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Attitudes Towards Digital literacy as a catalyst for technology-driven society praxis: a field study of Egyptian student teachers

Fayrouz Ramadan Elwakil*

Department of Foundations of Education, college of Education, Tanta University, Tanta, Egypt.

*Corresponding author:

Fayrouz Elwakil

E-mail: fayrouz_ramadan@edu.tanta.edu.eg

Abstract

Higher education institutions have a pivotal role in readying students to fulfill the requirements of a progressively technology-driven society. Drawing on a survey of 1222 student teachers in five universities in Egypt, this study investigates student teachers' real-life encounters with digital technology throughout their academic studies, aiming to provide a better understanding of the actual realities that student teachers encounter when utilizing technology. That is, student teachers' views on digital literacy and their levels of knowledge as well as their utilization of digital literacy were assessed in terms of various variables (gender, major, income level, and university affiliation). The study utilized a descriptive survey model, employing various statistical methods involving ANOVA, t-tests, and the Bonferroni test to analyze the collected data. The findings revealed that student teachers held generally fair and positive perspectives on digital literacy. The findings of the research conducted according to independent variables revealed that the digital literacy of student teachers varies according to gender, economic level, and university affiliation variables, but no significant difference was identified in terms of major. The results were subsequently discussed in the context of pertinent literature.

Keywords: *digital literacy; digital technologies; student teachers.*

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Introduction

In today's tech-driven society, with the emergence of the knowledge-based economy and the widespread adoption of the "Internet of Things," possessing digital skills and literacy is vital for individuals pursuing global goals **(Castells 2011) .**Possessing digital citizenship has emerged as a crucial skill set essential for the evolving demands of the workforce and navigating intricate social dynamics **(Erdem et al. 2023).** This encompasses various proficiencies such as technological literacy, a nuanced understanding of the digital realm and culture, ensuring secure communication online, active engagement in social media, awareness of digital etiquette and privacy, as well as active participation in and advocacy for a participatory democracy **(Işikli 2015).** The impact of digitizing our daily lives has brought about notable consequences in the sphere of education. With the widespread adoption of digital devices as well as educational software, schools and teachers are navigating the challenges of incorporating technology into the curriculum and equipping learners for their cybernetic futures, while in the midst of these challenges, the concept of "digital literacy" has surfaced as a crucial idea, aiding educators, researchers, and educational authorities in understanding the conflicting expectations placed on schools and learners in a digitally driven culture**(Pangrazio, Godhe, and Ledesma 2020) .**

It was in the United States, with the 1997 release of Digital Literacy (DL) by Paul Gilster, that the term "digital literacy" first originated **(Gilster and Glister 1997)**. DL is conceptualized as an individual's ability to effectively use digital resources; it embodies the technical, social, and cognitive abilities necessary to thrive in today's information-based society **(Alkali & Amichai-Hamburger, 2004; Mohammadyari & Singh, 2015) .**

Teacher qualifications are crucial factors that influence the development of future generations, and teachers who are enterprising and efficient tend to thrive in their profession and rebound swiftly and effectively from challenges **(Elwakil 2023)**. Teachers, being role models, must possess digital skills to promote their students in acquiring them. The importance of how teachers can guide students in developing digital citizenship competence, along with the significance of DL in fostering critical thinking among students, represent a core tent in the spheres of the 21stcentury **(De Abreu 2010)** . The undeniable reality is that technology has significantly influenced the educational culture, altering how students perceive and expect higher education. Consequently, this matter requires significant consideration from scholars and university administrators alike. Accordingly, the university should adjust its strategies to create an environment that resonates with the attributes of contemporary generations **(Ashour 2020)** . Scrutinizing the digital

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habits of pre-service educators is essential for propelling technological progression in education. Consequently, this study seeks to assess how technology has influenced the perspectives of college students preparing to become teachers. By unveiling student teachers attitudes towards DL, the study's results offer insights into their practical utilization of technology throughout their university experience. This research holds significance for policymakers and educators, as its findings can contribute to creating a more supportive academic environment for technology-integrated education.

Students of the twenty-first century: digital natives or digital users?

Digital natives, a term coined by Marc Prensky, refers to the cohort raised in the digital era, immersed in digital technology, and generally proficient and comfortable in its utilization as a fundamental aspect of their daily routines **(Prensky, 2001)**. DL Distance learning enables individuals to efficiently communicate, collaborate, and enhance their productivity, especially when interacting with persons who possess similar skills and competencies **(Martin 2008)**. DL has been figured out to decrease stress levels and diminish individuals' tendency to assess their accomplishments critically **(Eastin and LaRose 2000)**, hence increasing their confidence in their anticipated performance.

