3.8980 | 3.8980 | | |
| Upper | 72 | 4.0104 | 4.0104 | | |
| Total/Average | 824 | 3.9238 | .69194 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

Further analysis through an ANOVA test reveals that there is significant difference in value-oriented proficiency across socioeconomic categories, as evidenced by a *p* value of .05. Therefore, a post hoc test has carried out to determine the differences among age groups and the results are tabulated in Table 121.

**Table 121**

*Value-oriented – Socioeconomic status -wise Scheffe*

| Socio economic status | Lower | Middle | Upper |
|---|---|---|---|
| Lower | 1 | .088 | .784 |
| Middle | .088 | 1 | .422 |
| Upper | .784 | .422 | 1 |

Table 121 compares the value-oriented scores between pairs of socioeconomic groups. When examining the lower socioeconomic status group, there is no significant difference observed with either the middle or upper class. This lack of significance is indicated by the *p* values (.088 and .784, respectively), both of which exceed the conventional significance level of .05. For the middle class, the analysis reveals no significant difference with the lower socioeconomic group, as the *p value* is not less than .05. However, there is also no significant association with the upper class. This is evident from the *p value* of .422, which exceeds the significance threshold. Similarly, when considering the upper socioeconomic status group, there is a lack of significant association with the lower class.

#### 4.8.6 Effect of Socioeconomic Status *on Active & Critical Evaluators*

According to Table 122, students from each socioeconomic group have almost similar high levels of proficiency in active and critical assessment abilities, with mean scores ranging from 3.83 to 3.98. The lower and upper strata demonstrate slightly higher than the middle strata.

**Table 122**

*Active and Critical Evaluators – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.9471 | .81231 | | |
| Middle | 684 | 3.8360 | .63453 | 2.325 | .098 |
| Upper | 72 | 3.9806 | .59968 | | |
| Total/Average | 824 | 3.8578 | .64904 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The ANOVA test results indicate no significant difference in proficiency among socioeconomic categories, as indicated by the *p value* of .098. Therefore, despite minor variations in mean scores, these differences do not seem statistically significant.

#### 4.8.7 Effect of Socioeconomic Status on *Digitally Literate*

Table 123 provides information regarding digital literacy categorized according to different socioeconomic statuses. The lower socioeconomic status group demonstrates the highest mean digital literacy score (3.52), followed by the upper (3.48) and then the middle (3.33) status groups overall; all three SES categories show a consistently high level of digital literacy.

**Table 123**

*Digitally Literate – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.5294 | .74012 | 3.144 | **.05** |
| Middle | 684 | 3.3342 | .74665 | | |
| Upper | 72 | 3.4889 | .85044 | | |
| Total/Average | 824 | 3.3638 | .75763 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* of .05 suggests a significant difference in digital literacy scores among the socioeconomic status groups, as the *p value* is a significant threshold borderline.

**Table 124**

*Digitally Literate – Socioeconomic status -wise Scheffe*

| Socio-economic Status | Lower | Middle | Upper |
|---|---|---|---|
| Lower | 1 | .088 | .784 |
| Middle | .088 | 1 | .422 |
| Upper | .784 | .422 | 1 |

Table 124 presents the results of the Scheffe test analyzing digital literacy levels across different socioeconomic statuses. When comparing the lower socioeconomic status group with the middle class, the *p value* of .088 suggests that there is no statistically significant difference in digital literacy levels between these two groups. Similarly, the comparison between the middle and upper socioeconomic groups yields a *p value* of 0.422, indicating no significant difference in digital literacy levels between these groups. However, when comparing the lower and upper socioeconomic groups, the *p value* of 0.784 suggests once again that there is no statistically significant difference in digital literacy levels between these two groups.

Overall analysis indicates that there is a lack of significant differences in digital literacy levels between any pairs of socioeconomic groups.

### 4.8.8 Effect of Socioeconomic Status on *Affective*

It is depicted in Table 125 that the individuals classified under the lower socioeconomic status have the highest mean score for affective aspects (mean = 4.09) among the listed socioeconomic categories, followed by the upper socioeconomic status (mean = 4.04), and then the middle socioeconomic status (mean = 3.99). Therefore, students from the lower and upper socioeconomic classes show a very high level of affective component compared to those of the middle class.

**Table 125**

*Affective – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.0993 | .65241 | 1.015 | .363 |
| Middle | 684 | 3.9942 | .63652 | | |
| Upper | 72 | 4.0486 | .59285 | | |
| Total/Average | 824 | 4.0076 | .63420 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value (.363)* suggests that the differences in mean scores among the selected socioeconomic statuses for affective aspects are not statistically significant at a conventional significance level of .05. However, the lack of statistical significance implies that socioeconomic status may not be a decisive factor in determining affective aspects among students.

### 4.8.9 Effect of Socioeconomic Status on *Ethical and Responsible*

Table 126 shows mean scores and other statistics for ethical and responsible engagement across different socioeconomic classes. Individuals with lower socioeconomic status have a mean score of 3.85 for ethical and responsible engagement. The middle socioeconomic status shows a slightly lower mean score of 3.77. The upper socioeconomic status demonstrates a slightly higher mean score of

3.92. Even though a slight variation in the mean score exists, overall, there is a high level of ethical and responsible engagement among all three SES categories.

**Table 126**

*Ethical and Responsible – Socioeconomic status-wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.8529 | .80719 | 1.770 | .171 |
| Middle | 684 | 3.7716 | .69312 | | |
| Upper | 72 | 3.9201 | .61927 | | |
| Total/Average | 824 | 3.7913 | .69779 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value* (.171) indicates that there might not be statistically significant differences in mean scores among these socioeconomic statuses for an ethical and responsible engagement at a conventional significance level of .05.

**4.8.10 Effect of Socioeconomic Status on *Metacognition***

Table 127 reveals that the upper socioeconomic status group demonstrates the slightly higher mean score at 3.97, followed by the lower status group at 3.86 and the middle class at 3.83 for the metacognition of students. Although, three SES categories represent a high metacognitive skill among students.

**Table 127**

*Metacognition – Socioeconomic status-wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.8676 | .75561 | 1.484 | .227 |
| Middle | 684 | 3.8328 | .67576 | | |
| Upper | 72 | 3.9769 | .66273 | | |
| Total/Average | 824 | 3.8483 | .68192 | | |

* The mean difference is significant at the .05 level (p≤.05).

With a *p value* of .227, it appears that there may not be statistically significant differences in mean scores for metacognition among these three socioeconomic statuses, particularly at the conventional significance level of .05, given that the *p value* exceeds this threshold. Despite variations in mean scores across different socioeconomic statuses, the data suggests that these differences might not be statistically significant based on the obtained *p value*.

### 4.8.11 Effect of Socioeconomic Status on *Inquisitiveness*

Table 128 presents data regarding inquisitiveness scores categorized by socioeconomic status. Among the socioeconomic groups, individuals in the lower status category have a mean inquisitiveness score of 3.93, while those in the middle class have a mean score of 3.74, and those in upper socioeconomic status exhibit a mean score of 3.68 by demonstrating a high level of inquisitiveness among the students.

**Table 128**

*Inquisitiveness– Socioeconomic status-wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.9314 | .71134 | 2.154 | .117 |
| Middle | 684 | 3.7432 | .75425 | | |
| Upper | 72 | 3.6898 | .89570 | | |
| Total/Average | 824 | 3.7540 | .76523 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The analysis of variance (ANOVA) results indicates a *p value* of .117. This suggests that there may not be a statistically significant difference in inquisitiveness scores among the socioeconomic groups at the conventional significance level of .05, as the *p value* exceeds this threshold. Despite some variation in mean scores across different socioeconomic statuses, the obtained *p value* indicates that these differences might not be statistically significant.

### 4.8.12 Effect of Socioeconomic Status on *Adaptable*

Table 129 displays data regarding adaptability scores categorized by socioeconomic status. Specifically, individuals in the lower socioeconomic status group exhibit a higher adaptability with a mean score of 4.04, followed by the upper class with a high level of adaptability (mean=4.00). Additionally, individuals classified as belonging to the middle socioeconomic status demonstrate high adaptability, with a slightly lower level of mean score of 3.92.

**Table 129**

*Adaptable – Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.0478 | .58312 | 1.561 | .211 |
| Middle | 684 | 3.9287 | .61501 | | |
| Upper | 72 | 4.0069 | .62935 | | |
| Total/Average | 824 | 3.9454 | .61415 | | |

* The mean difference is significant at the .05 level (p≤.05).

The *p value is* .211, suggesting that there may be no statistically significant difference in adaptability between socioeconomic groups since the *p value* is less than 0.05.

### 7.8.13 Effect of Socioeconomic Status on *Metaknowledge*

Table 130 presents data on metaknowledge scores categorized by socioeconomic status, showing an inclination from high to higher. Within the upper and lower socioeconomic status groups, students demonstrate a high level of metaknowledge with a mean score of 4.18 and 4.04. However, students in the middle class exhibit high metacognition, with a mean score of 3.94.

**Table 130**

*Metaknowledge – Socioeconomic status-wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 4.0441 | .90494 | 2.786 | .062 |
| Middle | 684 | 3.9488 | .81996 | | |
| Upper | 72 | 4.1806 | .84464 | | |
| Total/Average | 824 | 3.9769 | .83117 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value* (.062) indicates that these differences might not be statistically significant at the .05 significance level.

### 4.8.14 Effect of Socioeconomic Status on *Diffident*

The diffident factor has a reverse scoring from five to one due to its negative aspect. Table 131 displays data on diffidence scores categorized by socioeconomic status, revealing that the students from all socioeconomic status groups have a mean score ranging from 3.22 to 3.33, showing low-level diffidence across them.

**Table 131**

*Diffident – Socioeconomic status-wise*

| Socio-economic Status | N | Mean | Standard Deviation | F value | *p value** |
|---|---|---|---|---|---|
| Lower | 68 | 3.2206 | 1.45423 | .142 | .867 |
| Middle | 684 | 3.2602 | 1.28949 | | |
| Upper | 72 | 3.3333 | 1.27820 | | |
| Total/Average | 824 | 3.2633 | 1.30139 | | |

* The mean difference is significant at the .05 level ($p \leq .05$).

The *p value is .867*, denoted as no significant difference between the socioeconomic status and diffidence of students at the South Indian IITs, as it greatly exceeds the conventional significance level of .05.

**Figure 21**

*Socioeconomic status- wise Metaliteracy*

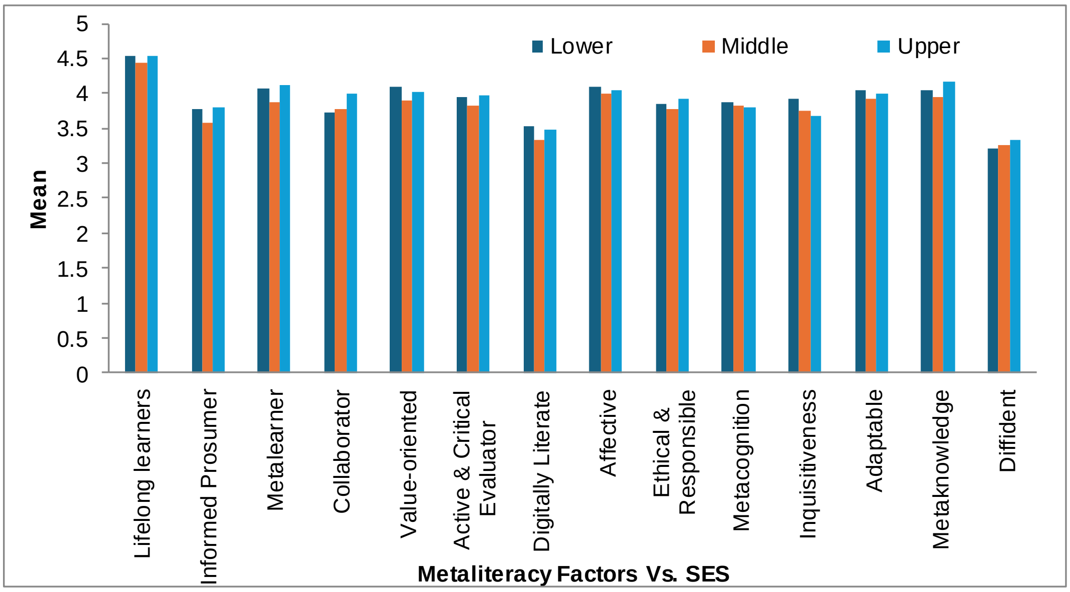



Figure 21 provides a comprehensive overview of the various metaliteracy factors, and their average mean scores across different socioeconomic status groups. It highlights that *lifelong learning* emerges as the most prominent factor across all socioeconomic status (SES) categories, indicating a strong inclination towards continuous learning irrespective of socioeconomic background. This suggests that the desire for lifelong education and skill development transcends economic status. Certain SES categories exhibit particularly advanced competence in specific factors. Notably, both the lower and upper socioeconomic classes demonstrate high proficiency in several key factors such *as metalearner*, *value-oriented behavior, affective engagement*, *adaptability*, and *metaknowledge*, while some factors remain at a high level across all SES categories. Overall, analysis indicates a more uniform distribution of skills among students from various socioeconomic backgrounds, except for a few factors. Thus, to prove the hypothesis, a clear picture of these factors is essential. To finalise this, additional statistical tests focusing on overall metaliteracy are conducted and detailed below.

**Table 132**

*Overall Metaliteracy- Socioeconomic status -wise*

| Socio-economic Status | N | Mean | Std. Deviation | F value | *P value* |
|---|---|---|---|---|---|
| Lower | 68 | 3.9070 | .52290 | 4.348 | .013 |
| Middle | 684 | 3.7978 | .43932 | | |
| Upper | 72 | 3.9317 | .45550 | | |
| Total | 824 | 3.8185 | .44994 | | |

Table 132 shows data indicating high metaliteracy levels of students across three distinct socioeconomic groups. Among these groups, students classified under the upper socioeconomic status display a somewhat higher mean score of 3.93; following closely, students from the lower SES exhibit a mean score of 3.90, while those in the middle SES demonstrate a slightly lower mean score of 3.79. The *P value* of .013 is less than the conventional significance level of .05, indicating that these differences are statistically significant. Therefore, the Scheffe test has been done to identify the significant difference between these socio-economic status (SES) groups.

**Table 133**

*Overall Metaliteracy- Socioeconomic status -wise-Scheffe*

| Socio-economic Status | Lower | Middle | Upper |
|---|---|---|---|
| Lower | 1 | .135 | .943 |
| Middle | .135 | 1 | .043 |
| Upper | .943 | .043 | 1 |

It is understood from Table 113 that, when considering the lower SES category with others, The *p value is* .135, greater than the conventional significance level of .05. Therefore, there is no statistically significant difference between metaliteracy scores for individuals in the lower SES and middle SES groups. In contrast, the *p value* is .943, much higher than .05. indicates that there is no statistically significant difference between metaliteracy scores for individuals in the lower SES and upper SES groups and vice versa. Similarly, the pair middle vs. upper class, with a *p value* of .043, which is less than .05, suggests a statistically significant difference between them. Overall, the Scheffe test results indicated that there is a significant difference in metaliteracy scores between the middle SES and upper SES groups. However, there are no significant differences between metaliteracy scores for the lower SES group compared to the middle SES and upper SES groups.

