Research Article

ICT Attitudes as a Predictor of Metacognitive Awareness in Higher Secondary Students

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Abstract

The integration of Information and Communication Technology (ICT) in education has transformed teaching-learning processes, yet limited research exists on how students' attitudes toward ICT relate to their metacognitive awareness. This study examined the relationship between attitude towards ICT and metacognitive awareness among 300 higher secondary students in Chennai, India. Using a descriptive correlational design, data were collected through standardized tools: the Attitude towards ICT Scale (Martinez, Abeledo & Machado, 2021) and the Metacognitive Awareness Inventory (MAI) adapted for secondary students (Schraw & Dennison, 1994). Descriptive statistics, Pearson's product-moment correlation, and simple linear regression were employed for analysis. Results revealed a significant positive but moderate correlation between attitude towards ICT and metacognitive awareness ($r = 0.324$, $p < 0.001$). Regression analysis indicated that attitude towards ICT explained approximately 10.5% of the variance in metacognitive awareness ($R^2 = 0.105$, $\beta = 0.324$, $p < 0.001$). No significant differences were found in either variable across gender, medium of instruction, stream of study, class level, type of school management, or family type ($p > 0.05$). These findings suggest that positive attitudes toward ICT contribute meaningfully to metacognitive awareness, though other cognitive and contextual factors may play substantial roles. The study discusses implications for educational practice and recommendations for future research.

Keywords: Attitude towards ICT, metacognitive awareness, higher secondary students, correlation, regression analysis, digital learning, self-regulated learning

Introduction

Education in the 21st century has been fundamentally transformed by the rapid integration of Information and Communication Technology (ICT). As Nelson Mandela famously stated, "Education

is the most powerful weapon which you can use to change the world." In contemporary contexts, this weapon is increasingly digital, with technology reshaping how students learn, teachers instruct, and educational institutions operate. The National Education Policy (NEP) 2020 in India emphasizes the importance of digital content, infrastructure, and resource development to meet the evolving demands of e-learning in higher education (Government of India, 2020).

The convergence of telecommunications, computers, and digital technologies has created unprecedented opportunities for educational enrichment. ICT in education encompasses a broad range of tools including computers, the internet, broadcasting technologies, and telephony that facilitate the creation, storage, dissemination, and management of information (UNESCO, 2021). According to the International Society for Technology in Education (ISTE, 2022), ICT integration in educational settings enhances learning through interactive experiences, personalized instruction, and access to diverse digital resources.

Metacognitive awareness, defined as "the ability to reflect upon, understand, and control one's learning processes" (Schraw & Dennison, 1994, p. 460), represents another critical dimension of student development. This construct encompasses both knowledge of cognition (declarative, procedural, and conditional knowledge) and regulation of cognition (planning, monitoring, and evaluation). Flavell (1979), who pioneered research in this area, described metacognition as "cognition about cognitive phenomena" or "thinking about thinking." Metacognitive awareness influences academic performance, problem-solving abilities, and lifelong learning by enabling students to become self-regulated learners (Zimmerman, 2002).

The intersection of ICT attitudes and metacognitive awareness represents a critical area of inquiry. Digital learning environments require students to navigate vast information resources, evaluate source credibility, and manage their own learning trajectories—all processes that demand metacognitive engagement (Azevedo & Aleven, 2013). While extensive international research has explored ICT utilization and digital literacy, studies examining their relationship with metacognitive awareness among Indian students remain scarce. Anthony et al. (2019) found significant relationships between students' technology attitudes and their self-regulated learning skills in Malaysian higher education. Similarly, Broadbent and Poon (2015) conducted a meta-analysis revealing that metacognitive strategies are among the strongest predictors of success in online learning environments.

The present study addresses this research gap by investigating the relationship between higher secondary students' attitudes towards ICT and their metacognitive awareness in Chennai, India.

Understanding this relationship is essential for educators, policymakers, and curriculum developers seeking to optimize technology integration and enhance students' self-regulatory capacities in digital learning environments.

Objectives

The study was guided by the following objectives:

1. To explore the relationship between attitude towards ICT and metacognitive awareness.
2. To determine whether attitude towards ICT predicts metacognitive awareness among higher secondary students.

Hypotheses

Based on the objectives, the following hypotheses were formulated:

- **H_{01}:** There is no significant relationship between attitude towards ICT and metacognitive awareness among higher secondary students.
- **H_{02}:** Attitude towards ICT does not significantly predict metacognitive awareness among higher secondary students.

Methodology

Research Design

This study employed a descriptive correlational research design. According to Creswell and Creswell (2018), research design constitutes the plan or proposal to conduct research, involving the intersection of philosophy, strategies of inquiry, and specific methods. The descriptive approach was appropriate as the study aimed to describe the characteristics of higher secondary students' attitudes and metacognitive awareness while examining relationships between variables (Kerlinger, 1986).