Digital natives are characterized by their familiarity and comfort with digital technology, their preference for interactive and multimedia-rich content, their ability to multitask, and their reliance on digital communication and information sources**(Prensky, 2001)** . This delves into the question of whether students are truly "digital natives" or simply "digital users", by examining the extent to which technology has shaped their experiences and cognitive processes. The distinction between being a "digital native" and a "digital user" is important in understanding the depth of influence that technology has on the current generation of students.

Undoubtedly, university students are recognizing and employing digital tools that prove most efficient for them within the context of their undergraduate education. However, these tools may not encompass the broadest, most creative, liberating, enlightening, or exhilarating applications of technological innovation **(Henderson et al., 2017)** .A study by **Thompson(2013)** indicated that learners in higher education mostly use technology primarily for executing routine tasks, indicating a necessity for further support in their technological initiatives.

Henderson et al. (2017) also believe that universities traditional practices and views prohibit change from occurring, forcing learners to adhere to a pre-determined educational framework that barely meets contemporary demands and features. According to **Conole et al. (2008)** , students prefer to do their homework

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utilizing basic technologies such as email, Google searches, and word processing. Similarly, **Buckenmeyer et al. (2016)** showed that the predominant technological practices among students involve activities such as using email, internet searches, and engaging in social networking, whereas students contend that technological tools neither boosted finding out nor did they inspire 'being cognizant outside the box'. According to **Rodríguez-Abitia et al. (2020) ,** universities' digital maturity is evaluated based on three factors: their IT infrastructure (e.g., internet access and computation devices), their use of technology in both instruction and learning (e.g., free educational assets and engaging lessons), and their collaboration and institutional platforms for process integration (systems for workflow and learning social ecosystems).

Conceptually, universities face political, social, and economic deeply rooted barriers that limit their ability to achieve their objectives **(Rodríguez-Abitia and Bribiesca-Correa 2021).** Although there are differences in how different generations adapt to new technologies, the capacity to learn rapidly is not always due to innate technological knowledge. Rather, modern generations' rapid learning may be attributed to their regular adoption of technology. Consequently, it may be more accurate to characterize today's learners as being "digital users" rather instead of "digital natives."

Digital literacy: Has technology revolutionized higher education?

DL is undeniably a crucial life skill within the contemporary knowledge-driven economy and information-centric community **(Martin and Madigan 2006).** Driven by a society reliant on knowledge, where economic prosperity hinges on individuals' ability to manage vast amounts of information and adapt to a constantly evolving workplace, DL has emerged as a critical concept for evaluating individual uptake of information technology **(Mohammadyari & Singh, 2015)** . DL entails the ability to securely and effectively utilize digital technology to access, organize, recognize, combine, communicate, analyze, and generate information in a secure as well as acceptable manner, using digital technology for employment, meaningful work, and entrepreneurial endeavors**(Law et al. 2018)** . DL is characterized as the ability to employ the internet and emerging media to access and evaluate diverse formats and categories of digital information critically, facilitating participation in a community's socioeconomic endeavors through digital content creation, communication, and interaction **(Sharma et al. 2016).**

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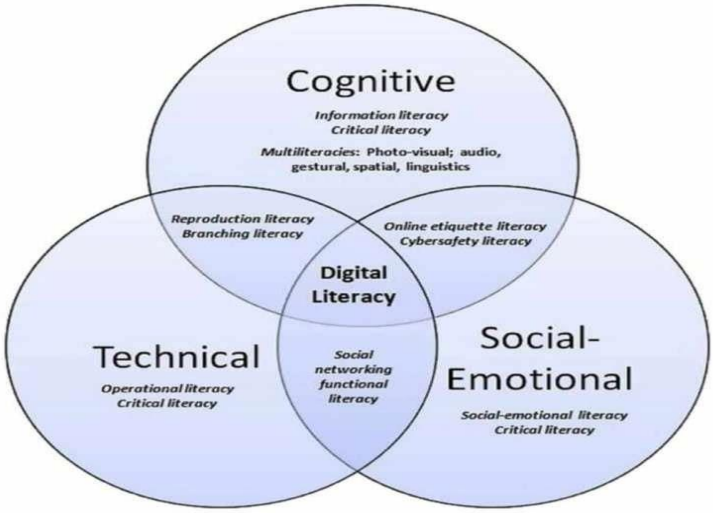

Fig.1 Digital literacy framework (source: **(Ng, 2012)**)

In the e-learning context, access to technology solely is insufficient to ensure that individuals achieve desired socioeconomic objectives, as certain core skills are necessary for the proper use of information technology **(Buckingham 2015).** According to **Rodríguez-Abitia et al. (2020),** universities can be evaluated for their digital maturity by assessing their IT infrastructure, how well they incorporate technology within teaching and learning, and the platforms they offer for collaboration and organizational integration of processes and people. Contextual limitations in the political, social, and economic spheres make it very difficult for colleges to achieve the aforementioned objectives.