### 4.11 Inter-correlation Analysis of Metaliteracy Factors

This section tests the association or correlation between metaliteracy factors by estimating Pearson's correlation coefficient and linear regression analysis. The Pearson Correlation Coefficient (r) is used to understand the relationships between metaliteracy factors that exhibit varying degrees and directions of correlation, including both positive and negative correlations. The "r" values range from negative to positive, showing either negative or positive relationships. A negative correlation means if one thing goes up, the other goes down, and vice versa. A positive correlation means if one thing goes up, the other goes up too, and if one goes down, the other goes down as well. The grading Table 134 is given below to determine the type of relationship.

**Table 134**

*Correlation Grading Table*

| Grading Standards | Correlation type | Degree of correlation |
|---|---|---|
| 0.90 to 1.00 | Strong Positive or Negative Correlation | Very strong |
| 0.70 to 0.89 | Positive or Negative Correlation | Strong |
| 0.50 to 0.69 | Positive or Negative Correlation | high |
| 0.30 to 0.49 | Positive or Negative Correlation | Weak |
| 0.00 to 0.29 | Little to No Correlation | Very weak or negligible |

Source:(Hinkle et al., 2003)

**Table 135**

*Correlation of Metaliteracy Factors*

| Factors | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lifelong Learner (1) | 1 | | | | | | | | | | | | | |
| Informed Prosumer (2) | .545** | 1 | | | | | | | | | | | | |
| Metalearner (3) | .591** | .633** | 1 | | | | | | | | | | | |
| Collaborator (4) | .556** | .570** | .574** | 1 | | | | | | | | | | |
| Value Oriented (5) | .575** | .504** | .557** | .511** | 1 | | | | | | | | | |
| Active & Critical Evaluator (6) | .489** | .581** | .576** | .380** | .386** | 1 | | | | | | | | |
| Digitally Literate (7) | .374** | .563** | .514** | .488** | .420** | .390** | 1 | | | | | | | |
| Affective (8) | .530** | .435** | .556** | .443** | .477** | .446** | .360** | 1 | | | | | | |
| Ethical & Responsible Engagement (9) | .491** | .607** | .525** | .475** | .418** | .445** | .453** | .401** | 1 | | | | | |
| Metacognition (10) | .426** | .416** | .422** | .374** | .500** | .316** | .334** | .397** | .424** | 1 | | | | |
| Inquisitiveness (11) | .463** | .476** | .548** | .471** | .482** | .375** | .447** | .484** | .375** | .382** | 1 | | | |
| Adaptable (12) | .538** | .570** | .568** | .488** | .535** | .494** | .424** | .485** | .499** | .422** | .459** | 1 | | |
| Metaknowledge (13) | .280** | .268** | .304** | .207** | .268** | .271** | .204** | .218** | .287** | .308** | .179** | .339** | 1 | |
| Diffident (14) | -.036 | -.001 | .007 | -.079* | -.133** | .071* | .006 | .069* | -.023 | -.098** | .012 | -.002 | -.065 | 1 |

** Correlation is significant at the 0.01 level (p ≤0.01) (2-tailed).
* Correlation is significant at the 0.05 level (p ≤0.05)(2-tailed)

Table 135 presents the results of correlation analysis by checking the relationship between metaliteracy factors. The data revealed a high and positive correlation exists between *lifelong learner* and other factors, such as *informed prosumer* (r=0.545). *metalearner* (r=.541), *collaborator* (r=.556), *value-oriented* (r=.575), *affective* (r=.530) and *adaptable* (r=.538). There is a weak positive correlation with *active and critical Evaluator* (.489), *digitally literate* (r=.374), and *ethical and responsible engagement* (r=.491); all these correlations are significant at the 0.01 level of significance—the only negative weak correlation with diffident (r=-.036). The second factor, *informed prosumer*, highly and positively correlates with seven other factors, including *metalearner* (r=0.633), *collaborator* (r=.570), *value-oriented* (r=.504), *active and critical evaluator* (r=.581), *digitally literate* (r=.563), *ethical and responsible engagement* (r=.607) and *adaptable* (r=.570). Two factors such as *metacognition* (r=.416) and *inquisitiveness* (r=.476), have a positive weak correlation when compared to others and a negative weak correlation with the diffident (r=.001) factor.

While considering the *metalearner* factor, it has highly positive correlations with factors like *collaborator*(r=.574), *value-oriented* (r=.557), *active and critical evaluator* (r=.576), *digitally literate* (r=.514), *affective* (r=.556), *ethical and responsible engagement*(r=.525), *inquisitiveness* (r=.548) and *adaptable* (r=.568). The *metacognition* (r=.422) and *metaknowledge* (r=.304) have a weak positive correlation and very weak correlation with the *diffident* (r=.007). The *collaborator* exhibits a high positive correlation with the *value-oriented* factor (r=..511) and weak correlation with rest of the all factors except *diffident* (r= -.079) that shows a negative weak correlation. The correlation of *value oriented* component demonstrate a high positive correlations with *metacognition* (r=.500), and *adaptable* (r=..535) and weak positive correlation with the other factors, the exception of *diffident* (r=-.133), which has a negative weak correlation. When the a*ctive and critical evaluator* (r) assesses, it reveals a weak positive correlation with all other factors. Similarly, this pattern persists when examining the *digital literate* and *affective* factor. With the exception of *diffident* (r=-.023), which has a negative weak correlation, the ethical and responsible encagement has a highly positive correlation with all other components. Likewise, this trend persists when analyzing *metacognition*, *adaptable* and *metaknowledge*. The overall analysis shows that a particularly high positive correlation among the majority of factors. However, the only factor exhibiting a negative weak correlation is diffident, as it aligns negatively with the majority of factors.

### 4.12 Regression Analysis on Factors of Metaliteracy

The metaliteracy competency of students is the sum of a total of fourteen factors. To fulfill the study's significance, it is crucial to examine the relative weightage of each factor in connection to overall metaliteracy. Linear Regression analysis is conducted in this study to determine the impact of the factors associated with metaliteracy. Using the R2 value, the fourteen factors are ranked according to their relative importance. Multiplying the R2 value by one hundred provides the contribution percentage, while the *p value* indicates the significance of the influence and contribution. This approach allows for the identification of stronger and weaker factors based on their contribution percentage. Table 136 presents the ranking of the 14 factors based on their impact and contribution to the overall metaliteracy score.

**Table 136**

*Ranking of Metaliteracy Factors*

| Model Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Metaliteracy Factor | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | |
| | | | | | R Square Change | F Change | p value |
| Lifelong Learner | .723[a] | 0.522 | 0.522 | 0.31114 | 0.522 | 899.068 | .000 |
| Informed Prosumer | .779[a] | 0.607 | 0.606 | 0.28233 | 0.607 | 1268.244 | .000 |
| Metalearner | .799[a] | 0.638 | 0.638 | 0.27081 | 0.638 | 1449.894 | .000 |
| Collaborator | .702[a] | 0.492 | 0.492 | 0.32075 | 0.492 | 797.52 | .000 |
| Value-oriented | .691[a] | 0.478 | 0.477 | 0.32526 | 0.478 | 752.926 | .000 |
| Active and Critical Evaluator | .676[a] | 0.457 | 0.456 | 0.33188 | 0.457 | 690.662 | .000 |
| Digital Literate | .660[a] | 0.436 | 0.435 | 0.33824 | 0.436 | 634.36 | .000 |
| Affective | .683[a] | 0.466 | 0.466 | 0.32886 | 0.466 | 718.624 | .000 |
| Ethical and Responsible | .691[a] | 0.478 | 0.477 | 0.32537 | 0.478 | 751.864 | .000 |
| Metacognition | .602[a] | 0.362 | 0.361 | 0.35958 | 0.362 | 466.642 | .000 |
| Inquisitiveness | .675[a] | 0.456 | 0.455 | 0.3321 | 0.456 | 688.687 | .000 |
| Adaptable | .735[a] | 0.54 | 0.539 | 0.30551 | 0.54 | 963.084 | .000 |
| Metaknowledge | .452[a] | 0.204 | 0.203 | 0.40164 | 0.204 | 210.844 | .000 |
| Diffident | .174[a] | 0.03 | 0.029 | 0.44335 | 0.03 | 25.642 | .000 |

Table 136 depicts all the metaliteracy factors, highlighting that the *metalearner* factor has the most influential and largest contributing factor of metaliteracy with R2 being 0.638 (63.8%). The *p value* of .000 indicates that the contribution of 63.8% is significant. The existing 63.8% need further improvement because metalearning plays a vital role in student development and academic achievement, and educators must actively teach such learning strategies for the metaleraning as it is important for students to think about their learning, solve problems, and use what they learn in real life (Colthorpe et al., 2018). In shaping students' metaliteracy, *informed prosumers* contributed as the second most substantial factor. The R2 stands at 0.607 (60.7%) with a highly significant *p value* of .000, reaching statistical significance at the 1% level. Those possessing this competency exhibit the qualities of being well-informed consumers and actively engaged producers of information. *Adaptability* is a key asset in a person's life, the third contributing factor of metaliteracy, with an R2 of 0.54. The *p value* of .000 is significant at a one percent level. So, the contribution of 54% is significant. adaptable students can navigate diverse information landscapes and adjust their learning strategies to various subjects and teaching styles in the ever-changing world (du Plessis et al., 2024). By adding 52.2% of the contribution, *lifelong learners* act as the fourth contributing factor of metaliteracy with an R2 value of 0.522. Lifelong learning emphasizes the value of continuous and self-directed learning throughout life. students can explore self-learning through libraries, which often host educational programs, workshops, and events that facilitate continuous learning, encouraging students to explore new topics and acquire new skills (Abou Said & Abdallah, 2024). The fifth contributing factor is *collaboration*, which promotes teamwork among students. It influences 49.2% of total metaliteracy with an $R^2$ value of 0.492. The collaborative work helps to be a part of diverse groups and share areas and collaborative problem-solving. Team-building activities strengthen interpersonal relationships and contribute to positive and inclusive collaborative work through the sharing of ideas and collaborative problem-solving**.**

The *value-oriented* factor is the sixth position that holds a substantial position of contribution (47.8%) among the factors under consideration. The R2 value is 0.478, and the *p value* is .000, significant at the 1% threshold. Students with a value-oriented approach exhibit ethical behavior, empathy, and a sense of responsibility in the community. The seventh factor is ethical and responsible, which shows evidence of a similar contribution of a value-oriented factor with an $R^2$ value of 0.478 and a *p value* of .000. Engaging with intellectual property ethically and responsibly is a fundamental aspect of academic and professional conduct. It involves citing sources, avoiding plagiarism, fair use, respecting the rights of creators, and ensuring compliance with copyright laws. Libraries play an integral role in educating students and creating awareness through various programs. The *affective* factor demonstrates a 46.6% impact, with an $R^2$ of 0.466, ranked as the eighth factor with a *p value* of .000. Affective is one of the domains of metaliteracy, highlighting the importance of affective aspects, such as emotions and attitudes in the learning process. It focuses on students' emotional intelligence and self-awareness by effectively understanding and managing their emotions. Promote empathy and the ability to navigate social relationships.

The *active and critical evaluator* factor is ranked due to its 45.7% impact, has an R2 of 0.457, and a *p value* of .000. The students are metaliterate learners who evaluate information critically by determining the authority, relevancy, accuracy, and validity of each source regardless of the information's delivery method. The tenth factor is *inquisitiveness*, with an R2 value of 0.456 and a 45.6% contribution to the overall metaliteracy. It exhibits statistical significance since the *p value* is .000. It helps students to create curiosity and a desire to explore new ideas or things. Inculcate inquisitiveness in students and enhance their ability to navigate, evaluate, and gain a deeper understanding of diverse perspectives in the dynamic world of information. *Digital literacy* contributed 43.6% and ranked as the eleventh factor with an R2 of 0.436 and a *p value* of .000. In an era where information is predominantly accessed and disseminated online, digital literacy equips IIT students with the skills to critically evaluate, utilize, and create digital content. *Metacognition* played a significant role in metaliteracy, showing 36.2% contribution and ranking twelfth in influence. An R2 value of 0.362 and a *p value* of .000 underscore the statistical significance at the one percent level. *Metacognition* empowers students to understand and control their own thinking processes. So, students can strategically approach tasks, monitor their progress, and adjust their strategies when faced with challenges.

The outcome of the regression analysis indicates that among the 14 factors of metaliteracy, *metalearner* stands out as the most influential and contributing competency. Consequently, it holds the position of the most vital competency within Metaliteracy. It suggests that students from the IITs exhibit stronger metalearner skills than other competencies. Among the 14 factors of metaliteracy, the least influential competency is *diffident,* ranking last in terms of influence. The low score indicates high levels of metaliteracy, and the rest of all the factors contribute significantly.

**Study III: Qualitative Analysis**

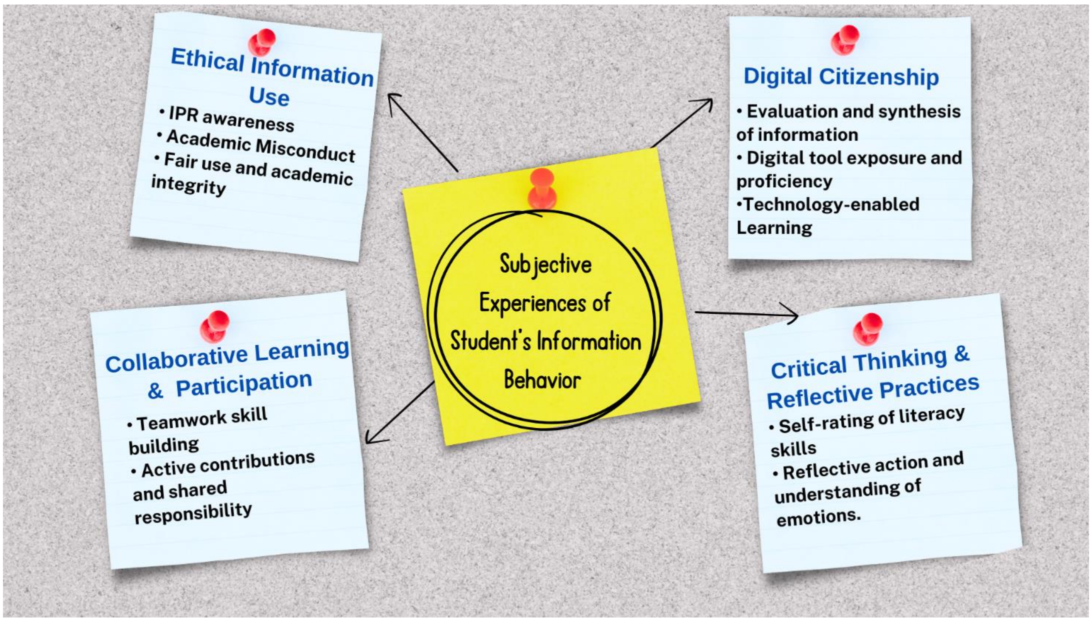
The qualitative data set consists of students' subjective experiences concerning multiple literacy thoughts. Subjective experiences are unique to an individual and offer personal feelings, perceptions, and interpretations influenced by cultural, social, and psychological factors. In an interview, subjective experiences can provide valuable insights into an individual's thoughts, emotions, and motivation (Petitmengin, 2006). In this study, the qualitative data collected through WhatsApp interviews underwent multiple rounds of analysis. With participants' consent, text and audio clip responses were stored on the mobile device during the interview. Following this, all interviews were transcribed using the *'Transcriber for WhatsApp*' application. After that, all interview transcripts were extracted into an Excel sheet for qualitative analysis.

