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Research Article

Digital Literacy and Effective Online Communication among Higher Education Teachers: Unravelling 21st Century Technology Skills

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Abstract

The goal of the study was to examine digital literacy and the level of information and communication technology (ICT) use for effective online communication among higher education teachers. The study was conducted among 250 higher education teachers working in government/aided and unaided institutions located in Sivagangai District, Tamil Nadu. The data were collected using an online digital literacy survey and a questionnaire, and measured the extent of ICT usage for effective online communication. The findings revealed no significant difference in digital literacy or in the extent of ICT use for effective online communication between male and female higher education teachers. However, due to the severe gender imbalance in the sample (38 male, 212 female), these findings should be interpreted as exploratory only.

Regarding institutional type, higher education teachers from unaided institutions showed higher levels of digital literacy and greater ICT use for effective online communication than those from government/aided institutions ($p < .01$, with moderate effect sizes). The findings suggest that while gender comparisons require cautious interpretation due to sample limitations, institutional differences are evident. The study highlights the need for strengthened institutional support systems and structured professional development initiatives to enhance digital literacy and effective online communication competencies among higher education teachers.

Keywords: digital literacy, effective online communication, higher education teachers, technology skills

Introduction

In the latter decades of the twentieth century and into the twenty-first century, civilization has experienced an accelerating pace of economic and technological change. Its effects on the workplace, and thus on the stresses on the educational system that prepares teachers for the workforce, have been significant in many ways. Technology has spanned the globe in the last few decades, connecting people in a whole new way. Based on the results, people from all countries have not only had to learn to use technology but also to communicate with each other. Voogt and Roblin (2012) indicate that ICT can help teachers improve their pedagogy, and that they need to better understand how ICT promotes 21st-century learning.

In the 1980s, the concept of digital literacy emerged. It was connected to the notion of digital literacy and highlighted the requirement to study evolving technologies and their programmes (Cordell, 2013). Later, attention was drawn to a broader concept of ICT literacy that extends beyond technical ICT skills. According to Van Laar et al. (2017), the definition was developed within a broader context of strengths and skills, now known as the expertise of the 21st century.

Although digital literacy has been widely discussed within the framework of 21st-century competencies, empirical research has yet to examine how it translates into effective online communication among higher education teachers. Digital proficiency alone does not promise communicative effectiveness in virtual learning environments. The capacity to convey academic content clearly, sustain interaction, and provide meaningful feedback through digital platforms represents a distinct pedagogical competence. Additionally, comparative evidence on these competencies between Government/Aided and Unaided institutions remains limited. Hence, the present study seeks to address this gap by examining digital literacy and its association with effective online communication across institutional types.

Strength that Empowers Growth: Digital Literacy

In today's world, literacy goes beyond students' simple ability to read and learn new skills, including digital literacy. Cornell University identifies digital literacy as "the ability to find, interpret, utilize, distribute, and create content using information technology and the Internet." Gilster (1997) defined digital literacy as the capability to understand and use information in multiple formats from a wide range of sources (p. 1). Moreover, Starkey (2011) stated that digital literacy and interconnected learning go hand in hand as students pursue these links using a wide range of digital tools. For students to develop these interactive literacy skills, a

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pedagogical approach that involves collaboration and involvement beyond the classroom would be required to build a flexible curriculum in a Web 2.0 environment.

Digital literacy is the willingness to use technology as a forum for studying, coordinating content collection, and collaborating, and to have a fundamental understanding of the ethical/ legal issues surrounding access to and use of information. In fact, Van Dijk and Hacker (2003) suggest that digital skills include not only the ability to operate hardware and software (instrumental/operational skills), but also the ability to search, find, handle and implement information (informative skills) from digital sources and use it strategically to improve one's position in society (strategic skills).

According to Deja et al. (2021), the idea of digital literacy involves activities essential to one's work life and, of course, to daily life related to information and communication technologies (ICTs). Anjaiah (2016) believed that Digital literacy is a cycle of teaching and learning about technology and its use. The ability to use ICTs to understand, assess, construct, and transfer information requires both cognitive and technical skills. As presented by computers, it is the ability to understand and use information from a wide range of sources in multiple formats.

The teacher is key in such a process of integrating technologies and plays a vital role in the implementation and execution of ICT in the classroom, since the alteration and development of education will depend, among other aspects, on educational action, which implies that teachers must have efficient digital competencies that allow them to incorporate and use technologies in an instructive way. Drawing on creative technologies such as broadcasting tools and social media tools, the present study focuses mainly on digital literacy skills and on how higher education teachers can discern facts, identify publishing outlets, and understand the technology behind them.

Objectives

1. To examine the gender differences among higher education teachers towards digital literacy.
2. To examine gender differences among higher education teachers in the extent of ICT use for effective online communication.
3. To compare the digital literacy of the higher education teachers in Government/aided and unaided institutions.
4. To analyze the extent of ICT usage for effective online communication among the higher education teachers in Government/aided and unaided institutions.