The advent of educational digital transformation requires addressing generational gaps between digital native learners as well as ICT-adopting faculty, requiring policies that support infrastructure and creative learning environments for Industry 4.0 and Society 5.0 **(Balyer and Öz 2018)** . The COVID-19 pandemic has spurred a pressing need for universities to transition to digital platforms, necessitating significant alterations in educational processes to effectively address the challenges it presents **(Kamysbayeva et al. 2021)** .According to **Pradhan et al. (2021)**, challenges could be morphed into opportunities for sustainable transformation. Thus, individuals possessing advanced DL can expect that their performance will benefit from using e-learning, since it will be easier for them to access and assess the systems, as well as adjust them to their own learning needs and priorities **(Mohammadyari & Singh, 2015)**.Maintaining a rapport and equipping learners with digital skills are crucial for successfully navigating and thriving in the digital age so as to prepare them for future careers that require digital proficiency,

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adaptability to technological advancements, and effective utilization of electronic tools and platforms **(Dowell 2019).**

According to the **Egypt Vision 2030 for Sustainable Development**, DL for teachers is deemed crucial for a variety of reasons. Initially, it ensures that educators can effectively leverage digital technologies to improve the quality of instruction and educational experiences. Secondly, it qualifies teachers to the essential skills to adapt to the changing educational scene, in which technology plays an increasingly important role. Additionally, DL empowers teachers to nurture critical thinking, creativity, and solution-oriented skills among students, aligning with the broader objectives of sustainable development. Overall, in the context of Egypt's vision for sustainable development, DL is considered crucial for teachers in order to promote educational excellence and provide students with the necessary skills for the future job market. Scholars focusing on digital technologies and emerging literacy research emphasize the significance of utilizing electronic environments to enhance literacy practices. However, there's a noticeable disparity between the classroom practices required for the twenty-first century and teachers' adoption of technological innovations. This discrepancy stems partly from teachers' attitudes toward technology use and their lack of active teaching strategies. To achieve successful incorporation of digital technology in education, it is necessary to possess skills and abilities that go beyond simple access and DL. Student teachers, who will play a key role in crafting the future of the country through education, are expected to possess proficient DL skills. Hence, the importance of digital literacy among student teachers is readily apparent. With this overarching objective in mind, the following inquiries were explored:

• To what extent do student teachers possess digital literacy skills?

• Do student teachers exhibit notable differences in their average digital literacy levels and scores across various subdimensions of digital literacy based on " gender"?

• Is there a significant variation in student teachers' average digital literacy levels and scores across different subdimensions of digital literacy with respect to their "major "field of study?

• Does the average digital literacy level and performance across subdimensions among student teachers vary significantly based on their "income level"?

• Are there significant differences in the average digital literacy levels and performance across subdimensions among student teachers based on their "university affiliation"?

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Method

The descriptive survey model aids in elucidating complex social phenomena and identifying key variables for subsequent explanatory and confirmatory research. Descriptive studies cater to insights and empirical evidence about the current state of a phenomenon, elucidate the interconnections between many occurrences, and facilitate predictions about the future trajectory of the phenomenon **(Pandey 2014).** For this reason, this study employed the descriptive survey model. The Cronbach alpha coefficient was computed to assess the internal consistency of the responses, yielding a value of 0.8. The statistical description of numerical data involves calculating the mean and standard deviation (SD). Categorical data, on the other hand, was expressed using frequencies (numbers for cases) and percentages. The numerical variables were compared utilizing a T test and a one-way ANOVA. A pairwise comparison was performed using the Bonferroni test. Statistical significance was determined for two-sided p-values that were less than or equal to 0.05. The statistical computations were conducted using the IBM SPSS software developed for Microsoft Windows, specifically version 25.