The qualitative datasets were analyzed and reported based on Braun and Clarke's six-phase thematic analysis procedure. The first phase is to familiarize the data set through multiple readings to understand it comprehensively. While reading the transcript, the researcher highlighted key phrases, quotes, and terms in each participant's response. Then, the highlighted terms of all participants' transcripts are grouped and written using the *'One Sheet Of Paper'* (OSOP) technique (Ziebland & McPherson, 2006). This activity helped organize participant responses into logical groups and topics. Then, initial codes were generated based on the sixteen participants' recurring responses, thought patterns, terms, and opinions. The next step is combining codes into themes by grouping related codes to identify overarching themes. Once all the themes are identified, they must be reviewed to check their coherence and relevance.

Finally, assessed the importance or prevalence of each theme within the dataset and determine the significance of themes and subthemes. A total of four main themes were identified in this study. The findings were reported based on the deductive method of analysis, in which pre-determined codes and ideas were found from the existing theoretical knowledge and linked to insights from this dataset (Braun & Clarke, 2021). Analyzing this rich transcript data gave valuable insights into the various thematic dimensions. Participants were given pseudonyms following ethical guidelines. The five main themes and sub-themes listed below are presented in detail.

**Figure 22**

*Central themes and Subthemes*

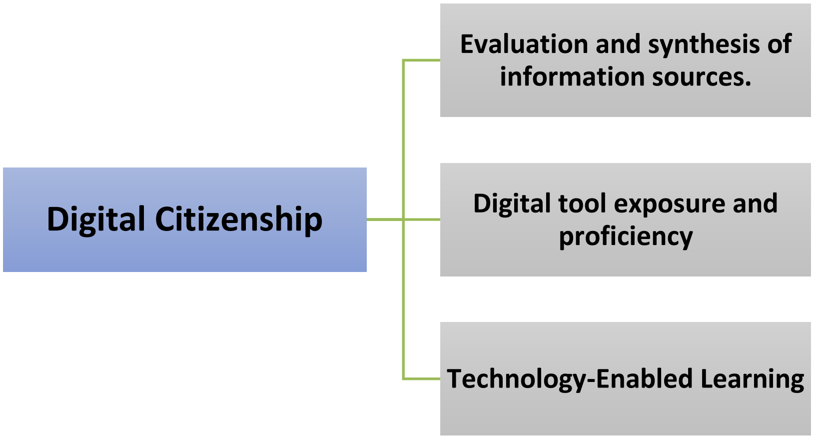


**Theme 1: Digital Citizenship**

The main theme unravels the practices and behavior concerned with digital technology. During the interview, the participants shared their understanding of different types of literacies in the digital age. The questions mainly revolved around digital, media, technological, and metaliteracy, and the responses received aligned with them. All participants acknowledged that multiple literacies are required for different contexts. Below are the sub-themes that emerged from the interview.

**Figure 23**

*Theme 1 and subthemes.*




**1.1 Evaluation and synthesis of information sources.**

Some questions are related to checking whether the students can evaluate the credibility and reliability of information sources. One question was asked to determine whether the students were able to differentiate between information and knowledge. Most of the students provided varied perspectives on the distinction between information and knowledge. Aman from IITH, says that "*Information for me I guess it's statistical data. Just about something, some topic you want to know something about the single term or a sentence, phrase maybe, or a topic you can say but knowledge it's all about the discourse whatever you learnt in your life*." Here, information was generally described as factual data or raw material, knowledge was seen as the meaningful interpretation and application of this information in different contexts. On other hand, Nithin from IITPKD, mention that *Information refers to facts and raw data, while knowledge involves contextual understanding and can be influenced by political and ideological factors. Information is like raw material, while knowledge is a meaningful amalgamation of various pieces of information, including debates, questions, arguments, and propositions*". Participants emphasized that knowledge goes beyond mere facts, incorporating understanding, experience, and practical application. They highlighted the importance of evaluation and interpretation in transforming information into knowledge and the role of personal experiences and external sources in shaping one's knowledge base. Overall, the consensus was that while information provides the foundation, knowledge is the deeper understanding and utilization of that information in real-world situations.

Furthermore, students recognize the importance of reliable sources and critical evaluation in distinguishing between trustworthy information and misinformation. Mr. Navaneeth from IITTP said: *"I think it is the ability to look critically at any information and understand its credibility... ability to logically reason/question it and make conclusions"[sic]*. This indicates a critical approach to information gathering, where the individual seeks to validate the credibility of sources by cross-referencing them with firsthand knowledge or evidence. Students also engage in the process of verifying the sources of information by comparing them with their own observations or personal experiences. Shri from IITM stated, *"Usually, I check sources of information and compare it with what I've seen*." It makes a conscious effort to ensure the accuracy and reliability of the information sources accessed or utilized. Students' advanced understanding of the concepts of information and knowledge and their proactive approach to evaluating and verifying information sources. Overall, this underscores the students' discerning approach to information literacy-related concepts, which are essential for navigating the complexities of the digital age.

### 1.2 Digital tool exposure and proficiency.

Many of the participants got their digital devices during adolescence, an age range of 10-14, which could include mobile phones, tablets, and desktop computers. Indicates the student's experience with digital gadgets at an early age, influencing their familiarity with technology. Mr. Kamal from IITDH, states, "*I got my first digital gadget at the age of 11 in the year 2006. Having been exposed to computers at an early age, learning and using them was very much self-explanatory."* The early access to digital devices can shape an individual's relationship with technology and enhance their proficiency in utilizing digital tools. Additionally, Aparna from IITM further emphasizes, "*I am comfortable with many different kinds of digital devices and internet platform even while using a new device, I am able to learn quickly and easily."* It indicates a high level of proficiency in navigating digital tools. These insights underscore the importance of early exposure to digital technology in shaping individuals' digital literacy skills and proficiency in utilizing digital tools effectively.

Regarding their self-assessment of digital literacy, students provided an average rating of 7.2 out of 10. This rating reflects a high level of proficiency. However, it's notable that participants attributed their scores due to unfamiliarity with newer technologies. Uma from IITH , revealed that "*Many of the things like AI and VR and all upcoming digital gadgets, I don't know IoT and Blockchain, cryptocurrency lot of things coming into the digital world which unknown to me'.* Similarly, Kiran from IITPKD responded "*I feel I can handle the gadget in a decent way, but there are some features I am yet to explore. I think I know something, and if needed, I can learn further and do things on my own in the digital world"[sic].* Despite having a high to high level of proficiency, few students feel comfortable using the technology because of its self-explaining features. For example, Isha, an IITH student, says,' *I think I have been using digital platforms for a long time now. Moreover, there is another advantage in digital platforms: the description of any button or box is generally explained beside it or can be seen by hovering over it. So according to me, it's easy to understand [sic].* Students recognising the need for further exploration and learning, their ability to navigate and understand digital platforms highlights the adaptability and resilience of today's digital natives in the face of evolving technological trends.

### 1.3 Technology-Enabled Learning

Employing new technology yields a positive outcome, empowering students to actively engage in the learning process through digital tools and improving the overall educational landscape. Students rely on digital materials for their study rather than textbooks. Mr. Navaneeth at IITPKD, says that *"We don't have any books in BTech to get additional information about anything; we use different YouTube and Google to get it".* Hence, new digital technologies are changing learning, making education inexpensive and easier to access. Similarly, Jinan from IITTP shared the thought that "My project is software based and for research, I use the internet rather than books. Classes on YouTube are better than actual offline classes. I get a better edge, *and I can save time".* Students depend on Online classes offer advantages such as any-time accessibility, efficiency, and time saving, providing a competitive advantage in studies. Thus, the digital revolution in education will improve learning and make it more sustainable.

When it comes to adaptability across different online platforms, most of the students agree that digital platforms are more user-friendly interfaces for the translation and deeper understanding of the concepts. Mr. Abhilash conveys that "*Most of the time, different platforms and website tools to translate different things, to acquire knowledge from the web or Wikipedia, not only from these. both qualitative and quantitative data, in that sense, so I use technology for studies".* Students exhibit their proficiency in translating information from diverse sources and effectively utilizing both quantitative and qualitative data from various platforms This shows their adaptability across multiple platforms, highlighting a metaliterate behavior.

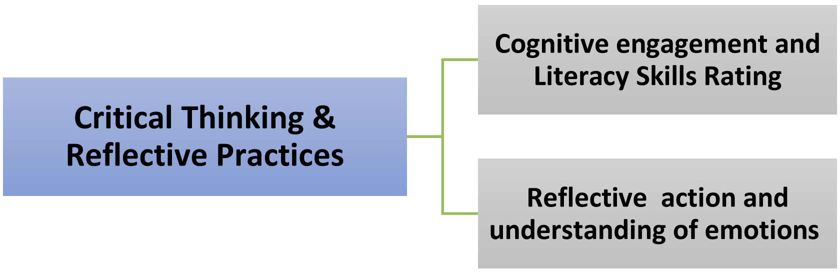
An IITH student, Aparna's comment emphasizes that other than adaptability, students used to share information in various formats for different audiences. She said that "*use of different formats like illustrations, graphics, audio, etc. enhance the information exchange process and help in better conveying of ideas."* The use of diverse formats in information exchange helps to communicate to different audiences globally. Digital media is preferred by the majority of students. As indicated from Ardra's statement, "Using sharing mediums/apps for document sharing and storage. Using webcam/tablet for making notes or writing instead of books," revealed that many of the students prefer the digital method over traditional pen and paper. This underscores the dependence on digital tools for enhancing learning experiences.

**Theme 2: Critical Thinking and Reflective Practices**

Theme 2 narrates the rating of metaliteracy skills and cognitive engagement in the learning environment. Also, discuss the reflective action and emotional intelligence-related experience of students.

**Figure 24**

*Theme 2 and Subthemes*




**2.1 Cognitive Engagement and Literacy Skills Rating**

This theme of evaluation of literacy skills consists of a diverse range of perspectives and challenges faced by students in their academic lives. Urbee from IITH expresses that "*When it comes to reading, writing and critical thinking, I think I am totally fine*". She has confidence in hes reading, writing, and critical thinking abilities, suggesting a level of proficiency in these areas. However, Nithin from IITPKD highlights that "*I think I need to work on my attention span and* *concentration a bit*." He emphasizes the need for self-cognitive attention by indicating a deeper level of cognitive engagement.

On the other hand, Navaneeth from IITTP underscores that "*different people have different mentalities and different ways of learning and different ways of approach*." He understands the variability in cognitive processes among individuals, acknowledging that different people possess distinct mentalities and approaches to learning. This recognition of diversity implies that strategies for evaluating cognitive processes may vary depending on individual preferences and strengths. Similarly, Isha from IITH expressed that *'I think it is the ability to look critically at any information and understand its credibility... ability to logically reason/question it and make conclusions*". She admits feeling overwhelmed at times when attempting to discern the relevance of content to her studies. This sentiment underscores the importance of developing effective cognitive strategies to filter and prioritize information efficiently. Assessing cognitive processes means understanding one strengths and weaknesses, acknowledging that everyone learns differently, and using smart strategies to improve how the mind works.

When it comes to literacy awareness, especially the concept of 'metaliteracy'. A few students were already familiar with this term as part of their studies. However, not all participants were familiar with it. The majority of students expressed a lack of awareness about metaliteracy and never heard of the term too. For example, Lathika from IITM says, "*To be honest, I haven't heard this word before. I don't know what it means.".* Certain students suggest that it is something more than literacy and related to that. For that, Aradhya from from IITPKD made a guess that *"Don't know, Knowledge about literacy."*

A few students have uncertainty about the exact definition of metaliteracy but suggests that it may involve the ability to understand knowledge systems both online and offline, including awareness of their sources. An IITM student Aparna stated that *"Literacy tells us whether a person knows certain things. Metaliteracy, on the other hand, also takes into account the process of learning, how it impacts the individual, putting learning into action, and evolving in the process."*

On the other hand, interpreting that it is a kind of knowledge acquisition that extends beyond conventional written sources like books. For instance, Karthik from IITPKD comment that, *Metaliteracy includes knowledge obtained from sources other than written stuff, like books. It may include knowledge from nature, communication skills, good mentality, and helpfulness."* A couple of students suggests that it might mean being able to understand information from both online and offline sources, including where the information comes from. Shari from IITM expresses that *"I don't know the exact definition of the term, but I'm assuming it might be the ability to comprehend knowledge systems both online and offline, the sources of it".*

Some among them believed that an understanding of something more when compared to traditional literacy skills. This suggests that individuals with this level of understanding are capable of not only reading and writing proficiently but also comprehending, analysing, and applying knowledge in various contexts. Like IITM student, *Aparna's statement "Literacy tells us whether a person knows certain things. Metaliteracy, on the other hand, also takes into account the process of learning, how it impacts the individual, putting learning into action, and evolving in the process.* She explains that literacy primarily assesses whether a person possesses knowledge about certain things. However, metaliteracy goes beyond this by considering the process of learning itself. Very few students learned the concept of metaliteracy during undergraduate studies. Specifically, Mr. Abhilash from IITH told that *"Oh, okay. So, the first time I heard about this term metaliteracy was in my Undergraduate because I am a Delhi university graduate in journalism. That time, second semester I guess, when the professor talked about that the sharing of information and communication to communicate with others or share information within web and social media, blogs, sharing and creating information via different methods maybe I am wrong.".* These perspectives underscore the multifaceted nature of metaliteracy, emphasizing its broader scope beyond traditional literacy and its importance in navigating the complexities of the digital age.

### 2.2 Reflective action and understanding of emotions.

Many students shared their experiences of reflective actions and emotional awareness. IITPKD student Aradhya's statement reflects the importance of self-awareness and continuous learning while asking the question that how to motivate oneself: "*I don't have an exact answer for it. I look back and look forward and keep on working. I can't learn quickly, but I will learn in a continuous manner. So, keep updating myself.*" By accepting her limitations and committing to continuous learning, she shows self-awareness and takes reflective action accordingly.

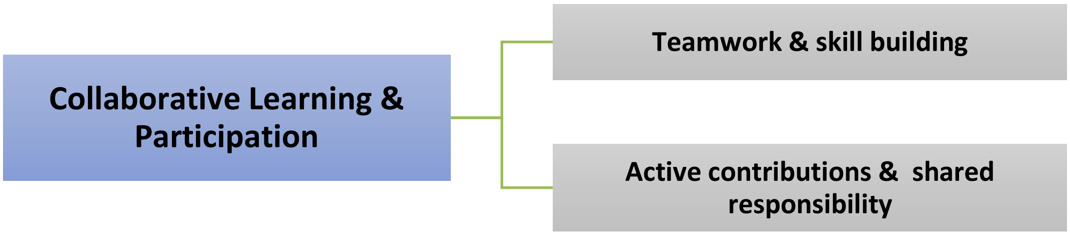
An IITM student, Koushik’s reflection on motivation and self-reflection highlights the importance of introspection in driving personal growth: "*Just the thought that if I won't continue to improve, I won't grow or make any progress. sometimes I just sit alone and think about myself in order to push myself to get something done*.[sic]" The reflective self-thought helps to understand the inner feelings and emotions to formulate strategies for self-improvement. Nitish from IITPKD emphasizes the emotional satisfaction derived from the learning process itself rather than focusing solely on outcomes: "*The process of learning is itself my reward. I am not that bothered about results.*" Isha’s (IITH student) perspective underscores the intrinsic motivation derived from self-improvement: "*The happiness or satisfaction that one gets on realizing that one's doing a little better than before is a lot of motivation! Happens automatically I think[sic]*."In total, these quotes show how reflecting on actions and understanding emotions are important for both personal and academic success because they foster self-awareness, emotional regulation, motivation, and positive relationships.