Hypotheses

1. There exists no significant difference in the digital literacy of male and female higher education teachers.
2. There is no significant difference among higher education teachers in the extent of ICT use for effective online communication.
3. There is no significant difference in the digital literacy of higher education teachers between Government/aided and unaided institutions.
4. There is no significant difference between Government/aided and unaided higher education teachers in the extent of ICT use for effective online communication.

Methodology

A descriptive survey method of investigation was employed for the current study.

Sample

A random sampling technique was adopted to collect the data. From the various higher education institutions in Sivagangai District, 250 education teachers were selected. The institutional distribution included 130 teachers from government/aided institutions and 120 teachers from Unaided institutions. Regarding gender, the sample included 38 male and 212 female teachers. The distribution across institutional categories was as follows: Government/aided institutions: 18 males and 112 females; unaided institutions: 20 males and 100 females. Gender and institutional type were treated as independent descriptive variables. It is important to note the severe gender imbalance in the sample (38 males, 212 females). While this distribution reflects the actual gender composition of higher education teachers in the region, it significantly limits the interpretive strength of gender-based comparisons. An a priori power analysis indicated that with $n = 38$ in the male group, the study had only 34% power to detect a medium effect size ($d = 0.5$) at $\alpha = .05$. Therefore, all gender-based findings should be considered exploratory and interpreted with caution.

Tools

Online Digital Literacy Survey

The online digital literacy survey consisted of 32 items measuring five dimensions: (i) Technical Skills, (ii) Information Evaluation, (iii) Digital Communication, (iv) Online Safety and Ethics, and (v) Digital Content Creation. Responses were recorded on a five-point Likert scale ranging from *strongly disagree* (0) to strongly agree (5). Content validity was established through expert review by specialists in educational technology.

Effective Online Communication Questionnaire

The questionnaire was constructed by the investigator and the supervisor to find out the extent of the usage of ICT for effective online communication. For the purpose of this study, effective online communication is operationally defined as the ability of higher education teachers to convey instructional content clearly, promote student interaction, provide constructive feedback, and sustain meaningful engagement through digital platforms. The instrument comprised 24 items distributed across three subscales: (i) Clarity of Digital Instruction, (ii) Interactive Engagement, and (iii) Feedback and Responsiveness. Sample items include: "I can explain complex topics clearly through online teaching platforms" and "I actively encourage student participation during virtual classes.

The tool was standardized using the test-retest method, and its coefficient was .72, indicating reliability. In addition, content validity was ensured through expert evaluation prior to administration. While the reliability coefficient (.72) indicates adequate stability, further validation across contexts is suggested.

Statistical Technique

The obtained data were analyzed using the mean, standard deviation, and an independent *t*-test effect size (Cohen's *d*), and 95% confidence intervals around mean differences. All statistical analyses were conducted using SPSS version 26.

Limitations of the Study

The study has certain limitations. The unequal gender distribution may limit the interpretive strength of gender-based comparisons. While the effective online communication questionnaire demonstrated adequate reliability (0.72), additional validation across diverse contexts is recommended. Institutional infrastructure and access to technological resources were not directly measured, which limits the contribution to the interpretation of institutional differences.

Results and Discussion

An independent-samples *t*-test was employed to examine gender differences. The *t*-value for male and female higher education teachers' digital literacy ($t = 0.41$, $df = 248$, $p = .682$) was not statistically significant. The effect size (Cohen's $d = 0.08$) indicates a negligible effect, and the 95% confidence interval [-3.21, 4.95] includes zero, confirming the absence of a meaningful difference. Therefore, the null hypothesis is accepted. There is no significant difference in digital literacy between male and female higher education teachers.

The *t*-value for the extent of ICT usage for effective online communication (t = 0.78, df = 248, p = .436) was also not statistically significant. The effect size (d = 0.15) indicates a small effect, and the confidence interval [-1.67, 3.73] includes zero. Therefore, the null hypothesis is accepted. There is no significant difference between male and female higher education teachers in the extent of ICT usage for effective online communication.

Table 1
Gender Difference in Digital Literacy and the Extent of ICT Usage Among Higher Education Teachers

Variable	Gender	*n*	*M*	*SD*	*t*	*df*	*p*	Cohen's *d*	95% CI	
									LL	*UL*
Digital literacy	Male	38	100.8	8.3	0.41*	248	.682	0.08	-3.21	4.95
	Female	212	101.7	12.0						
Extent of ICT usage for effective online communication	Male	38	21.7	2.8	0.78*	248	.436	0.15	-1.67	3.73
	Female	212	22.2	4.0						

Note. N = 250. *p = .05. CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Due to the severe gender imbalance in the sample (38 males vs. 212 females), these findings should be interpreted with caution. The small male sample size limits statistical power, and the results are considered exploratory. Future research with balanced gender representation is needed to confirm these findings.