Participants

The research population consisted of 1222 student teachers, selected by a random number generator. The participants in this study were primarily selected from five prominent faculties of education, namely Tanta University (25.9%), Banha University (34.3%), Zagazig University (15.8%), El Mansura University (15.5%), and Kafr Elsheikh (34.3%). 43.4% were student teachers enrolled in theoretical majors, and 56.6% were student teachers enrolled in scientific majors. This group of undergraduate education students was chosen for deeply understanding the perspectives on digital literacy development among student teachers, as these beliefs could significantly influence their future decisions regarding teaching digital literacy to their own students. The majority of the sample consisted of females (83.6%), mirroring the gender distribution of teachers in Egypt, particularly within faculties of education. A large proportion of pre-service teachers (85.4%) have moderate family income **(Table 1).**

Table1. Study participants by their demographic profiles(n=1222)

Studied variables		N	%
Gender	Male	200	16.4
	Female	1022	83.6
Major	Theoretical	530	43.4
	Scientific	692	56.6
Income	Low	144	11.8
	Fair	1043	85.4
	High	35	2.9

University	Tanta	316	25.9
	Banha	105	8.6
	Mansoura	189	15.5
	Zagazig	193	15.8
	Kafr El Sheikh	419	34.3

1- Data collection

The Digital Literacy Scale has been utilized to gauge the attitudes of student teachers regarding digital literacy **(Ng 2012)** . It consists of 10 items and is segmented into three dimensions. Developing essential skills in technical, cognitive, and socio-emotional spheres is key to achieving digital literacy. The technical subscale (6 items) pertains to individuals' technical abilities to utilize ICT effectively for acquiring knowledge and everyday tasks, including connecting devices, understanding their functions, protecting files, troubleshooting, and operating technology competently. Items include *'You know how to resolve your own technical problems'* and *'You possess the technical expertise necessary to utilize ICT for learning as well as to produce artifacts (such as presentations, digital stories, wikis, and blogs), illustrating your comprehension of the material learned'*.

Ng's DL(**Fig.1**) model's cognitive aspect (2 items) involves critically thinking throughout the search, evaluation, and creation phases of managing digital information, as well as selecting suitable software programs for learning or specific tasks, while also necessitating an understanding of ethical, moral, and legal considerations concerning online activities such as copyright and plagiarism. Items include *'you are confident to search and evaluate information effectively from the Web" and 'you are familiar with issues concerning web-based activities, such as cyber safety, search challenges, and plagiarism'.*

The social and emotional subscales (2 items) entail responsibly utilizing the internet for communication, social interaction, and learning, which includes adhering to 'netiquette' guidelines akin to face-to-face communication, safeguarding personal safety and privacy by minimizing the disclosure of personal information. Items include *'you frequently obtain help with your university work from your friends over the Internet, utilizing platforms like Skype, Facebook, and blogs 'and 'ICT facilitates improved collaboration with your peers on projects and various learning tasks'*.

Participants rated their agreement with the statements using a five-point Likert scale (5= strongly agree, 4= agree, 3= undecided/neutral, 2= disagree, and 1 =strongly disagree). Subsequently, the responses were totaled to derive a score for

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each dimension. Back translation, a conventional method, was employed to ensure translation accuracy. The Cronbach's Alpha internal consistency coefficient for the scale was calculated as 0.8. Participant data on key characteristics **(Nasah et al., 2010),** such as gender, age, specialization, university affiliation, and level of family income, were collected.

2- Data analysis

When analyzing the data gathered from the scale, a significance level of $p \leq .05$ was assumed. The data underwent analysis utilizing the SPSS 25.0 software, employing techniques suited to the study's objectives. To ascertain whether there were variations in total scores based on independent variables, parametric analysis methods, namely t-tests for independent samples and one-way analysis of variance (ANOVA), were employed. Should a significant difference be detected, the homogeneity of variances was assessed to pinpoint the specific groups between which the difference existed. In cases where variances were homogeneous, the Bonferroni test, a form of multiple comparisons, was utilized.

3- Results

The key objective of this section is to examine objective 1, which is to evaluate pre-service teachers' technical, cognitive, and socio-emotional perceptions of digital literacy. **Table 2** displays the means and standard deviations in technical awareness, cognitive response, and socio-emotional response from the attitude survey, presenting findings based on the levels of digital literacy perception across technical, cognitive, and socio-emotional dimensions. In comparison to the socio-emotional (M=7.6, SD=1.5) and cognitive (M=7.2, SD=1.5) scales, participants exhibited a higher response on the technical scale (M=21.2, SD=3.6). **Table 3** presents descriptive data pertaining to the digital literacy of pre-service teachers. In the social and emotional dimension of DL concerning the significance of technical skills for ICT adoption, participants expressed a relatively positive stance, albeit predominantly neutral (mean =3.2). However, they were notably more concerned about the impact of this educational enabler on classroom techniques and work dynamism (mean = 4.1) within the school practice sphere.