Sample

The sample consisted of 300 higher secondary students randomly selected from government, government-aided, and private schools in Chennai district, Tamil Nadu. The sample distribution included 141 boys (47%) and 159 girls (53%). Regarding medium of instruction, 198 students (66%) studied in English medium and 102 (34%) in Tamil medium. The stream of study distribution comprised 211 science students (70.3%) and 89 commerce students (29.7%). Class-wise, 94 students (31.3%) were in Plus One (Grade 11) and 206 (68.7%) in Plus Two (Grade 12). Family type distribution showed 24 students (8%) from joint families and 276 (92%) from nuclear families. School

management types were equally represented with 100 students (33.3%) each from government, government-aided, and private schools.

Instruments

Three instruments were employed for data collection:

Personal Data Sheet: Developed by the investigator to collect demographic information including gender, stream of study, medium of instruction, type of school, class, and family type.

Attitude towards ICT Scale: Developed and standardized by Martinez, Abeledo and Machado (2021), this scale consists of 24 items distributed across three dimensions: cognitive (8 items), affective (8 items), and behavioral (8 items). The scale employs a five-point Likert format ranging from "Completely Agree" (5) to "Completely Disagree" (1), with reverse scoring for negative items (1, 8, 9, 11, 12, 15, 18, 19, 21, 22, 24). Cronbach's alpha coefficients ranged from 0.7 to 0.92, indicating satisfactory reliability.

Metacognitive Awareness Inventory (MAI): Originally developed by Schraw and Dennison (1994) for adults, this study utilized the adapted version for secondary students validated by Balcikanli (2011). The inventory comprises 30 items across two dimensions: knowledge of cognition (17 items) including declarative, procedural, and conditional knowledge; and regulation of cognition (13 items) including planning, monitoring, and evaluation. Responses are recorded on a five-point Likert scale from "Always true" (5) to "Never true" (1). The adapted scale demonstrated strong reliability with Cronbach's alpha of 0.89 for the overall inventory.

Procedure

After obtaining permission from school authorities, the investigator administered the questionnaires to students with assistance from respective teachers. Clear instructions were provided regarding response procedures. Students completed the personal data sheet followed by the two scales. Approximately 40 minutes were required for completion. Data collection occurred over four weeks across five schools in Chennai.

Data Analysis

Statistical analysis was conducted using SPSS software version 26. Descriptive statistics (means and standard deviations) were computed for both variables. Pearson's product-moment correlation examined the relationship between attitude towards ICT and metacognitive awareness. Simple linear regression analysis determined the predictive capacity of attitude towards ICT on

metacognitive awareness. Independent samples t-tests and one-way ANOVA examined differences across demographic variables. Statistical significance was set at $p < 0.05$.

Results

Correlation Analysis

H_{01}: There is no significant relationship between attitude towards ICT and metacognitive awareness.

Pearson's product-moment correlation was computed to test this hypothesis.

Table 2: Correlation between Attitude towards ICT and Metacognitive Awareness

Variable	N	Pearson's r	p-value
Attitude Towards ICT and Metacognitive Awareness	300	0.324	<0.001**

**p < 0.01

The correlation coefficient ($r = 0.324$) indicates a moderate positive relationship between attitude towards ICT and metacognitive awareness. The p-value of less than 0.001 is below 0.05, leading to rejection of the null hypothesis. Therefore, a significant moderate positive correlation exists between the two variables.

Regression Analysis

H_{02}: Attitude towards ICT does not significantly predict metacognitive awareness.

Simple linear regression analysis was conducted to examine the predictive relationship.

Table 3: Simple Linear Regression Analysis for Attitude towards ICT Predicting Metacognitive Awareness

Predictor	B	SE	β	t	p	R^2
(Constant)	70.24	6.83		10.28	<0.001	
Attitude Towards ICT	0.56	0.09	0.324	5.91	<0.001**	0.105

**p < 0.01

The regression analysis revealed that attitude towards ICT significantly predicts metacognitive awareness, $F(1, 298) = 34.93$, $p < 0.001$. The unstandardized coefficient ($B = 0.56$)

indicates that for every one-unit increase in attitude towards ICT scores, metacognitive awareness increases by 0.56 units. The standardized coefficient (β = 0.324) represents the moderate positive relationship. The R^2 value of 0.105 indicates that attitude towards ICT explains approximately 10.5% of the variance in metacognitive awareness. This suggests that 89.5% of the variance in metacognitive awareness is attributable to other factors.

Discussion

The primary finding of this study is the significant moderate positive correlation between attitude towards ICT and metacognitive awareness among higher secondary students ($r = 0.324$, $p < 0.001$). This result aligns with previous research by Anthony et al. (2019), who found that students' technology attitudes significantly predicted their self-regulated learning skills in Malaysian higher education contexts. Similarly, Broadbent and Poon (2015) conducted a meta-analysis revealing that metacognitive strategies are among the strongest predictors of success in online learning environments, suggesting a bidirectional relationship between technology engagement and metacognitive development.