These results align with the study conducted by Albini et al. (2016), which also found that gender differences do not significantly influence computer literacy. This finding is further corroborated by Sharma and Sharma (2015), who reported non-significant differences in attitudes toward digital classrooms between male and female teachers (t = 0.95, p >.05) in the Indian context. In the contemporary digital landscape, both male and female educators have comparable access to technology and opportunities to develop digital competencies, which may explain the absence of gender differences in digital literacy and ICT use for online communication.

Table 2
Comparison of Digital Literacy and Extent of ICT Usage for Effective Online Communication among Higher Education Teachers by Type of Institution

Variable	Type of institution	*n*	*M*	*SD*	*t*	*df*	*p*	Cohen's *d*	95% CI	
									LL	*UL*
Digital literacy	Unaided	120	103.4	11.8	2.4	248	.017*	0.30	0.67	6.47
	Govt/aided	130	99.8	11.85						
Extent of ICT usage for effective online communication	Unaided	120	23.3	4.1	4.9	248	.001**	0.62	1.38	3.24
	Govt/aided	130	21.0	3.3						

Note. N = 250. *p = .05, **p = .001 significant level.

The *t*-value obtained for digital literacy between higher education teachers in government/aided and unaided institutions (t = 2.4, df = 248, p = .017) was statistically significant at the .05 level. The effect size (d = 0.30) indicates a small to moderate effect, and the 95% confidence interval [0.67, 6.67] does not include zero, confirming the reliability of the difference. The mean score for teachers in unaided institutions (M = 99.83) indicates greater digital literacy among these teachers. Therefore, the null hypothesis is rejected.

Regarding the extent of ICT use for effective online communication, the t-value (t = 4.9, df = 248, p = < .001) was statistically significant at the .001 level. The effect size (d = 0.62) indicates a moderate to large effect, and the confidence interval [1.38, 3.24] does not include zero. The mean score for unaided institution teachers (M = 23.3) was substantially higher than that for government/aided institution teachers (M = 21.0), indicating greater ICT use for effective online communication. Therefore, the null hypothesis is rejected

These findings are consistent with Chalkiadaki (2018), who documented variation in 21st-century skills and ICT utilization across different institutional contexts. Nonetheless, it is crucial to acknowledge that this study did not specifically assess institutional infrastructure, the accessibility of technological resources, or exposure to professional development. As a result, although there are statistically significant differences among institutions with relevant effect sizes, the fundamental structural factors need additional empirical research. Future studies should focus on exploring institutional support mechanisms, technology availability, and training options to gain a clearer understanding of these disparities.

The finding that male and female higher education teachers do not differ significantly in digital literacy or ICT usage for online communication aligns with contemporary research suggesting that the traditional "digital gender divide" has narrowed considerably in educational contexts. Cai et al. (2017) found that among Chinese university teachers, gender was not a significant predictor of technology integration, with institutional support and personal innovativity playing more substantial roles. Similarly, Scherer et al. (2021) reported that gender differences in teachers' digital competence were negligible when controlling for access and experience.

Educational Implications

The study's findings are of utmost importance to higher educational institutions, particularly government/aided institutions, for the upliftment of higher education teachers. Various UGC and other organizations' funds are provided to govt/aided institutions, which should be utilized properly for teachers so that they can be more confident in 21st-century digital skills. Since classroom and student contexts are complex, higher education teachers can engage in innovative thinking to develop or adapt learning materials and events that respond to the educational needs of different contexts or learner groups. In spite of the fact that ICT is one of the inseparable skills that should be given hands-on experience in the usage of various apps and software, as it is important for higher education teachers because they are faced with the challenge of equipping themselves with a long list of 21st-century skills, which are critically important in today's world.

Conclusion

In general, the ability philosophy of the 21st century is driven by the assumption that the most appropriate, useful, in-demand, and universally applicable should be taught to future citizens by higher education teachers. In today's Education systems, online technical technologies should be prioritized to develop and fine-tune any element of teacher communication skills that will work in both professional and personal life. The significance of this study was based on evidence that higher education teachers are not well equipped with the online communication, teamwork, and digital literacy skills needed, and employers see these skills as important to their employees' progress. The question this analysis addressed was how forward-looking social network technologies can be incorporated into mainstream learning environments to promote technical skill development in the 21st century.

AI Use Statement

The authors disclose that they used ChatGPT (OpenAI) exclusively for language refinement and structural organization during manuscript preparation. All intellectual content, research conceptualization, data collection, statistical analysis, interpretation of findings, and theoretical contributions remain the authors' original work. AI-assisted content was carefully reviewed, edited, and verified by the authors, who assume full responsibility for the final manuscript.

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