Grounded on the data shown in **Table 4**, it can be concluded that pre-service teachers possess a positive level of digital literacy. As for the grading of each subscale according to the total score, participants exhibited fair digital literacy competence. According to **Table 4**, 49.6% of the participants demonstrated fair knowledge, while 41.2% indicated good knowledge regarding their digital literacy. Additionally, 61.2% of the participants demonstrated their digital competence on the socio-emotional dimension, while 48.9% demonstrated their digital

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competence on the technical dimension. The first hypothesis was supported as participants showed fair knowledge and awareness toward digital literacy (technical and cognitive). However, participants overall agreed with ICT social and emotional integration.

Table 2. Descriptive Statistics for Digital Literacy Scores and its Three Subscales among Pre-Service Teachers.

Scale	N	Mean	SD
Total DL score	1222	36.1	5.2
Technical dimension score	1222	21.2	3.6
Ability to solve technical problems	1222	3.5	0.8
Easily learning new technologies	1222	3.9	0.8
Keep up with significant new technologies	1222	3.8	0.8
Have knowledge about various technologies	1222	3.4	1
Having technical skills to use ICT	1222	3.2	0.9
Ability to solve technical problems Having good ICT skills	1222	3.4	0.8
Cognitive dimension score	1222	7.2	1.5
Confident with own search	1222	3.9	0.8
Familiar with issues related to web-based activities	1222	3.3	1
Social & emotional dimension score	1222	7.6	1.5
Frequently obtain help from friends	1222	3.6	1
ICT enhances collaborative opportunities with peers for project work	1222	4.1	0.8

Note: Mean scores are one (strongly disagree) to five (strongly agree). Higher scores signify a greater inclination towards the concept of digital literacy among participants.

Table 3. Digital literacy among pre-service teachers.

Item	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		M	SD
	N	%	N	%	N	%	N	%	N	%		
Technical dimension												
Ability to solve technical problems	23	1.9	111	9.1	459	37.6	527	43.1	102	8.3	3.5	0.8
Easily learning new technologies	8	0.7	59	4.8	220	18.0	713	58.3	222	18.2	3.9	0.8
Keeping up with significant new technologies	7	0.6	53	4.3	281	23.0	685	56.1	196	16.0	3.8	0.8

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Have knowledge about various technologies	8	0.7	146	11.9	457	37.4	518	42.4	93	7.6	3.4	0.8
Having technical skills to use ICT	35	2.9	258	21.1	411	33.6	425	34.8	93	7.6	3.2	1
Having good ICT skills	23	1.9	165	13.5	444	36.3	507	41.5	83	6.8	3.4	0.9
Cognitive dimension												
Confidently searching and evaluating web skills	12	1.0	55	4.5	211	17.3	676	55.3	268	21.9	3.9	0.8
Familiarity with web-based activities (cyber safety, search issues, plagiarism)	36	2.9	220	18.0	415	34.0	431	35.3	120	9.8	3.3	1
Social and emotional dimension												
Frequently obtain help with my university work from my friends over the Internet (through Skype, Facebook, Blogs)	40	3.3	150	12.3	282	23.1	570	46.6	180	14.7	3.6	1
ICT enhances collaborative opportunities with peers for project work	14	1.1	39	3.2	158	12.9	642	52.5	642	52.5	4.1	0.8

Note: 5 (strongly agree), 4 (agree), 3 (neutral), 2 (disagree), and 1 (strongly disagree).

Table 4. Data summarizes the findings based on participants' levels of awareness regarding digital literacy across technical, cognitive, and socio-emotional subcategories.

	Poor < 60%		Fair 60-75%		Good > 75%	
	N	%	N	%	N	%
Technical subscale score	162	13.3	597	48.9	463	37.9
Cognitive subscale score	136	11.1	518	42.4	568	46.5
Social and emotional subscale score	80	6.5	394	32.2	748	61.2
Total score	113	9.2	606	49.6	503	41.2

The following section presents the findings for each of the demographic variables. Moving forward, I delve into objective 2, which aims to explore how factors such as gender, field of study, income, and university affiliation influence pre-service teachers' technical, cognitive, and socio-emotional attitudes towards DL.