### Theme 3: Collaborative Learning and Participation

Collaborative learning is when students team up to reach a common goal. It encourages students to actively participate, communicate, and develop problem-solving skills. It fosters a culture where students share ideas and learn from each other's experiences and viewpoints. The interview results show that all the participants are often involved in collaborative work as part of the studies. Below are the sub-themes provided in detail, drawn from the participants' experiences.

**Figure 25**

*Theme 3 and Subthemes*




### 3.1 Teamwork & skill building

Students show a positive approach toward teamwork and peer learning. Abhilash from IITH says *"Peer learning is the great thing I have ever experienced in my life. Class teaching is just a myth.".* He implies that students highly value peer learning and see it as promoting collaborative and interactive learning environments. Similarly, Aradhya IITPKD also supports it by saying that *"Learning is easier when we discuss and do things in a group. Faster and innovative too."* It shows the effectiveness of group discussions and collaborative activities in learning process. On the Other hand, Mr. Nithin from IITPKDopined that the teamwork could save the time and effort by saying *"Oh always save time and effort if you have collaborators in learning. Its mutual give and take.*

Also, mutual exchange in collaborative learning suggests that it facilitates a give-and-take dynamic that enhances the overall learning experience. At the same time, enhancing skills through teamwork also accelerates the learning process. Mr. Abhilash from IITH stated that "*In collaborative settings for the development of existing skills and knowledge, I totally rely on my co-fellows, as well as books, and whatever internet data and facilities are available for discourse available in different websites for that particular topic. But more of that I totally rely on peer* *learning*". Aparna’s I(ITM-student) statement "*I utilise my strengths in a collaborative setting by contributing more on that side and it helps me improve on my existing stills*." By leveraging their strengths and actively contributing to group efforts, students can enhance their existing skills while also learning from their peers.

### 3.2 Active contributions and shared responsibility

Further, importance of active involvement and need to approach others' viewpoints with a positive mindset. Mr.Abhilash asserts that "*So actually whenever we collaborate with others, any organizers and any focused group or any participant, then we contribute our previous knowledge on that topic compulsorily of What we learned in a till date of that particular discourse And also try to positively understand what others point of view."* It emphasizes the individual contribution in the collaborative work. Active participation and shared responsibility in collaborative settings, where individuals are expected to contribute their expertise while also valuing and understanding the contributions of others. According to Student's view, the relationship between teamwork, peer learning, and individual skill development are explained.

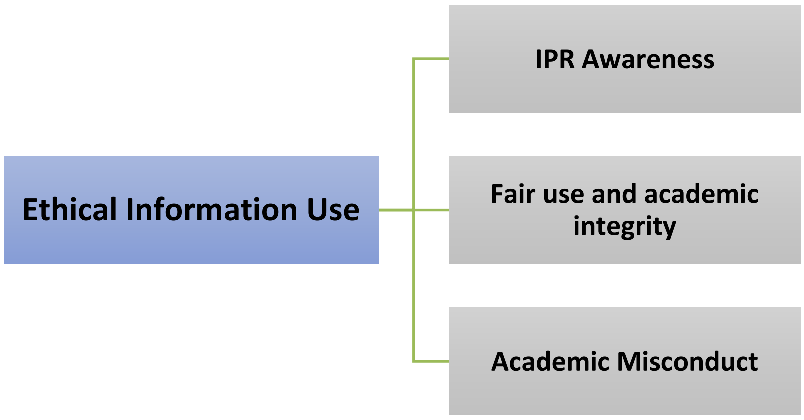
Some of the students observed the division of tasks and the opportunity to gain a broader perspective on the topic in collaboration. As IITPKD student, Karthik, replied that *"It has also been helpful as division of task makes the overall project easier. Like if people from different domains are collaborating it makes the overall project easier, as we don't need to have knowledge from other domains."* When individuals collaborate with others, this exposure to different viewpoints broadens their understanding of the topic. Aparna from IITM emphasizes this, saying that *"collaborating with others gives me a broader perspective on the topic and helps me learn a lot more than I could on my own. It has always been a positive experience for me".* Student perspectives highlight the multifaceted benefits of teamwork, peer learning, and individual skill development within collaborative settings for an enriching learning experience.

**Theme 4: Ethical Information Use**

Theme 3 explains that ethical behavior in handling information encompasses respecting intellectual property rights, giving proper credit to sources, and avoiding plagiarism. Upholding ethical standards fosters trust among users, promotes academic integrity, and safeguards against the spread of misinformation.

**Figure 26**

*Theme 4 and Subthemes*




Students shared their various viewpoints on the ethical use of information. Many students rely on Google to get the information, but they encounter difficulty due to the vast amount available, making it challenging to find what's relevant. Isha from IITH stated that "*I guess simple Google search will get all the information, but sometimes it is difficult the get needed [sic]*.". It was noted that a significant number of students depend on Google as their primary source for obtaining information. Nitin from IITPKD gave a statement that "First, I gather all information I need to it, *then I will start studying and understand if. If I have doubt, I will use Google to clarify it*".

**4.1 Intellectual Property Rights Awareness**

Students are aware of intellectual property rights (IPR). However, despite this awareness, they often use copyrighted materials from different websites as access is free and convenient. An IITH student, Abhilash's statement, "*Well, then, I would say, personally, I know that it is not good to use the electronic books* *available on the internet, but sometimes I store it for easy reading*," agreed that students were tempted to use digital course materials they find online for easier reading. Even though they know it's not right, sometimes gives convenience. They often find it hard to balance easy access to digital stuff with respecting the rights of creators.

On the other hand, an IITH student, Isha, revealed that even though some study materials are freely available on the internet, his professor insists students not use such materials, approaching the library to go for the subscription. It shows teachers inculcating the habit of the ethical use of information. Additionally, libraries are playing a proactive role by organizing awareness workshops on intellectual property rights, emphasizing the importance of ethical information utilization among students.

### 4.2 Fair use and academic integrity

The impact of new media technology has changed students' learning and information behavior in everyday life (Pfannenstiel, 2010). The ready availability of information at one's fingertips has increased usage but has also reduced the significance of maintaining academic integrity. Jinan, a student from IITTP, expressed concerns about the prevalence of plagiarism in assignments, emphasizing the importance of proper citation when incorporating others' work into her own by stating that "*I am worried about the plagiarised content in my assignment, so usually I try to use proper citation if I take anything from other's work."* Most of the students are familiar with fair use and the importance of acknowledging the proper credit if taking the ideas of others. Uma from IITH revealed that "*As research scholar, I know how to write an article honestly and always give the credit all*". This statement highlights the honest way of writing and respect for peers in collaborative work . The conversations focus on fair use and academic integrity in the academic community, pointing out the importance of continuing education and upholding ethical standards in Scholarly activities.

### 4.3 Academic Misconduct

Academic misconduct, a serious concern in educational institutions worldwide, encompasses a range of unethical behaviors that violate the principles of academic integrity. One fundamental aspect of academic misconduct is plagiarism, which involves the unauthorized use or appropriation of someone else's work without proper citation (Christensen Hughes & Eaton, 2022). Aparna from IITM expressed that "*When I write papers now, I used to give the citations. when I attended an author workshop, then I got know the importance of acknowledgment*."

This statement underscores the significance of academic workshops and educational initiatives in raising awareness about academic misconduct. By participating in such workshops, students gain insights into the ethical considerations surrounding citation and acknowledgment of sources. Most students know about the citation software and the importance of upholding ethical standards in their academic works. Additionally, libraries in this institution usually conduct training programs and workshops for awareness of research ethics.

### Conclusion

The triangulation of quantitative and qualitative data provides a comprehensive understanding of metaliteracy levels among IIT students across different demographics. Quantitatively, the analysis using descriptive statistics, ANOVA, and t-tests reveals high mean scores across various metaliteracy factors, such as lifelong learning, informed prosumer skills, metalearner skills, and collaboration, with no significant differences observed across age groups, genders, or departments. This suggests a consistently high level of metaliteracy skills across the student population. Specifically, the quantitative data indicates that mean scores for lifelong learning and informed prosumer skills are particularly high across all IITs, with no significant differences among institutions ($p > 0.05$), highlighting the uniformity in metaliteracy among students.

Qualitative themes support these findings by providing deeper insights into students' experiences and perceptions. The thematic analysis revealed that students place a strong emphasis on lifelong learning, digital citizenship, critical thinking, and collaborative practices. For instance, students consistently highlighted the importance of continuous learning and the ability to critically evaluate information, which aligns with the high quantitative scores for these factors. Themes such as ethical and responsible engagement, metacognition, and adaptability were also prominent, reflecting students' awareness and strategic approaches to learning and information use.

In summary, the alignment between quantitative and qualitative data confirms that IIT students possess robust metaliteracy skills, which are uniformly distributed across different demographics. The high levels of engagement in lifelong learning, digital literacy, and critical thinking underscore the effectiveness of the educational strategies employed by IITs in fostering these essential competencies. The consistency of these findings across both data sets demonstrates the comprehensive nature of metaliteracy education at IITs, ensuring that students are well-equipped to navigate the complexities of the digital age.

However, the study also identifies a lack of awareness regarding academic misconduct, ethical information use, and a deficiency in specific metaliteracy instructional training. While information literacy instruction is commonly provided, it may not adequately prepare students to navigate the complexities of the digital information landscape or fulfill the evolving roles of digital citizens. Consequently, the study advocates for enhanced awareness training in libraries tailored to address these challenges effectively. This targeted training can help students better understand ethical considerations, improve their research skills, and become more adept at using information responsibly and effectively.

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# CHAPTER V

# FINDINGS, SUGGESTIONS AND CONCLUSION



*This chapter summarizes the study's major findings, discusses the tenability of the hypotheses, and offers recommendations for metaliteracy-oriented education based on student responses and data analysis. It also outlines the implications, suggestions, scope for future research and provides a clear conclusion.*

*Haseena.V.K.K.M. "Metaliteracy among the Students of IITs in South India" Thesis. University of Calicut,2024*

## 5.1 Introduction

This study is a purposeful inquiry to assess the metaliteracy among the students of IITs in South India. This study has been guided by three main research questions: developing a reliable and valid metaliteracy scale, quantitative assessment of metaliteracy, and exploring students' strategies and information behaviors in the digital age through qualitative methods. Following the data analysis, this section consolidates the major findings of the study in relation to each research question. The formulated hypotheses are tested, and the implications are also presented. Additionally, this section provides suggestions and recommendations for enhancing students' metaliterary in a digital environment and highlights areas for further research.

## 5.2 Major Findings of the Study

### 5.1.1 Study I: Development of Metaliteracy Scale

1. The Metaliteracy Scale (MS) is designed following the Boateng et al. (2018) model, which intends to assess students' metaliteracy and is designed within the context of the Indian educational system.

2. The Metaliteracy Scale (MS) exhibits high reliability and strong internal consistency with its sub-factors.

3. The MS scale exhibits notable face and content validity, as it was evaluated by the metaliterary developers Thomas Mackey and Trudi Jacobson and other subject experts at national and international levels.

4. The final version of the MS scale comprises 56 items in English, with fourteen factors identified through exploratory factor analysis (EFA) and carried out confirmatory factor analysis (CFA) to understand the structure and validate the scale's content.

### 5.1.2 Study II: Assessment of students' metaliteracy

Based on the study objectives, hypotheses, and data analysis, the following major findings of the quantitative study are presented through a series of fourteen factors of metaliteracy, and its classificatory variables are given below.

**Institution-wise Analysis**

5. Lifelong learning skills exist consistently at a high level among the students across the selected five IITs in South India, with no significant difference in lifelong learning among them.

6. The selected five IITs exhibit a high level of informed prosumer skills, and there is a lack of significant difference between them.

7. Students' metalearner skills are generally at a high level across all institutions, except for IITDH, which demonstrates a notably higher proficiency, and there is no significant association between the metalearner competency and institutions.

8. The five selected IITs demonstrate high proficiency in collaboration and reveal that the difference in collaboration among students from various institutions lacks statistical significance.

9. There is a high level of value-oriented activities among students across the five IITs, and there is a lack of difference among these IITs in handling ethical principles, integrity, and responsible information use in digital and information environments.

10. IIT students engage in a high level of proactive engagement in information handling while applying critical thinking skills to assess, analyze, and make informed judgments. There is no significant association between active and critical evaluator skills among the institutes.

11. The student's digital literacy level is high, and there is a lack of statistically significant differences between these institutes and digital literacy.

12. The students possess a high to very high affective aspect across five IITs, with IITTP having the highest, followed by other IITs, and there is no significant difference between the affective domain of metaliteracy of students across the five institutions.

13. A high level of ethical and responsible engagement of information by the students of five IITs in South India in which IITDH and IITH have equal levels, followed by the remaining ones, and the differences are not statistically significant.

14. The students' metacognitive aspect is highly consistent across all institutes, suggesting that there isn't a significant association between metacognition and all institutes under consideration.

15. The IIT students show a high level of inquisitiveness across the institutions, and there might not be a statistically significant difference among them.

16. All selected IITs show a high level of adaptability among the students across various platforms and indicate a lack of significant difference among these institutes and adaptability.

17. The students' metaknowledge has shown a variation from higher to a high level, in which both IITDH and IITTP showed higher, and the rest of the institutions followed them, and there is no statistical significance in terms of metaknowledge among these institutions.

18. A low level of diffidence is seen among students, which signifies a high level of metaliteracy, and there is no significant difference among these five institutes concerning the diffidence levels of students.

19. There is a high level of metaliteracy among the five IITs, and minimal variance of metaliteracy level exists among them, and there is no significant difference in the total metaliteracy level across these selected institutes.

**Department-wise Analysis**

20. Lifelong learning skills are consistently high among students across all three departments. While the sciences show slightly higher compared to the Engineering & Technology, and Social Science categories, the differences are not statistically significant.

21. Students from the three departments exhibit a high level of informed prosumer skills, with no significant differences observed between them.

22. All three departments exhibit exceptionally high metalearner skills, with students in the Humanities and Social Sciences departments showing slightly higher levels than those in the Engineering & Technology and Science departments. There is no significant association between metalearner competency and departments

23. The students from three departments demonstrate high proficiency in collaboration, with no statistically significant differences in collaboration skills between various departments.

24. There is a high level of value-oriented activities among students across the three departments, with no significant differences among them.

25. All three departments exhibit exceptionally high active and critical evaluation skills, with students in the Humanities and Social Sciences departments showing slightly higher levels than those in the Engineering & Technology and Science departments. There is no significant association between active and critical evaluation skills and departments.

26. The three departments demonstrate high proficiency in digital literacy competency, with no statistically significant differences in digital literacy among students from these departments.

27. Students possess high to very high affective skills across three departments, with Science and Humanities & Social Science having the highest levels,

followed by Engineering and Technology. There is no significant difference in the affective domain of metaliteracy among students and departments.

28. All three departments demonstrate a high level of ethical and responsible engagement with information, with slightly higher levels among students from the Humanities and Social Sciences compared to the other two departments. However, the Scheffe test reveals a statistically significant difference between the Engineering & Technology and Humanities & Social Sciences departments.

29. The students' metacognitive skills are highly consistent across all departments, indicating no significant association between metacognition and departments.

30. The IIT students display a high level of inquisitiveness across three departments, with no statistically significant differences observed among them.

31. Students possess high to very high adaptable skills across the three departments, with Humanities & Social Science having the highest levels. However, Scheffe test showed that there is a significant difference in the affective domain of metaliteracy among students and departments.

32. Student's metaknowledge is high among students in the Science and Humanities & Social Science and high in Engineering & Technology department, with no statistically significant differences among them.