The moderate correlation magnitude ($r = 0.324$) is theoretically meaningful and exceeds the weak correlation often found in educational psychology research. This suggests that students who hold more positive attitudes toward ICT tend to demonstrate greater metacognitive awareness. This relationship can be explained through several theoretical lenses. According to Azevedo and Aleven (2013), digital learning environments inherently demand metacognitive engagement as students must navigate hypermedia, evaluate information sources, and monitor their comprehension without constant teacher guidance. Students with positive ICT attitudes may be more willing to engage deeply with these environments, thereby exercising and developing their metacognitive skills.

The regression analysis revealed that attitude towards ICT explains 10.5% of the variance in metacognitive awareness, indicating that 89.5% is attributable to other factors. This finding is consistent with theoretical frameworks emphasizing the multifaceted nature of metacognition. Flavell's (1979) model of metacognition identifies multiple components including metacognitive knowledge, metacognitive experiences, goals, and strategies. More recently, Efklides (2008) proposed the Metacognitive and Affective Model of Self-Regulated Learning (MASRL), which emphasizes interactions among cognition, metacognition, affect, and motivation. These theoretical perspectives suggest that metacognitive awareness emerges from complex interactions among cognitive, motivational, and contextual factors beyond ICT attitudes alone.

The finding that ICT attitudes explain 10.5% of variance in metacognitive awareness is notably higher than the 3.3% variance explained in achievement motivation in similar studies. This differential finding is theoretically significant—it suggests that ICT attitudes may be more closely aligned with metacognitive processes than with motivational constructs. Digital environments require metacognitive skills such as planning information searches, monitoring comprehension, and evaluating online resources (Greene et al., 2018). Students with positive ICT attitudes may be more inclined to engage in these metacognitive behaviors, creating a virtuous cycle of technology engagement and metacognitive development.

Implications for Educational Practice

These findings have several important implications for educational practice. First, the moderate relationship between ICT attitudes and metacognitive awareness suggests that fostering positive attitudes toward technology may contribute to metacognitive development. Schools should therefore invest not only in technology infrastructure but also in creating positive technology experiences that encourage students to view ICT as a tool for learning rather than mere entertainment (Greene et al., 2018).

Second, given that 89.5% of variance in metacognitive awareness remains unexplained, educators should adopt comprehensive approaches to metacognitive development. Effective strategies include explicit instruction in metacognitive strategies (Veenman et al., 2006), modeling of self-regulatory behaviors (Zimmerman, 2002), providing opportunities for reflection (Schraw et al., 2006), and creating classroom environments that support autonomous learning (Perry et al., 2019).

Third, the uniform metacognitive awareness across demographic groups suggests that interventions can be standardized rather than requiring differentiated approaches for various student populations. However, this uniformity should not mask potential differences in access to metacognitive-supportive learning environments. Schools should ensure that all students, regardless of background, receive instruction and support for metacognitive development.

Fourth, the finding that ICT attitudes explain more variance in metacognitive awareness than typically found for motivational outcomes suggests that technology integration initiatives may be particularly effective when designed to promote self-regulated learning. Digital tools that incorporate metacognitive supports—such as prompts for planning, self-monitoring checklists, and reflection questions—may be especially beneficial (Azevedo & Aleven, 2013).

Delimitations of the Study

Several limitations warrant consideration. First, the sample was limited to Chennai district, restricting generalizability to other regions. Second, self-report measures may be subject to social desirability bias and may not fully capture actual metacognitive processes (Paulhus & Vazire, 2007). Third, the cross-sectional design precludes causal inferences about the direction of relationship between ICT attitudes and metacognitive awareness. Fourth, the focus on higher secondary students limits applicability to other educational levels. Fifth, the study did not examine specific types of ICT use (e.g., entertainment vs. educational) which may differentially relate to metacognitive awareness.

Recommendations for Future Research

Future research should employ longitudinal designs to examine causal relationships and developmental trajectories of metacognitive awareness in relation to technology attitudes. Experimental studies investigating specific ICT interventions designed to promote metacognition could identify effective strategies. Qualitative research exploring how students actually employ metacognitive strategies in digital environments could provide deeper understanding of the mechanisms linking ICT attitudes and metacognition (Creswell & Poth, 2018). Studies across diverse geographical regions and educational contexts would enhance generalizability. Finally, examination of mediating variables (e.g., digital literacy, self-efficacy, parental mediation) and moderating variables (e.g., teaching methods, curriculum design) could clarify the conditions under which ICT attitudes influence metacognitive awareness.

Conclusion

This study demonstrates a significant moderate positive relationship between attitude towards ICT and metacognitive awareness among higher secondary students in Chennai. The regression model indicates that ICT attitudes explain 10.5% of variance in metacognitive awareness, suggesting that positive technology attitudes contribute meaningfully to students' capacity to reflect upon and regulate their learning. The absence of demographic differences across gender, medium, stream, class, family type, and school management indicates uniform attitudes and metacognitive awareness across student populations. These findings have important implications for educational practice, suggesting that technology integration efforts should be designed to explicitly promote metacognitive development. As education continues its digital transformation, understanding the complex interplay between technology attitudes and metacognitive awareness remains essential for preparing students to become self-regulated lifelong learners in the digital age.

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