3.1. Findings related to the Gender variable

The t-test was performed to assess whether there was a difference between the genders of pre-service teachers and their average digital literacy scores, and the results are shown in **Table 5**. Table 5 shows that participants responded more

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strongly to the technical dimension (M=22.3, SD=3.5) than to the cognitive (M=7.7, SD=1.6) and socio-emotional dimensions (M=7.7, SD=1.4). The differences in arithmetic mean scores favours male pre-service teachers.

There were notable differences observed in the technical and cognitive dimensions of digital literacy between male and female individuals. Nevertheless, the study did not find any statistically significant differences in socio-emotional responses between males and girls when including the gender variable.

Table 5. Results from Independent sample T-test according to Gender across total Digital literacy scores and the three subscales.

Scale	Male		Female		P value
	M	SD	M	SD	
Total digital literacy score	37.7	5.3	35.8	5	<0.001*
Technical dimension score	22.3	3.5	21	3.6	<0.001*
Cognitive dimension score	7.7	1.6	7.1	1.5	<0.001*
Social and emotional dimension score	37.7	5.3	7.6	1.5	0.542

Note: *statistically significant ($P \leq 0.05$)

3.2. Findings related to the Major variable

The t-Test was employed to determine whether there was a significant difference between the majors of pre-service teachers and their average scores in digital literacy. The findings are presented in **Table 6**. According to the findings presented in **Table 6**, the participants exhibited greater levels of dedication for the technical dimension (M=21.2, SD=3.6) in comparison to the socio-emotional dimension (M=7.7, SD=1.5) and cognitive dimension (M=7.3, SD=1.5). No significant differences were found between theoretical and scientific majors in attitude responses regarding the major variable in this study. This suggests that the major does not have a significant impact on the digital literacy competency of pre-service teachers.

Table 6. Results from Independent-sample T-test according to Major across total Digital literacy scores and the three subscales.

	Theoretical		Scientifical		P value
	M	SD	M	SD	
Total DL score	36.2	5	36	5.2	0.792
Technical dimension score	21.2	1.5	21.3	3.6	0.829
Cognitive dimension score	7.3	1.5	7.2	1.5	0.484
Social and emotional dimension score	7.7	3.6	7.6	1	0.455

Note: *statistically significant ($P \leq 0.05$)

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3.3. Findings related to the income level variable

The impact that the three various income levels had on the technical attitudes of participants regarding digital literacy was examined using a one-way between groups analysis of variance (ANOVA). The findings are shown in **Table 7**.

As demonstrated in **Table 7**, technical-significant differences are found between income groups. The statistical significance of the ANOVA suggested that the income levels of the participants had an impact on their technical responses on digital literacy.

A pairwise comparison using the Bonferroni test revealed that, compared to individuals with moderate income levels (M=21. 3, SD=3.5) and high-income levels (M=23.3, SD=4), participants with low-income levels (M=20.05, SD=4.1) exhibited considerably poorer technical awareness of digital literacy. There were significant differences between participants with moderate and high-income levels as well as low and high-income levels. Nevertheless, no statistically significant difference was observed in the technical attitude scores among participants with varying levels of income, specifically low and moderate.

Table 7. One-way ANOVA results of the pre-service teachers' digital literacy according to the variable "income level"

Scale	Low (1)		Moderate (2)		High (3)		P value
	M	SD	M	SD	M	SD	
Total DL scores	35	5.8	36.2	5	38.4	5.3	0.001*(a)
Technical dimension score	20.5	4.1	21.3	3.5	23.3	4	<0.001*(a)
Pairwise comparison(b)			P1=0.067	P2=0.004*	P3<0.001*		
Cognitive dimension score	7.1	1.7	7.2	1.5	7.5	1.5	0.238(a)
Social and emotional dimension score	7.4	1.6	7.7	1.4	7.6	1.6	0.058*(a)

Note: *Statistically significant at the level of P ≤ 0.05. (a) One Way ANOVA (b) Bonferroni test P1(1-2) P2(2-3) P3(1-3)

3.4. Findings related to the university affiliation variable

An analysis of variance (ANOVA) with a one-way between groups was employed to examine the influence of the five universities on the participants' cognitive tendencies towards digital literacy. As shown in **Table 8**, cognitive-significant differences are found between university groups. The statistical significance of the ANOVA suggested that the participants' educational background had an impact on their cognitive tendencies with regard to digital literacy. A pairwise comparison, using the Bonferroni test, revealed that participants affiliated to Zagazig and Tanta University (*M=7.1, SD=1.6), (M=7.1, SD=1.5*) exhibited significantly lower levels of cognitive awareness of the digital literacy than participants affiliated to

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Banha University *(M=7.2, SD=1.6*), Kafr Elshiekh University (*M=7.3, SD=1.5*) and participants affiliated to Mansoura University *(M=7.5, SD=1.4*).There were significant differences between participants affiliated to Tanta and Mansoura University on the cognitive dimension. Regarding the relationship between university type and cognitive competence, no further significant differences have been identified. Based on that finding, one could deduce that the variable representing "university affiliation" exerts an impact on the digital literacy proficiency of pre-service teachers.