33. A low level of diffidence is observed among students from three departments, indicating a high level of metaliteracy. There are significant differences in the difference between Engineering & Technology and Humanities & Social Science departments.

34. Student's metaliteracy levels are high across the three departments, with statistically significant differences observed among the departments, and the

Scheffe test reveals that the difference exists between Humanities & Social Science and Engineering & Technology departments.

**Course -wise Analysis**

35. Students across all courses consistently demonstrate high lifelong learning skills, with a significant difference observed among the three courses of study. The Scheffé test revealed that this difference exists between two pairs, undergraduate and postgraduate students, as well as undergraduate and Ph.D. scholars, in terms of lifelong learning skills.

36. Students across the courses exhibit high levels of informed prosumer skills, but there are significant differences between course levels. The post-hoc test highlighted these differences specifically between undergraduate and postgraduate, undergraduate and PhD, and postgraduate and PhD levels.

37. Students at the IITs demonstrate high to very high metalearner competency across all three course levels, with Ph.D. students showing the highest levels. However, the Scheffe test results indicate a significant difference in metalearner skills between course levels, particularly between undergraduate and Ph.D. students.

38. High levels of collaborative skills are present among students from all three courses, such as UG, PG, and Ph.D. with significant differences observed between them. Specifically, notable differences are seen between pairs, such as undergraduate vs. postgraduate and undergraduate vs. Ph.D. scholars.

39. The IIT students demonstrate a high to very high level of the value-oriented component, with Ph.D. students showing higher levels than those in lower categories, who exhibit a high level. There is a significant difference between value-oriented features and the courses. This association is noticeable between undergraduate vs. postgraduate and postgraduate vs. Ph.D. students.

40. Students from all three course categories demonstrate high levels of active and critical evaluation skills, with Ph.D. students showing slightly higher levels compared to the other two categories. However, there is no significant difference between them.

41. Students from all three courses exhibit high levels of digital literacy competency, with significant differences noted between them. Particularly, noteworthy distinctions are observed between the undergraduate and Ph.D. categories.

42. Postgraduate and Ph.D. students exhibit a very high level of the affective component, while undergraduates display a high level. No significant difference is observed in the affective nature of students across different courses of study.

43. Students across all three courses exhibit high levels of ethical and responsible behavior, with Ph.D. students showing slightly higher levels. According to the Scheffe test, there is a significant difference in ethical and responsible engagement among students across different courses, particularly between the pairs: undergraduate vs. postgraduate, undergraduate vs. Ph.D., and postgraduate vs. Ph.D.

44. Students' metacognition is high across all courses, with a significant difference observed among them. The Scheffe test indicates that particularly notable differences exist between undergraduate students and Ph.D. scholars.

45. Students at the IITs exhibit high inquisitiveness among the three-course levels, with a significant difference between courses and student's inquisitiveness. The difference exists between undergraduate and postgraduate students.

46. Adaptability is very high among Ph.D. students, while it is high among students in the other two course levels. A significant difference in adaptability is observed across courses, with the Scheffe test indicating

particularly notable distinctions between undergraduate students and Ph.D. scholars.

47. Students from all three course levels demonstrate a high level of metaknowledge, with Ph.D. students showing slightly higher levels than those in the other two courses. The Scheffe test reveals a significant variance in metaknowledge across different courses, particularly between undergraduate students and Ph.D. scholars

48. Students from all three courses exhibit a low level of diffidence, with no significant differences observed in diffidence levels among courses.

49. Students' metaliteracy is high across the three courses, showing statistically significant differences among them. However, Scheffe test indicate that the notable differences are observed between undergraduate and postgraduate, as well as between undergraduate and Ph.D. students.

**Age-wise Analysis**

50. Students across all age groups exhibit a very high level of lifelong learning skills, with significant differences observed among them. According to the Scheffe test, these differences are evident between the age groups below 20 and 21 to 30, as well as between those below 20 and those over 31.

51. Students across all age groups exhibit high informed prosumer skills, significantly varying between these skills and the age category. The Scheffé test revealed differences in informed prosumer skills between the age groups below 20 and 21 to 30, as well as between those below 20 and 31 plus age groups.

52. Students aged 31 above exhibit a very high level of metalearning skills, whereas students in all other age groups demonstrate high metalearning competency. Additionally, there is a significant difference in the metalearning abilities of students across different age groups. Only the

below-20 age group and the 31 above age category show a significant difference in metalearning skills.

53. A high level of collaborative skills is evident across all age groups, with a slight increase observed from younger to older age brackets. Moreover, there is a significant difference in metalearning across various age groups. The Scheffe test shows that these differences are particularly noticeable when comparing the below-20 age group with the 21-30 and 31-plus age groups

54. The age bracket 31 above showcases a very high level of value-oriented nature, whereas those in other age brackets exhibit high value orientation. Moreover, there exists a significant difference in value orientation across various age groups, as per Scheffe test it is particularly noticeable when comparing the below-20 and 21-30 age groups, as well as the below-20 and 31-plus age groups.

55. Students across all age categories demonstrate a high level of active and critical evaluation. Additionally, there are no significant differences in these skills across the various age groups.

56. High levels of digital literacy competency can be seen among students from all three age groups, with significant differences observed between them. Specifically as per Scheffe test, the notable differences are seen between the below 20 vs. 31 above and 21-30 vs 31 plus age categories.

57. Students within all age ranges demonstrate a high level of the affective component, whereas those below 20 and 21 to 30 exhibit a very high level. There is no significant association between age and the affective nature of the students.

58. Students aged 31 and above exhibit a very high level of ethical and responsible engagement, while those aged below 20 to 30 display a high level. There is a significant difference between age and the ethical and

responsible engagement of the students. Below 20 and 21-30 and below 20 and 31 plus groups show a significant difference among them.

59. Very high metacognition is exhibited by students aged 31 and above, while those other groups display a high level. There is a significant difference between the students' age and metacognition. Especially below 20 and 31 above groups show a significant difference between them.

60. Students at the IITs exhibit high inquisitiveness among the three age levels, especially the 31-plus category demonstrate a very high level when comparing other two groups and no significant difference between these skills among age groups.

61. Adaptability is high among students across all three age groups, with a slight increase observed from younger to older age brackets. However, there is no significant association between adaptability and age.

62. Students exhibit very high levels of metaknowledge across two age categories such as 21-30 and 31 plus, whereas the below 20 group shows a high level, with statistically significant differences observed among them.

63. A low level of diffidence is observed among students from the three age groups, and there is no significant difference in diffidence levels and age.

64. Very high levels of metaliteracy competency are observed in students across all age groups, with statistically significant differences among them. Notably, these differences are seen between the age groups below 20 and 21 to 30 and between those below 20 and 31 above age categories.

**Gender-wise Analysis**

65. Lifelong learning skills are consistently high among students of all genders, with no significant differences observed between the genders in terms of their lifelong learning abilities.

66. Informed prosumer skills are high among students of all genders, with no significant differences observed between genders in these skills.

67. Students exhibit high metalearner competence across the genders, and there is no significant association between them.

68. Collaborative skills are high among students of all genders, with no significant difference between gender and collaboration.

69. Among students of all genders, value-oriented traits are high, with no significant differences related to gender.

70. Active and critical evaluation traits are high among students of all genders, with no significant gender-related differences.

71. Both the male and female students demonstrate a high level of digital literacy competency. However, there is a significant difference observed between gender and digital literacy skills.

72. Female students demonstrate a very high level of affective component, while male students exhibit a high level. However, a significant gender-related difference is evident

73. Both male and female students exhibit a high level of ethical and responsible components, showcasing a significant difference between them.

74. Metacognition among all genders is at a high level, and there is a significant association between gender and metacognitive abilities.

75. At a high level, inquisitiveness is evident among all genders, and there is a lack of significant association between them.

76. Female students have a higher level of adaptability than male students, and there is a significant difference in student's adaptability and genders.

77. Both the genders show a high level of metaknowledge, slightly higher in female students. There is no significant difference in metaknowledge between genders.

78. Students exhibit low diffidence across the genders, and there is no significant association between them.

79. Both males and females exhibit a similar range of high collective metaliteracy levels and there is no significant gender-related difference is observed concerning metaliteracy.

**Socioeconomic status-wise (SES) Analysis**

80. Lifelong learning skills are consistently high among students across socioeconomic statuses (SES), with no significant differences observed between the lifelong learner and SES of the students.

81. The students from the three SES categories exhibit high levels of informed prosumer skills, and there are significant differences exist between them. However, the Scheffe test noticed that the significant association is between the middle and upper strata.

82. Students from lower and upper SES exhibit a very high level of metalearner competency, while those from middle SES show a high level. There is a significant association between metalearner competency and SES category. However; according to the Scheffe test, the difference particularly evident between the middle and lower cohorts.

83. High levels of collaborative skills are observed among the students across three SES groups, with a lack of statistically significant differences among them.

84. The lower-class and upper-class students have a higher level of value-oriented factor than middle-class students, and there is a significant difference in value-oriented proficiency across socioeconomic categories.

85. Students from all three SES groups demonstrate high proficiency in active and critical evaluation, with no statistically significant differences between them.

86. Digital literacy is high among students across all SES groups. Although a borderline *p value* suggests a potential difference, the Scheffe test ultimately reveals no statistically significant difference across SES categories.

87. All SES categories exhibit high to very high affective traits, with no significant association observed between them

88. Students across all three SES categories engage in ethical and responsible activities at a high level, with no significant differences observed among these groups.

89. The metacognition levels of students from various SES backgrounds are high, and the absence of significant association among them is observed.

90. IIT students display a high level of inquisitiveness across three SES strata, with no statistically significant differences observed among them.

91. All the SES categories show high to very high adaptability. There is no significant difference across the socioeconomic categories and adaptability.

92. Middle SES has a high, whereas lower and upper SES have a high level of metaknowledge, and there is no significant association between them.

93. A low level of diffidence is observed among students from three SES, indicating a high level of metaliteracy. There is no significant difference in diffidence levels between SES categories.

94. Students possess high levels of overall metaliteracy in which a significant difference exists among the metaliteracy and various socioeconomic statuses; the Scheffe test has revealed that this difference is exhibited between the middle and upper SES categories.

### 5.2.3 Study III: Subjective Experiences of Students

95. The qualitative analysis extracted four central themes: *digital citizenship, critical thinking and reflective practices, Collaborative learning and participation,* and *ethical information use.*

96. Students are able to distinguish information and knowledge, showcasing their ability to synthesize information effectively and confirm its reliability, and it highlights a proactive approach to ensuring its accuracy, underscoring their metaliteracy skills.

97. Early exposure to digital devices during adolescence has led to a high level of proficiency in navigating various digital tools among students while revealing the unfamiliarity with newer technologies, emphasizing their adaptability in the digital landscape.

98. Students rely on digital materials like YouTube and Google over textbooks, highlighting a shift towards digital platforms for education, enhancing accessibility and cost-effectiveness.

99. Students highlight the effectiveness of teamwork and peer learning for faster learning and skill growth, emphasizing active participation, shared responsibility, and exposure to diverse perspectives in collaborative settings.

100. Students are aware of intellectual property rights and fair use but face challenges balancing easy access to digital materials with respecting creators' rights. While some rely on freely available online resources, others emphasize the importance of proper citation and academic integrity in scholarly activities.

101. Students have the ability to adapt their cognitive processes to different learning environments and emotional intelligence in managing academic stress and setbacks.

## 5.3 Tenability of Hypotheses

The hypotheses formulated based on the study's objectives are evaluated in light of the study's findings. The study assessed metaliteracy levels by examining fourteen factors. However, there was a dilemma in verifying the hypothesis's tenability, as certain factors showed variance in significance on both sides. Therefore, the mean score of all fourteen factors is taken together and considered as overall metaliteracy performed in the statistical test to clarify the tenability checking of hypotheses. The final decision regarding tenability is based on this analysis.

### Hypothesis 1

Hypothesis 1 states that **there is no significant difference in students' metaliteracy levels among the five IITs in South India**.

Finding numbers 1 to 19 supports this hypothesis, indicating that there are no significant differences in any of the fourteen metaliteracy factors when considering the institution. The statistical data for these factors are presented in Tables 14 to 27.

Additionally, findings 19 further reinforce hypothesis 1 by demonstrating that there is no significant difference in students' metaliteracy levels across these five IITs in South India. The statistical analysis using ANOVA confirms this result, as shown in Table 28. This finding highlights a consistently high level of metaliteracy among students at these institutions.

Therefore, based on above-stated findings, the hypothesis 1 is accepted,

### Hypothesis 2

Hypothesis 2 states **that there is no significant difference in students' metaliteracy levels across the departments of study at the five IITs in South India.**

Following findings numbers 20 to 27, 29,30, and 32 and the statistical outcome of the ANOVA test shown in table numbers 28-35, 38,39, and 42 that these metaliteracy factors such as *lifelong learner, informed prosumer, metalearner,* *collaborator, value-oriented, active & critical evaluator, digitally literate, affective, metacognition, inquisitiveness,* and *metaknowledge* have no significant association with the departments. On the other hand, three of them significantly differ between the departments, including *ethical and responsible engagement, adaptability,* and *diffidence;* the respective finding numbers are 28, 31, and 33, corresponding to table numbers 36, 40, and 43.

Therefore, to solve the quandary, finally, the overall metaliteracy is considered. It is also evident from finding number 34 and the ANOVA and Scheffe test, their results are given in Tables 46 and 47, that there exists a significant difference in students' metaliteracy levels among the departments of the study. The analysis underscores high metaliteracy levels among the students across the three departments, and significant differences exist between Humanities & Social Science and Engineering & Technology departments.

Hence, based on the findings mentioned above, the hypothesis 2 is rejected.

**Hypothesis 3**

1. Hypothesis 3 expresses that **there is a significant difference in students' metaliteracy levels across course levels at the five IITs in South India.**

The findings numbered 35 to 39, 41, and 43 to 48, supported by ANOVA results in Tables 48 to 57, 59-60, and 62 to 71, reveal that various metaliteracy factors exhibit significant variation by course level. These factors include *Lifelong Learning, Informed consumer behavior, Metalearning, Collaboration, Value, Orientation, Digital Literacy, Ethical and Responsible Engagement, Metacognition, Inquisitiveness, Adaptability,* and *Metaknowledge.*

In contrast, three metaliteracy factors do not show significant differences between course levels. These factors, identified in findings 40 and 42 and detailed in Tables 58, 61, and 72, are *Active and Critical Evaluation,* Affective, and *Diffident*

Therefore, the overall metaliteracy has been taken into consideration, and finding number 49 indicates a significant difference in students' metaliteracy levels across different course levels. Analysis of variance data shown in Tables 73 and 74 added that the overall metaliteracy level among students remains high, suggesting that students' capabilities in these areas improve as they progress to higher levels of education. Further, the post hoc test reveals that significant distinctions are evident between undergraduates and both postgraduate and Ph.D. students.

Thus, with regard to the aforementioned findings, the hypothesis 3 is accepted.