Table 8. Results of One-way ANOVA Analyzing Pre-service Teachers' Digital Literacy Based on "University Affiliation" Variable

scale	Tanta(1)		Banha(2)		Mansoura (3)		Zagazig(4)		Kafr Elshiekh(5)		P value
	M	SD	M	SD	M	SD	M	SD	M	SD	
Total DL score	36	5	36.5	5.2	36.7	5.2	35.6	5.6	36	5	0.278(a)
Technical dimension score	21	3.6	21.8	3.2	21.3	3.5	21	3.9	21.1	3.7	0.179(a)
Cognitive dimension score	7.1	1.5	7.2	1.6	7.5	1.4	7.1	1.6	7.3	1.5	0.008*(a)
Pairwise comparison (b)	P1>0.999 P2=0.011* P3>0.999 P4=0.196 P5>0.999 P6>0.999 P7>0.999 P8=0.069 P9>0.999 P10=0.853										
Social and emotional dimension score	7.8	1.4	7.5	1.6	7.6	1.5	7.5	1.5	7.5	1.4	0.111(a)

Note: *Statistically significant at the level of $P \leq 0.05$. (a) One Way ANOVA (b) Bonferroni test P1(1-2) P2(1-3) P3(1-4) P4(1-5) P5(2-3) P6(2-4) P7(2-5) P8(3-4) P9(3-5) P10(4-5)

Discussion

Within this section, the research objectives were examined in relation to the outcomes derived from this study and juxtaposed with the pertinent findings documented in the current stream of literature. The sample for this study comprised 1222 pre-service teachers who were currently pursuing various teacher education programs across five prominent education faculties. The significance of investigating the requisite abilities among teachers and student teachers has been amplified by the digitization of education **(Smestad et al. 2023) .**The present study has underscored the significance of examining the perspectives of student teachers with regards to their proficiency in digital literacy. Prior studies have mostly

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concentrated on the examination of the sustainable advancement of digital teaching proficiency, acknowledging its pivotal significance for pre-service educators in proficiently incorporating technology into their instructional practices and equipping themselves for the digital era, as it directly impacts the quality of future educational experiences **(Howard et al. 2021; Lemon and Garvis 2016; Instefjord and Munthe 2016).** Although pre-service teachers may have a positive perception of their digital competence, they may not have attained the necessary level of proficiency to improve the teaching process **(Chu et al. 2023).** This resonates with the argument revealed by **Reisoğlu and Çebi (2020)** that the cultivation of digital abilities is an essential element within the training of student teachers, encompassing a diverse array of strategies.

The present study seeks to examine the digital literacy features of student teachers, encompassing several variables such as gender, major, income level, and university affiliation. It was revealed that student teachers exhibited strong and favorable views regarding their competency in digital literacy. This suggests they feel confident in their ability to utilize a range of digital skills effectively. Specifically, participants expressed belief in possessing the cognitive and technical abilities necessary to utilize various technologies adeptly. They possess the necessary skills to effectively search for and retrieve information, analyse search outcomes, and evaluate the reliability of the information obtained. The findings align with previous studies **(Ata and Yıldırım 2019; Garcia-Martin and Garcia-Sanchez 2017; Güneş and Bahçivan 2018)** .

This study revealed a notable gender gap, with male undergraduate students demonstrating more favorable perceptions of digital literacy compared to their female counterparts. This indicates that males tend to exhibit a greater inclination towards digital skills, while females, particularly among pre-service teachers, may find technology-related matters more challenging. However, findings on this matter differ across various studies in the literature. While this study's findings align with certain research in the literature **(Seok and DaCosta 2017; Ata and Yıldırım 2019),** other research suggests that gender is not a significant factor in this context **(Teo, Fan, and Du 2015; Tondeur et al. 2018)**, or conversely, females demonstrate superior performance to males in the overall score of the digital literacy test **(Scherer, Rohatgi, and Hatlevik 2017).** No significant differences were observed between learners majoring in theoretical and scientific fields in their attitude responses toward the major variable in this study. This suggests that gender may not exert a significant influence on the DL perceptions of pre-service teachers. Hence, it can be inferred that the choice of major may not be

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a determining factor in digital literacy (DL) differences. Instead, such variances may be more closely linked to disparities in general literacy levels.