**Hypothesis 4**

Hypothesis 4 conveys that **there is a significant difference in students' metaliteracy levels across different age categories at the five IITs in South India.**

In accordance with finding numbers 50 to 54, 56, 58 to 59, and 62, along with ANOVA results in tables 75 to 84, 86, 88, 91 to 92, 94, and 95, indicating that various metaliteracy factors significantly vary by age group categories. These factors are *Lifelong Learning, Informed Prosumer, Metalearning, Collaboration, Value Orientation, Digital Literacy, Ethical and Responsible Engagement, Metacognition,* and *Metaknowledge.*

on the flip side, the five metaliteracy factors do not show any significant differences between age brackets. Identified in findings 55, 57, 60, 61, and 64 and represented in tables 84,87, 92, 93, and 96, these factors are *active and critical evaluator, affective, inquisitiveness, adaptable,* and *diffident.*

Thus, considering total metaliteracy, finding number 64 pinpointed a significant difference in students' metaliteracy levels across age groups. The ANOVA and Scheffe test results are also provided in Tables 97 and 98, showing that while the overall metaliteracy level among students is high, noteworthy differences are evident between the under 20 groups, the 21-30 group, and the 31-40 age categories may be attributed to varying levels of exposure, experience, and educational background among different age cohorts.

In light of these above-mentioned findings, the hypothesis 4 is accepted.

**Hypothesis 5**

1. Hypothesis 5 points out that **there is no significant difference in metaliteracy levels among students of different genders at the five IITs in South India.**

As indicated by finding the numbers 65 to 70, 75, 77 and 78, there is no significant gender-related difference observed concerning nine factors—*lifelong learning, informed prosumer behavior, metalearning, collaboration, value orientation, metaknowledge, active and critical evaluation, inquisitiveness,* and *diffidence.* This insight is supported by the corresponding statistical data provided in Tables 99 to 104, 109, 111, and 112.

Alternatively, highlighted in findings 71 to 74 and 76 alongside their respective T-test results in Tables 105 to 108, and 110, clearly mentioned that the remaining five metaliteracy factors—*digital literacy, affective disposition, ethical and responsible engagement, metacognition,* and *adaptability*—display a significant association with gender.

Besides, the overall metaliteracy and the corresponding statistical test outcomes provided in Table 113 clearly show that finding number 79 does not exhibit any significant differences based on gender. Moreover, it is clearly visible that a high metaliteracy level is exhibited by both genders.

Therefore, considering these findings,the hypothesis 5 is accepted.

**Hypothesis 6**

Hypothesis 6 conveys that **there is a significant difference in students' metaliteracy levels across various socioeconomic status categories at the five IITs in South India.**

According to the finding numbered 81, 83, 84, and 86, which pertain to four metaliteracy factors (*informed prosumer behavior, metalearning, value orientation,* and *digital literacy*), a significant difference exists among the student's metaliteracy, and various socioeconomic status groups and the statistical data is given in tables 115 to 118, 120-121, 123, and 124.

Conversely, findings 80, 83, 85, and 87 to 93 show that the remaining ten factors—*lifelong learning, collaboration, metaknowledge, active* and *critical evaluation, affective disposition, ethical and responsible engagement, metacognition, inquisitiveness, adaptability, and diffidence*—do not demonstrate any significant differences based on socioeconomic status. This observation is supported by the corresponding statistical data presented in Tables 114, 119, 122, and 125 to 131.

Hence, overall metaliteracy is statistically analyzed and presented in tables 132 and 133; finding number 94 further confirms this hypothesis by indicating that there is significant differences in students' metaliteracy levels across various socioeconomic status categories and also shows that high metaliteracy exists among them.

Drawing from the preceding findings, the hypothesis 6 is accepted.

## 5.4 Implications of the study

1. **Metaliteracy Assessment in Indian context**: Metaliteracy research has primarily focused on contexts outside of India, especially those conducted within the United States of America and other countries. The newly constructed survey instrument, the Metaliteracy Scale (MS), has been designed within the context of Indian educational institutions.

2. **Curriculum /Course Development**: The study's findings could assist initiatives for integrating metaliteracy courses into the curriculum design at IITs and other similar educational institutions to empower students as metaliterate learners.

3. **Professional Development**: The students' subjective experiences of information behavior related to metaliteracy offers insights into their

information-seeking practices, preferences, and challenges. These insights help the design of professional development programs for educators, librarians, and other educational stakeholders, equipping them with better strategies to support students' information literacy development and promote lifelong learning skills.

4. **Policy Development**: The finding gives valuable insights for policymakers on how these factors influence students' metaliteracy levels and can inform the development of policies for quality education and fostering inclusive learning environments.

## 5.5 Suggestions of the Study

According to student responses and findings on various aspects of metaliteracy, the following suggestions aim to enhance metaliteracy skills and promote lifelong learning across all communities, particularly in the technological age.

1. The study identified high metaliteracy among the students. So, teachers and librarians collaboratively may provide a metaliteracy training program to prepare students to navigate the complexities of the modern information landscape, promoting informed and active participation in personal, academic, and professional contexts.

2. The study strongly recommends that libraries in higher educational institutions implement metaliteracy learning collaboration for effective metaliteracy training.

3. Organize targeted workshops, seminars, and training sessions focused on metaliteracy to provide students with hands-on experience navigating, evaluating, and creating digital content.

4. Educational institutes can incorporate metaliteracy practices into the existing curriculum across various disciplines to ensure that students develop essential information literacy skills alongside their technical knowledge.

5. Libraries can offer personalized support through one-to-one consultations with librarians or designated mentors to help students with specific information literacy challenges they may face.

6. Library can create online learning modules and tutorials that students can access at their convenience to improve their metaliteracy skills.

7. Leverage interactive technologies such as virtual reality, simulations, and gamification to make metaliteracy training more engaging and effective for students.

8. The educational curriculum needs to utilize various learning modes, including audio, video, and interactive content, to cater to different learning styles and enhance engagement.

9. Mobile apps hold immense potential to revolutionize metaliteracy education. By offering engaging, interactive lessons alongside curated access to valuable resources and practical tools, these apps can make learning convenient and accessible for students anywhere, anytime. This fosters a broader reach for promoting digital literacy and information skills, empowering learners of all ages to become confident navigators of the digital world.

10. Similarly, the use of the flipped classroom approach is effective where students engage with metaliteracy content outside class and apply their knowledge through activities in class.

11. Libraries establish feedback mechanisms to gather students' input on the learning and research requirements and make necessary improvements.

12. Libraries need to expand the range of digital and print resources, including access to databases, e-books, and online journals, to support students' research and learning needs.

13. The library must educate students about the ethical aspects of information use, including issues related to plagiarism, copyright, and digital privacy, to promote responsible behavior in the digital environment.

14. The library can organize competitions and challenges related to information literacy and digital content creation to motivate students and foster a competitive spirit.

15. The academic institution encourages peer learning and collaboration by setting up study groups and discussion forums where students can share knowledge, resources, and strategies for effective information use.

16. Institute can offer training programs for faculty to help them integrate metaliteracy into their teaching and better support their students and implementation of the metaliteracy badging system.

17. Equip librarians with the necessary training on metaliteracy concepts so they can effectively guide students in finding and evaluating information.

18. Educators can use data analytics to track student engagement and progress in overall learning; this information can help educators tailor their instruction to meet the needs of different students, especially to enhance metaliteracy skills.

19. Encourage students to actively participate in community projects or initiatives that involve information sharing, critical analysis, and digital content creation. This hands-on approach not only reinforces metaliteracy skills but also cultivates a sense of social responsibility and civic engagement.

20. Create opportunities for interdisciplinary collaboration and knowledge exchange among students from different academic backgrounds. Collaborative projects or interdisciplinary seminars provide a ground for exploring diverse perspectives, integrating knowledge domains, and developing metaliteracy skills.

21. Promote the use of OER platforms and repositories to expand students' access to high-quality educational materials, fostering a culture of continuous learning and resourcefulness. Additionally, encourage students to contribute to OER initiatives by sharing their own content or creating open-access resources

22. The study's finding emphasizes creating robust assessment tools to measure students' metaliteracy competencies and track their progress over time.

## 5.6 Conclusion

In recent decades, the growth of digital technology has transformed the information landscape, access, and consumption, necessitating a paradigm shift in literacy competency. While traditional literacy skills remain fundamental, the emergence of digital literacy, encompassing metaliteracy, has become increasingly important. This study gives a comprehensive examination of metaliteracy assessment among students at IITs in South India. Recognizing the importance of metaliteracy in navigating the complexities of the digital age, the study evaluated students' proficiency in critically evaluating digital information, identifying credible sources, and engaging ethically in online environments. By employing an assessment tool and analyzing students' performance, the study sought to provide valuable insights into the extent to which IIT students possess essential metaliteracy competencies and identify areas for further development. These findings hold significant implications for curriculum design, pedagogical approaches, and institutional initiatives aimed at fostering students' metaliteracy skills and preparing them to be informed digital citizens.

The findings indicated that students possess diverse metaliteracy skills, with varying degrees of proficiency across different areas. Notably, the study identified areas where students excel, such as critical evaluation of information sources and areas for improvement, such as understanding the ethical implications of digital information use. Additionally, the research highlighted the need for ongoing support and education in metaliteracy skills to ensure students are equipped to navigate the complexities of the digital age effectively. Educators and policymakers can empower IIT students to thrive in an increasingly digitized world by fostering a culture of critical inquiry and ethical engagement with digital information.

Considering the lifelong learning skills, students exhibit a consistently high commitment to acquiring knowledge and skills across various demographic factors such as institutions, departments, courses, age groups, genders, and socioeconomic statuses. This dedication to lifelong learning underscores its importance in students continual personal and intellectual growth, regardless of their background or circumstances. Students value lifelong learning as a critical component of their academic and personal growth. Therefore, educators should recognize and support students' utilization of digital resources for learning purposes, fostering a culture of lifelong learning and growth within academic institutions.

The high levels of informed prosumer skills among students signify their capacity to critically evaluate and contribute to digital information environments effectively. This competence reflects students' ability to navigate, assess, and generate content in today's information-rich landscape, showcasing their adaptability and proactive engagement with diverse media platforms. Empowering students to use digital platforms for learning helps create an active learning space that enhances their ability to assess information and contribute meaningfully. This approach supports students in developing their skills as informed consumers and producers of digital content, fostering their intellectual growth across domains.

The qualitative findings from this study gave insights into the evaluation and synthesis of information sources; students showcased an understanding of the distinction between information and knowledge, emphasizing the transformative role of interpretation and personal experience in shaping knowledge. Their ability to identify credible sources and actively verify information reflects a critical approach to information literacy, essential for navigating the digital landscape effectively. By prioritizing evaluation and interpretation, students demonstrate a proactive stance toward transforming information into actionable knowledge, highlighting the depth of their understanding in real-world contexts.

Regarding digital tool exposure and proficiency, students' early access to digital devices has significantly influenced their proficiency in utilizing technology. While their self-assessment of digital literacy reflects a high level of proficiency, students acknowledge the need for further exploration, particularly in emerging technologies. Despite this, their adaptability and resilience in navigating digital platforms underscore the efficacy of digital tools in enhancing learning experiences. Through a combination of self-exploration and reliance on intuitive features, students showcase a willingness to embrace technological advancements, positioning themselves as adept digital natives in an evolving landscape.

In technology-enabled learning, the integration of new technologies has revolutionized educational paradigms, offering students unprecedented access to resources and fostering an interactive learning environment. By leveraging online platforms and digital materials, students transcend traditional learning constraints, embracing flexibility and efficiency in their educational pursuits. The collaborative nature of digital platforms not only enhances accessibility but also cultivates a culture of shared knowledge and diverse perspectives. Students' preference for digital mediums underscores their recognition of the transformative potential of technology in enriching learning experiences and promoting sustainability in education.

## 5.7 Recommendations for Further Research

This study has provided insights into metaliteracy in the digital environment among students at IITs in South India. The investigator suggests the following areas for further research to expand knowledge in this field:

- **Cross-Institutional and Cultural Studies:**

Future research could expand this study's insights by examining similar inquiries in different institutions and cultural contexts. This would help to understand how metaliteracy practices vary across diverse academic and cultural settings.

- **Standardization and Validation of the Metaliteracy Scale:**

A study can be conducted to standardize and further validate the newly constructed metaliteracy scale across a broader range of institutions. This would ensure its reliability and applicability across diverse academic settings, enhancing the tool's utility for future research.

- **Meta-Analysis of Existing Research:**

Further meta-analysis can be conducted on existing research on metaliteracy to synthesize findings across studies. This would help identify common themes, gaps in the literature, and areas for future inquiry, providing a comprehensive overview of the current state of knowledge in the field.

- **Role of Technology in Shaping Metaliteracy:**

Studies can be done to identify the role of technology in shaping metaliteracy practices and explore innovative approaches for leveraging digital tools and online resources. This would aim to enhance students' information literacy and critical thinking skills.

- **Impact of AI Tools on Metaliteracy:**

Investigating the impact of AI tools on students' information evaluation skills and metaliteracy abilities to navigate AI-generated information would provide insights into the evolving challenges and opportunities presented by AI in education.

- **Effectiveness of Gamified Learning Approaches:**

Experimental investigations can be conducted to identify the effectiveness of gamified learning approaches in teaching metaliteracy skills. This could explore how game-based learning can engage students and improve their metaliteracy competencies.

- **Comparative Studies on Literacy Assessments:**

Comparative studies on current literacy assessments and instruments can provide insights into their similarities, differences, and effectiveness. This would help in understanding which tools are most effective in measuring various aspects of metaliteracy.

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# APPENDICES

# APPENDIX I

## METALITERACY SCALE -MS
## (Haseena & Azeez,2024)

Dear participant,

I am developing a scale to assess the metaliteracy of students. I wish to test the usability of this scale for which I require your help. The information you provide will allow me to determine the psychometric properties and applicability of the scale. I will be grateful for your effort and time. For any queries you can contact me:

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General Information for Participation in the Study & Privacy Declaration:

- It may take 5-10 minutes to complete the questionnaire.
- The information given by you will be used for research and academic purposes only.
- There are no right and wrong answers your honest response will help in gaining great insights into this topic of research.
- Your kind participation would be a voluntary contribution to this research.

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Haseena. VKKM, Ph. D. Research Scholar,

Library & Information Science, CHMK Library, University of Calicut, Kerala-India haseenavkkm@uoc.ac.in

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* Indicates required question

1. Email *

2. I agree to participate *

*Check all that apply.*

☐ Yes
☐ No

***Instructions***: The scale consists 56 statements and provides five points starting from *'Not at all, Slightly, Moderate, Very much* and *Extremely'* against each statement. Please read each statement carefully and mark each item as per your choice of any of the five alternatives. You are requested to give responses to all the statements.

3. 1. I often monitor my own thoughts about my learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

4. 2. I am aware of my existing knowledge and the things I don't know. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

5. 3. I am confident in explaining my knowledge strengths to others. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

6. 4. Thinking about my thought process helps me to improve my learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

7. 5. I am aware how information helps me to consider multiple perspectives on a piece of information. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

8. 6. I know how to ethically integrate someone else's intellectual property into my own work. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

9. 7. To be ethical, I remember to cite the references of the materials that I use for an assignment. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

10. 8. I produce information as well as consume it. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

11. 9. I understand that learning is a lifelong process *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

12. 10. I learn from my mistakes. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

13. 11. Sometimes reflecting on my mistakes provides me with insights about my learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

14. 12. I understand adaptability and flexibility are important in lifelong learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

15. 13. As an informed, self-directed learner, I broaden my worldview through the use of social media *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

16. 14. I build upon the exciting ideas of others in an ethical way. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

17. 15. I critically assess user-generated sources (eg. Wikipedia) while writing my assignments. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

18. 16. I share my knowledge with others while working in teams. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

19. 17. I can learn from others while working collaboratively. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

20. 18. I can verify the credibility of information from a source. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

21. 19. I am aware that there is so much more to know than what I know. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

22. 20. I am aware information content is not always produced for legitimate reasons. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

23. 21. I am able to identify bias in the content that I come across. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

24. 22. I am able to identify my own bias. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

25. 23. I consider perspectives other than my own perspective. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

26. 24. I am able to distinguish between a research article and content from popular media. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

27. 25. I am able to differentiate the facts versus the opinions of others on social media platforms. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

28. 26. I can thoroughly evaluate frequently changing content online. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

29. 27. I am able to identify open licensed content (i.e. content that can be reused) *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

30. 28. I am able to differentiate and produce original information and reproduce openly licensed content. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

31. 29. I can distinguish between personal and public information to make decisions about whether to share it or not. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

32. 30. I see myself as both a learner and a teacher when I collaborate with others. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

33. 31. I can identify gaps in the literature through my research. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

34. 32. The more I know the better I can think critically about new content. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

35. 33. I can communicate and collaborate in the classroom and understand multiple perspectives. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

36. 34. I work well in groups. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

37. 35. I often use social media for professional networking. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

38. 36. I am willing to take a task/assignment that no one else wants to do. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

39. 37. I think well before I do something. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

40. 38. When I commit, I keep up to it. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

41. 39. I share my knowledge by teaching others. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

42. 40. I often try to represent theoretical knowledge in different formats like ppts, flowcharts etc. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

43. 41. I utilize resources beyond my curriculum for lifelong learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

44. 42. I seek information from a wide range of reliable information sources. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

45. 43. When I read news I consider different viewpoints. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

46. 44. I effectively use new technologies for learning. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

47. 45. I participate responsibly in groups. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

48. 46. I take measures to secure my personal privacy online. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

49. 47. I effectively communicate using appropriate methods when producing and sharing information for specific audiences. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

50. 48. I seek new learning opportunities in social settings and online communities. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

51. 49. I'm enthusiastic about new learning and new situations. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

52. 50. I recognize when my attitude is negative. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

53. 51. I procrastinate (delay things/ waste) because I worry I won't succeed. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

54. 52. I allow myself to get excited about the things I do. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

55. 53. I have an open mind. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

56. 54. I am inspired by what I learn from others in a group setting. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

57. 55. I am aware that my feelings influence the information I seek. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not | ◯ | ◯ | ◯ | ◯ | ◯ | Extremely |

58. 56. I am aware about how I feel about the information I get. *

*Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Not at all | | | | | | Extremely |
| | ◯ | ◯ | ◯ | ◯ | ◯ | |

59. Specify the IIT where you are studying. *

*Check one that apply.*

- [ ] IIT Madras
- [ ] IIT Hyderabad
- [ ] IIT Palakkad
- [ ] IIT Tirupati
- [ ] IIT Dharwad

60. Course of Study ? *

*Check one that apply.*

- [ ] Undergraduate (UG)
- [ ] Postgraduate (PG)
- [ ] Ph. D Scholar

61. Your Department ? *

*Mark only one oval.*

- Engineering & Technology
- Science
- Humanities & Social Science
- Other: ______________________

62. Your Gender? *

*Mark only one oval.*

- Male
- Female
- Transgender

63. Your age group? *

*Mark only one oval.*

- Below 20
- 21-30
- 31-Above

64. Your Socioeconomic status? *

*Mark only one oval.*

- Upper
- Middle
- Lower

65. Would you like to participate in an interview for a follow-up study? *

*Mark only one oval.*

- Yes
- No

66. Any things else you want to mention, kindly write them in the input box provided below. Any comment, suggestion, etc.

Thank you very much for giving your most-valuable time and participating in this survey.

# APPENDIX II

# INTERVIEW GUIDE

**Dear Participant,**

Thank you for voluntarily participating and agreeing to share your valuable experiences!

***Instructions***: Please answer the following questions as honestly and thoroughly as possible, sharing your experiences just as they are. There are no right or wrong responses—every answer is valuable to analysis. The information you provide will be stored anonymously, and the results will be used solely for academic and research purposes.

1. When did you get your first digital gadget? (Mobile/laptops/desktop)
2. On a scale of 1 to 10 (1=low, 10=high) rate your digital literacy? Why did you rate so?
3. On a scale of 1 to 10 how efficiently do you use technology for your studies? Why?
4. How do you use technology for educational purposes/to improve productivity?
5. Rank according to your usage:
   - Mobile technology/Portable devices
   - Open Educational Resources (Eg:- e-PG Pathshala, Swayam, Coursera)
   - Online communities
   - Social media platforms (Facebook, Twitter, Instagram, WhatsApp, Telegram, LinkedIn)
   - Online forums
   - Wikis
6. How did you learn to use these technologies?
7. How do you update yourself about the latest technologies?
8. What techniques do you use to learn better?

9. What did you learn from your experiences of collaborating with others? (Behavioural)
10. What were your contributions while collaborating with others? (Behavioural)
11. How do you build on your existing skills and knowledge in collaborative settings?
12. How do you motivate yourself to improve? (Affective)
13. How do you distinguish between information and knowledge? (Cognitive)
14. On a scale of 1 to 10, how satisfied are you with your daily output (in terms of work)? (Cognitive) why?
15. What are the different formats(audio/video/text/others) in which you share information? (Goals)
16. What are the different methods you use to adapt information to make it suitable (medium) for your audience? (Goals)
17. What do you understand about 'Metaliteracy'?

# APPENDIX III

## EFA-TOTAL VARIANCE EXPLAINED

| Components | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulativ e % | Total | % of Variance | Cumulativ e % | Total | % of Variance | Cumulativ e % |
| 1 | 14.783 | 26.399 | 26.399 | 14.783 | 26.399 | 26.399 | 3.772 | 6.736 | 6.736 |
| 2 | 2.588 | 4.621 | 31.020 | 2.588 | 4.621 | 31.020 | 3.740 | 6.678 | 13.414 |
| 3 | 2.277 | 4.066 | 35.086 | 2.277 | 4.066 | 35.086 | 3.239 | 5.784 | 19.197 |
| 4 | 2.037 | 3.638 | 38.723 | 2.037 | 3.638 | 38.723 | 2.983 | 5.327 | 24.525 |
| 5 | 1.652 | 2.950 | 41.673 | 1.652 | 2.950 | 41.673 | 2.685 | 4.795 | 29.320 |
| 6 | 1.544 | 2.756 | 44.430 | 1.544 | 2.756 | 44.430 | 2.623 | 4.683 | 34.003 |
| 7 | 1.417 | 2.530 | 46.959 | 1.417 | 2.530 | 46.959 | 2.460 | 4.393 | 38.396 |
| 8 | 1.349 | 2.409 | 49.368 | 1.349 | 2.409 | 49.368 | 2.440 | 4.358 | 42.754 |
| 9 | 1.240 | 2.214 | 51.582 | 1.240 | 2.214 | 51.582 | 2.085 | 3.723 | 46.477 |
| 10 | 1.210 | 2.161 | 53.743 | 1.210 | 2.161 | 53.743 | 2.013 | 3.595 | 50.072 |
| 11 | 1.199 | 2.142 | 55.885 | 1.199 | 2.142 | 55.885 | 1.767 | 3.155 | 53.226 |
| 12 | 1.125 | 2.009 | 57.894 | 1.125 | 2.009 | 57.894 | 1.699 | 3.034 | 56.260 |
| 13 | 1.073 | 1.917 | 59.811 | 1.073 | 1.917 | 59.811 | 1.537 | 2.745 | 59.004 |
| 14 | 1.008 | 1.799 | 61.610 | 1.008 | 1.799 | 61.610 | 1.459 | 2.606 | 61.610 |
| 15 | .945 | 1.688 | 63.299 | | | | | | |
| 16 | .921 | 1.645 | 64.944 | | | | | | |
| 17 | .893 | 1.595 | 66.538 | | | | | | |
| 18 | .856 | 1.529 | 68.068 | | | | | | |
| 19 | .837 | 1.495 | 69.563 | | | | | | |
| 20 | .826 | 1.474 | 71.037 | | | | | | |
| 21 | .799 | 1.428 | 72.465 | | | | | | |
| 22 | .769 | 1.374 | 73.839 | | | | | | |
| 23 | .750 | 1.339 | 75.178 | | | | | | |
| 24 | .719 | 1.285 | 76.462 | | | | | | |
| 25 | .681 | 1.216 | 77.679 | | | | | | |
| 26 | .671 | 1.197 | 78.876 | | | | | | |
| 27 | .647 | 1.155 | 80.031 | | | | | | |
| 28 | .628 | 1.121 | 81.152 | | | | | | |
| 29 | .612 | 1.093 | 82.245 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 30 | .590 | 1.053 | 83.298 | | | | | | |
| 31 | .564 | 1.008 | 84.306 | | | | | | |
| 32 | .536 | .957 | 85.263 | | | | | | |
| 33 | .516 | .921 | 86.184 | | | | | | |
| 34 | .501 | .895 | 87.079 | | | | | | |
| 35 | .493 | .880 | 87.959 | | | | | | |
| 36 | .458 | .818 | 88.776 | | | | | | |
| 37 | .454 | .811 | 89.587 | | | | | | |
| 38 | .439 | .785 | 90.372 | | | | | | |
| 39 | .429 | .766 | 91.137 | | | | | | |
| 40 | .401 | .715 | 91.853 | | | | | | |
| 41 | .395 | .706 | 92.559 | | | | | | |
| 42 | .378 | .676 | 93.234 | | | | | | |
| 43 | .355 | .635 | 93.869 | | | | | | |
| 44 | .345 | .616 | 94.485 | | | | | | |
| 45 | .329 | .587 | 95.073 | | | | | | |
| 46 | .320 | .572 | 95.645 | | | | | | |
| 47 | .308 | .550 | 96.195 | | | | | | |
| 48 | .299 | .533 | 96.728 | | | | | | |
| 49 | .284 | .508 | 97.235 | | | | | | |
| 50 | .270 | .483 | 97.718 | | | | | | |
| 51 | .244 | .436 | 98.154 | | | | | | |
| 52 | .238 | .425 | 98.579 | | | | | | |
| 53 | .223 | .399 | 98.978 | | | | | | |
| 54 | .213 | .380 | 99.357 | | | | | | |
| 55 | .201 | .359 | 99.716 | | | | | | |
| 56 | .159 | .284 | 100.000 | | | | | | |

# APPENDIX IV

## CONSENT FORM FOR STUDY

Dear Participant,

The study intends to check the usability of a metaliteracy scale, which is currently in its construction phase. Your voluntary participation and data will help us evaluate the validity, reliability, and applicability of this scale. There are no right or wrong answers; please select the options that best reflect your views. I assured that all responses will be kept confidential and used solely for research and academic purposes. Your contribution is invaluable to the completion of this study, and greatly appreciate your effort. For any queries you can contact:


Haseena.V.K.K.M

Ph.D Research Scholar in Library and Information Science

CHMK Library, University of Calicut

email: haseenavkkm@uoc.ac.in


I have read the information provided about the study and understand that I can seek clarification from the researcher if I have any doubts. I am aware that I have the right to refuse to answer any questions that I am not comfortable with. I also understand that the information collected during this study will be kept confidential and used exclusively for academic and research purposes. I provide my consent to participate in this research study.

Participants signature/Initial: __________ Date:______

# APPENDIX V

# EXPERTS COMMENTS-FACE VALIDITY

## METALITERACY AMONG STUDENT OF IITs IN SOUTH INDIA

**What is Metaliteracy?**

Metaliteracy promotes critical thinking and collaboration in a digital age, providing a comprehensive framework to effectively participate in social media and online communities. It is a unified construct that supports the acquisition, production, and sharing of knowledge in collaborative online communities. Metaliteracy challenges traditional skills-based approaches to information literacy by recognizing related literacy types and incorporating emerging technologies. (Mackey & Jacobson, Reframing Information as a Metaliteracy, 2011, 62-62)

**Scale**

**Demographic Information**

1. Name of IIT: IITM IITH IITD IITT IITP
2. Course of Study: PG UG Ph.D.
3. Department:
4. Gender: F/M
5. Age
6. Socio-economic Status: Upper, Middle, Lower

**Instructions**

The following statements are about what IIT students do while participating in online social communities. Please rate the level of awareness/performance of these activities based on the day-to-day learning experience in social media and online communities

**Scale values**: 5=Extremely, 4=Very much, 3=Moderate, 2=Slightly, 1= Not at all

| Metacognitive | | Extremely | Very much | Moderate | Slightly | Not at all |
|---|---|---|---|---|---|---|
| **No** | **Statements** | | | | | |
| 1 | I often monitor my own thoughts about my learning. | | | | | |
| 2 | I often try to understand the gap between the things I know, and the things I don't know | | | | | |
| 3 | I am aware of my existing knowledge and what I still need to learn. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | I am confident in explaining my knowledge strength/areas of expertise to others | | | | | |
| 6 | Thinking about my thought process helps me to improve my learning. | | | | | |
| | **Goals** | | | | | |
| 7 | I am aware how information helps me to consider multiple perspectives on a piece of information | | | | | |
| 8 | I know how to ethically integrate someone else's intellectual property into my own work | | | | | |
| 9 | I remember to cite ethically the references of the materials that I use for an assignment. | | | | | |
| 11 | I produce information as well as consume it. | | | | | |
| 12 | I understand that learning is a lifelong process | | | | | |
| 13 | I learn from my mistakes | | | | | |
| 14 | Sometimes reflecting on my mistakes provides me with insights about my learning. | | | | | |
| 15 | I understand adaptability and flexibility are important in lifelong learning | | | | | |
| 16 | As an informed, self-directed learner, I broaden my worldview through the use of social media | | | | | |
| 17 | I build upon the exciting ideas of others in an ethical way | | | | | |
| | **Cognitive** | | | | | |
| 18 | I use my intelligence productively | | | | | |
| 19 | I share my knowledge with others while working in teams | | | | | |
| 20 | I can learn from others while working collaboratively | | | | | |

Ananda Krishnan
May 27, 2022

choose one

*Comments above copied from original document*

Trudi Jacobson
Apr 6, 2022

these seem to be quite appropriate, though the producer/consumer ones might be slightly refocused. For example, #11, I produce information as well as consume it.

*Comments above copied from original document*

Tom Mackey
May 24, 2022

I know how to cite the references of the materials that I use for an assignment.

Ananda Krishnan
May 27, 2022

Remember because we need to know if people will be ethical enough to remember to give due credit.
Know feels like it is about styles of citation, like APA

Tom Mackey
May 24, 2022

This is fine but I also wonder about: I am adaptable and flexible in my learning (or in how I learn).

Ananda Krishnan
May 27, 2022

We would like to emphasize that the individual values adaptability and

| | Goals | | | | | |
|---|---|---|---|---|---|---|
| 21 | I can verify the credibility of information from a source | | | | | |
| 22 | I am aware that there is so much more to know than what I know | | | | | |
| 23 | I am aware information content is not always produced for legitimate reasons | | | | | |
| 24 | I am able to identify bias in the content that I come across | | | | | |
| 25. | I am able to identify my own bias. | | | | | |
| 25 | I am willing to consider multiple perspectives that I come across | | | | | |
| 26 | I am able to distinguish between a research article and content from popular media | | | | | |
| 27 | I am able to differentiate the facts versus the opinions of others on social media platforms | | | | | |
| 28 | I can thoroughly evaluate frequently changing content online | | | | | |
| | I am able to identify openly licensed content | | | | | |
| 30 | I am able to differentiate and produce original information and remixing openly licensed content | | | | | |
| 31 | I can distinguish between personal and public information to make decisions about whether to share it or not. | | | | | |
| 32 | I see myself as both a learner and a teacher when I collaborate with others | | | | | |
| 33 | I can find gaps in understanding (when reviewing literature I am able to find research gaps) | | | | | |

**Haseena V K K M**
May 28, 2022

We would like to emphasize that the individual values adaptability and flexibility especially in lifelong learning

**Tom Mackey**
May 24, 2022

Maybe: I challenge myself to build upon the ideas of others in an exciting way.