A significant difference was detected in the DL perceptions of participants based on their income levels, with those in higher income brackets holding more favorable perceptions. Students from high-income households typically exhibit greater proficiency in digital skills compared to their low-income counterparts. Studies suggest a correlation between income levels and digital skills, with students from higher-income families often having superior access to technology and educational resources, which enhances their digital competence. This observation is corroborated by findings from various research in the literature **(Hecker and Loprest 2019; Laufer et al. 2021).** This phenomenon could be attributed to the digital divide, which underscores the societal disparity between those who have access to essential infrastructure for digital education, namely computers and internet connectivity, and those who lack them **(Garcia and Lee 2020).** Conceptually, perceived social support from the primary socializing agents -family, peers and significant others- is deemed a key component in attitude-forming systems **(Elwakil, 2024).**

Furthermore, the perceptions of pre-service teachers differed significantly according to the university affiliation from which they graduated. This finding supports the idea that higher university digital resources can lead to higher digital literacy among students. This appeared to be a critical element influencing participants' digital skills. This finding suggests that individuals from higher-income families are more inclined to become proficient in digital literacy, implying that digital competences could serve as a compensating factor for familial background discrepancies. This finding underscores the significance of higher education institutions in fostering digital skills and literacy through tailored training programs and media courses, emphasizing the importance of institutions staying abreast of technological advancements to prepare students with the essential competencies for the digital era **(Farias-Gaytan, Aguaded, and Ramirez-Montoya 2023).**

Conclusion

Digital literacy is increasingly recognized as a key skill set in the 21st century, essential for academic success, professional advancement, civic engagement, and personal empowerment. As technology continues to evolve rapidly, individuals must continually update and expand their digital literacy skills to efficiently navigate the ever-changing digital landscape. Educational institutions, employers, and policymakers play a vital role in promoting DL through curriculum

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development, training programs, awareness campaigns, and policy initiatives. Digital literacy encompasses a full range of skills, including basic computer literacy, confident use of various digital tools and devices, competent online searching, distinguishing between credible and unreliable sources, using social media platforms, creating digital content, and engaging in online communication and collaboration.

Digital literacy is essential for success in today's digital spheres, both in higher education and in the professional realms. Given the rapid pace of technological advancement, the concept of DL is ever-changing and requires constant learning to keep up with new applications and updates. Teachers must possess DL to seamlessly incorporate technology in their teaching, enhance digital responsibility among students, and equip them for a swiftly evolving digital landscape **(Zhang 2023) .** This underscores the importance of teachers being adept at digital literacy to both anticipate future job requirements and deliver effective instruction in the digital era.

The study's core finding is that student teachers held generally favorable and positive perceptions regarding their competency in DL. Grounded on the study's results, developing the DL skills of pre-service teachers is crucial to equip them for effectively integrating technology into their future educational environments. The present findings hold significant relevance for policymakers as well as educators, offering insights that can aid in creating a more conducive academic environment for technology-driven education. Such insights are crucial for devising strategies aimed at seamlessly integrating technology into teaching as well as learning methodologies. Consequently, this study adds to the ongoing discourse regarding technology's role in higher education and the necessity to align teaching approaches with the preferences and expectations of modern students, who are more accurately characterized as "digital users" rather than "digital natives."

Suggestions for fostering digital literacy among pre-service teachers include: (1) Incorporating digital tools and technologies into teacher training courses and practicum experiences, integrating digital literacy concepts and activities across subject-specific courses, lesson planning exercises, and teaching methods courses ; (2) Exemplify exemplary methods for digital literacy within teaching and learning environments, guiding pre-service teachers in critical evaluation of online resources, ethical citation of digital content, safeguarding digital privacy and security, and promoting responsible online communication ; (3) Ensure pre-service teachers have access to a diverse array of digital resources, including educational websites, digital libraries, open educational resources, educational apps, and multimedia content repositories ; (4) Create collaborative learning environments

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for student teachers to collectively enhance their digital literacy skills, promoting peer mentoring, collaborative projects, and peer feedback on digital assignments and projects ; (5) There is a need to create technology-driven educational settings that enable female prospective teachers to engage more actively, given the observed tendency for male prospective teachers to have higher levels of digital literacy. ; and (6) There is a need to offer ongoing support and resources for prospective teachers to continue enhancing their digital literacy skills beyond their initial training, as it has been observed that those with higher income levels tend to exhibit greater proficiency in this realm.

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