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**Trudi Jacobson**
Apr 6, 2022

?

**Tom Mackey**
May 24, 2022

I'm not sure which one this is based on, maybe: I gain knowledge when producing information.

*Comments above copied from original document*

**Tom Mackey**
May 24, 2022

Could we also add: I am able to identify bias in myself or I am able to identify my own bias.

*Comments above copied from original document*

**Trudi Jacobson**
Apr 6, 2022

2 different things, though for cognitive, I suppose the example is appropriate

| | | | | | | |
|---|---|---|---|---|---|---|
| | I can identify gaps in the literature through my research | | | | | |
| 34 | The more I know the better I can think critically about new content | | | | | |
| 35 | I can communicate in the classroom and understand multiple perspectives.<br>I can collaborate in the classroom to learn from multiple perspectives | | | | | |
| | **Behavioural** | | | | | |
| 36 | I work well in groups | | | | | |
| 37 | I often use social media for professional networking | | | | | |
| 38 | I am willing to take a task/assignment that no one else wants to do (may be we will consider dropping) | | | | | |
| 39 | I think well before I do something | | | | | |
| 40 | When I commit, I keep up to it | | | | | |
| 41 | I share my knowledge by teaching others | | | | | |
| 43 | I utilize resources beyond my curriculum for lifelong learning | | | | | |
| | **Goals** | | | | | |
| 44 | I seek information from a wide range of reliable information sources. | | | | | |
| 45 | When I read news I consider different viewpoints | | | | | |
| 47 | I use new technologies for learning effectively | | | | | |
| 48 | I participate responsibly in groups | | | | | |
| 49 | I take measures to secure my personal privacy online. | | | | | |

Tom Mackey
May 24, 2022

Yes I agree this is two different things. Maybe since there was an earlier one about gaps in knowledge, this one should be: I can identify gaps in the literature through my research. or I can find gaps in my own understanding through research.

Trudi Jacobson
Apr 6, 2022

**Replace:** *"/ to critically evaluate I try to learn/know more"* with *"bout new content"*

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Trudi Jacobson
Apr 6, 2022

perhaps this part should be a separate item?

*Comments above copied from original document*

Trudi Jacobson
Apr 6, 2022

?

Tom Mackey
May 24, 2022

This is not necessarily metaliteracy but shows ability to collaborate so maybe something like: I am willing to take on a task or assignment in cooperation with my team.

Haseena V K K M
May 27, 2022

Are you willing to take on a task that no one else wants to do? Taken from behavioural ...

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| | | | | | | |
|---|---|---|---|---|---|---|
| 50 | I effectively communicate using appropriate methods when producing and sharing information for specific audiences. | | | | | |
| 51 | I seek new learning opportunities in social settings and online communities. | | | | | |
| | **Affective** | | | | | |
| 52 | I'm enthusiastic about new learning and new situations | | | | | |
| 52 | I recognize when my attitude is negative | | | | | |
| 53 | I procrastinate (delay things/ waste) because I worry I won't succeed | | | | | |
| 54 | I allow myself to get excited about the things I do | | | | | |
| 55 | I have an open mind | | | | | |
| | **Goals** | | | | | |
| 56 | We learn from each other in group settings | | | | | |
| 57 | I often try to represent theoretical knowledge in different formats like ppts, flowcharts etc. | | | | | |
| 58 | I critically assess user-generated sources (eg. Wikipedia) while writing my assignments. | | | | | |
| 59 | I am aware that my feelings influence the information I seek | | | | | |
| 60 | I am aware about how I feel about the information I get | | | | | |

Trudi Jacobson
Apr 6, 2022

not really behavioral

Tom Mackey
May 24, 2022

Agree, maybe something like: I have the ability to apply my thoughts and reflections into productive action.

*Comments above copied from original document*

Trudi Jacobson
Apr 6, 2022

not ML, the next one either, at least as worded

Tom Mackey
May 24, 2022

I wonder if this relates to "Value persistence, adaptability, and flexibility in lifelong learning. (M)" which is metacognitive. So maybe something like: I have the ability to persist in and adapt to new learning situations" or break it up: I have the ability to persist in my learning. I have the ability to adapt to new learning situations.

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Trudi Jacobson
Apr 6, 2022

these 3 don't seem to have anything to do with affective--we could rewrite

Tom Mackey
May 24, 2022

Maybe:
I am inspired by what I learn from others in a group setting.

Show more

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# APPENDIX VI

# DATA COLLECTION REQUESTS AND APPROVALS

**C.H. MOHAMMED KOYA LIBRARY**

**UNIVERSITY OF CALICUT**

**University Librarian**

Grams : UNICAL
Email: chmklibrary@yahoo.com
Fax : (0494) 2400269
Phone : Offi. :(0494) 2407287
(0494) 2407290
CALICUT UNIVERSITY P.O.
673 635 KERALA INDIA

25th March 2022

**To Whom It May Concern**

Sub: Letter of Recommendation for Data Collection and Research Work

This is to certify that Ms. Haseena.VKKM is a bonafide student of Library and Information Science, CHMK Library and Research Centre, University of Calicut. She is conducting research entiled " Assessment of Metaliteracy Competency among Students of IITs in South India: An investigation". She needs to collect data from students from your institution and I kindly request you to do the needful. I assure you that the data will be used for academic purpose only.

Thanks and Regards

**Dr.Abdul Azeez T A**
Reseach Supervisor and Head
CHMK Library and Research Centre

C.H. MOHAMMED KOYA LIBRARY
P.O. CALICUT UNIVERSITY
UNIVERSITY OF CALICUT

Indian Institute of Technology Palakkad
भारतीय प्रौद्योगिकी संस्थान पालक्काड
Under Ministry of Education, Govt. of India
शि क्षा मं त्रालय के अधीन, भारत सरकार

IIT PALAKKAD

Prof. Dr. Jagadeesh Bayry
Dean (Student Affairs)

No. STDT/IITPKD/Com-12/2022

June 26, 2022

***Permission letter to Ms. Haseena VKKM***

Herewith, I am permitting Ms. Haseena VKKM, a bonafide student of Library and Information Science, CHMK Library and Research Centre, University of Calicut to collect a survey-based data from the students of IIT Palakkad for assessing their metaliteracy competency.

The permission is conditional and Ms. Haseena VKKM has to maintain the confidentiality of the IIT Palakkad students' identity and should adhere to the questionnaire shared with the competent authority (enclosed).

Dean (Student Affairs)

Dean (Student Affairs)
Indian Institute of Technology Palakkad
Phone no: 04923 226 341
Email: deanstudents@iitpkd.ac.in

**Copy To:**

Director's office
Dean (Academics)
Advisor (Student Matters)

Ahalia Integrated Campus, Kozhipara, Palakkad - 678 557
अहलिआ एकीकृ त कै म्पस, कोज़्हि पारा, पालक्काड- 678557
Phone: +91 4923 226 300 Fax: +91 4923 226 300 Email: deanstudents@iitpkd.ac.in url: iitpkd.ac.in

Haseena V K K M <haseena.vkkm@admin.iith.ac.in>

**Re: Permission to collect data for a Ph.D. research reg.**
11 messages

**Haseena V K K M** <haseena.vkkm@admin.iith.ac.in> Tue, Jun 14, 2022 at 9:04 AM
To: Dean Students <dean.students@iith.ac.in>, Dean Student Office <office.students@iith.ac.in>
Cc: Institutional Ethics Committee IIT Hyderabad <office.iec@iith.ac.in>

Dear Sir/Madam,
Greetings!!

This is a request for collecting data from the students through a google form for the Ph.D. study.

I am Haseena VKKM, Presently working as a Library Information Assistant, IITHLibrary. I am a part-time Ph.D. scholar in Library Science at the University of Calicut, Kerala. My topic of research is "Assessment of Metaliteracy Competency among Students of IITs in South India: An Investigation". I need to collect data from IITH students and I kindly request you to grant permission for the same. I assure you that the data will be used for academic purposes only.

Permission letter from the University of Calicut is attached.

Thanks & Regards
Haseena.VKKM

**Administration Dean** <dean.admin@iith.ac.in> Mon, Jun 20, 2022 at 5:36 PM
To: "DR, HR IIT Hyderabad" <dr.hr@iith.ac.in>
Cc: Haseena V K K M <haseena.vkkm@admin.iith.ac.in>

I am fine with it as long as the survey does not ask and publish personal data and information
Regards
[Quoted text hidden]

**DR, HR IIT Hyderabad** <dr.hr@iith.ac.in> Wed, Jun 22, 2022 at 9:44 AM
To: Haseena V K K M <haseena.vkkm@admin.iith.ac.in>
Cc: Administration Dean <dean.admin@iith.ac.in>

Ms.Haseena

Dean(Admin) has already approved your request, vide his email dt.20/06/22 subject to the conditions mentioned therein. You may go ahead accordingly.

With thanks/regards
**Syed Ali Sabeer**
Deputy Registrar (HR) & (S&P)
PH:040-23016062
**భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్**
**भारतीय प्रौद्योगिकी संस्थान हैदराबाद**
**Indian Institute of Technology Hyderabad**

[Quoted text hidden]

Gmail Haseena V K K M <vkkmhaseena@gmail.com>

**Permission to collect data for a Ph.D. research reg.**
14 messages

**Haseena.V.K.K.M** <vkkmhaseena@gmail.com> Sun, Jun 19, 2022 at 9:11 PM
Bcc: dean.students@iittp.ac.in, dost@iitm.ac.in, dean.students@iitpkd.ac.in, dean.students@iitdh.ac.in

Dear Sir/Madam,
Greetings!!

This is a request for collecting data from the students through a google form for the Ph.D. study.

I am Haseena VKKM, Presently working as a Library Information Assistant, at IIT Hyderabad Library. I am a part-time Ph.D. scholar in Library Science at the University of Calicut, Kerala. My topic of research is "Assessment of Metaliteracy Competency among Students of IITs in South India: An Investigation". I need to collect data from IIT students and kindly request you grant permission for the same. I assure you that the data will be used for academic purposes only.

A permission letter from the University of Calicut is attached.

Thanks & Regards
Haseena.VKKM
Ph.D. Scholar, Dept. of Library and Information Science
University of Calicut
Ph:9605972978

Sender notified by
Mailtrack

**Data collection Request.pdf**
495K

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**DOST** <dost@iitm.ac.in> Thu, Jun 23, 2022 at 8:11 PM
To: "Haseena.V.K.K.M" <vkkmhaseena@gmail.com>
Cc: DOSTOFFICE <dostoffice@iitm.ac.in>

Respected Haseena Madam,

Greetings. Please send us the survey form. We will go through the same and circulate the survey form to students.

Best wishes.

Yours sincerely,
नीलेश ज. वसा
डीन (छात्र), भारतीय प्रौद्योगिकी संस्थान मद्रास, चेन्नै
Nilesh J. Vasa
Dean of Students (DoSt),
IIT Madras, Chennai 600036.
(+91 94440 08050)
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Disclaimer: The information contained in this email is confidential and may contain proprietary information. It is meant solely for the intended recipient.

Gmail Haseena V K K M <vkkmhaseena@gmail.com>

**Permission to collect data for a Ph.D. research:IITDH reg.**
19 messages

**Haseena.V.K.K.M** <vkkmhaseena@gmail.com> Sun, Jun 19, 2022 at 9:26 PM
To: bltembe@iitdh.ac.in

Dear Sir,
Greetings!!

This is a request for collecting data from the students through a google form for the Ph.D. study.

I am Haseena VKKM, Presently working as a Library Information Assistant, at IIT Hyderabad Library. I am a part-time Ph.D. scholar in Library Science at the University of Calicut, Kerala. My topic of research is "Assessment of Metaliteracy Competency among Students of IITs in South India: An Investigation". I need to collect data from IIT students and kindly request you grant permission for the same. I assure you that the data will be used for academic purposes only.

A permission letter from the University of Calicut is attached.

Thanks & Regards
Haseena.VKKM
Ph.D. Scholar, Dept. of Library and Information Science
University of Calicut
Ph:9605972978

Sender notified by
Mailtrack

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**BL Tembe** <bltembe@iitdh.ac.in> Fri, Jul 22, 2022 at 10:22 AM
To: "Haseena.V.K.K.M" <vkkmhaseena@gmail.com>, Public Relations Officer <pro@iitdh.ac.in>

Dear Ms. Haseena:

Kindly approach pro@iitdh.ac.in with copies of permissions from other IITs.

B L Tembe

**Public Relations Officer** <pro@iitdh.ac.in> Mon, Aug 8, 2022 at 3:14 PM
To: "Haseena.V.K.K.M" <vkkmhaseena@gmail.com>
Cc: Dean Student Welfare <dean.sw@iitdh.ac.in>

Dear Ms Haseena,

Your request has been accepted with the following conditions:
1. You should forward the questionnaire and the Google Forms link to us.
2. We will forward the Google Forms link to the students (UG, PG and PhD).
3. The students will be asked to fill and submit the Google Forms on voluntary basis. We will give a deadline (of about a week) for submission and we shall not be following up with the students with reminders, etc.
4. Wherever you are using the data collected from IIT Dharwad, you should clearly mention the same and also provide a copy to us for our records.
5. The data collected from the students of IIT Dharwad should be solely used for Academic purposes only.

Thanks & regards,
Anilkumar Angadi
Public Relations Officer
Indian Institute of Technology Dharwad,
WALMI Campus, Belur Industrial Area,
Near High Court, Dharwad,
Karnataka - 580011.
Mobile: 9886116537

[Quoted text hidden]

Gmail

Haseena V K K M <vkkmhaseena@gmail.com>

**Permission to collect data for a Ph.D. research:IITTP reg.**

4 messages

**Haseena.V.K.K.M** <vkkmhaseena@gmail.com> Sun, Jun 19, 2022 at 9:21 PM
To: dost@iittp.ac.in

Dear Sir/Madam,
Greetings!!

This is a request for collecting data from the students through a google form for the Ph.D. study.

I am Haseena VKKM, Presently working as a Library Information Assistant, at IIT Hyderabad Library. I am a part-time Ph.D. scholar in Library Science at the University of Calicut, Kerala. My topic of research is "Assessment of Metaliteracy Competency among Students of IITs in South India: An Investigation". I need to collect data from IIT students and kindly request you grant permission for the same. I assure you that the data will be used for academic purposes only.

A permission letter from the University of Calicut is attached.

Thanks & Regards
Haseena.VKKM
Ph.D. Scholar, Dept. of Library and Information Science
University of Calicut
Ph:9605972978

Sender notified by
Mailtrack

**Data collection Request.pdf**
495K

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**Dean of Students Affairs IITT** <dean_sa@iittp.ac.in> Sat, Jun 25, 2022 at 11:21 AM
To: "Haseena.V.K.K.M" <vkkmhaseena@gmail.com>

Dear Ms.Haseena,

Yes, you can collect the data from our students.

Thanks & Regards

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**Dr. N. VENKAIAH**
**Dean of Students Affairs**
**Indian Institute of Technology Tirupati**
Yerpedu – Venkatagiri Road, Yerpedu Post,
Tirupati District, A.P - 517619
Phone: 0877-2503035 (Office)
94937 08913 (Mobile)

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