Digital literacy level of prospective teacher students in the 4.0 industrial revolution era

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Abstract: Digital literacy is an essential competency needed in the Industrial Revolution 4.0 era, driven by rapid technological advancements. This study aims to analyze the level of digital literacy of prospective teacher students in facing the Industrial Revolution 4.0 era, focusing on students' demographics, namely age, gender and length of study. Survey method was administered in this study, involving 120 prospective teacher students from Universitas Insan Budi Utomo as the respondents. The data were collected through a questionnaire of 1-5 Likert scale, which included questions assessing students' digital literacy levels. The findings of this study portrayed data on students' digital literacy levels according to demographics (gender, age, and length of study). In general, the digital literacy level of Insan Budi Utomo University students is known to be in the "fairly good" category with an average score of 3.14 for the knowledge aspect and 3.20 for the usage aspect. The results of this study are recommended as a reference for designing learning experiences that empower digital literacy, supporting students in becoming more digitally proficient.

Keywords: Age, digital literacy, gender, industrial revolution

Abstrak: Literasi digital merupakan kompetensi yang sangat diperlukan di era revolusi industry 4.0 karena perkembangan teknologi yang begitu cepat. Penelitian yang dilakukan saat ini bertujuan untuk menganalisis tingkat literasi digital mahasiswa calon guru dalam menghadapi era revolusi industry 4.0 yang ditinjau dari demografi mahasiswa yaitu usia, jenis kelamin dan lama studi. Penelitian ini merupakan penelitian survei dengan responden berjumlah 120. Pengumpulan data melalui penyebaran angket dengan skala likert 1-5 kepada mahasiswa Universitas Insan Budi Utomo. Angket berisi pertanyaan untuk mengukur kemampuan literasi digital mahasiswa. Hasil penelitian yaitu data tingkat literasi digital mahasiswa berdasarkan demografi (jenis kelamin, usia, dan lama studi). Kesimpulan penelitian ini adalah tingkat literasi digital mahasiswa Universitas Insan Budi Utomo dalam kategori cukup baik dengan nilai rerata 3,14 untuk aspek pengetahuan dan 3,20 untuk aspek penggunaan. Hasil penelitian ini dapat digunakan sebagai acuan dalam mengembangkan pembelajaran yang memberdayakan literasi digital sehingga mahasiswa menjadi literat digital.

Kata kunci: Usia, literasi digital, gender, revolusi industri

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INTRODUCTION

In the Industrial Revolution 4.0 era, rapid adaptation to change is essential. To navigate this era, 'new literacy' skills are required, as 'old literacy' primarily serves as a foundation for social capital (Muliani et al., 2021). Students today must develop three critical literacies—data literacy, technological literacy, and human literacy—to meet future demands and remain competitive. These literacies are closely tied to digital literacy, which plays a pivotal role in preparing students for the challenges ahead (Muliani et al., 2021). Digital literacy means the capacity to utilize information and communication technology for locating, understanding, assessing, generating, and disseminating digital information, necessitating both cognitive and technical competencies (Mbandje & Loureiro, 2023).

Digital literacy in education is crucial for adjusting to the Fourth Industrial Revolution. The advancing Higher Education 4.0 model within Industry 4.0 underscores the critical necessity to improve the digital competences of the academic community. This is essential for guaranteeing instructional quality in institutions and enhancing student learning in contemporary higher education (Dang et al., 2024). Similarly, education universities that train future teachers must develop these skills to build students's digital literacy over time (Sánchez-Cruzado et al., 2021).

Digital literacy has been promoted for quite a long time but it became most prominent during the covid-19 outbreak when face-to-face meetings were restricted so that learning transitioned from in-person education to virtual education. This led teachers and students to adjust quickly. The importance of technology became evident, and to this day, learning continues to evolve through technology, making digital literacy essential (Yustika & Iswati, 2020). In the digital era, self-learning and information-seeking abilities are easily accessible, with many learning resources available online due to technology (Fauzi & Usmeldi, 2022). Digital literacy is essential for improving interaction and communication throughout the learning process (Irhandayaningsih, 2020).

With the rapid advancement of modern technology, digital literacy is becoming increasingly important. Having this skill allows individuals to engage in various sectors and expands opportunities in the future workforce (Potyrała & Tomczyk, 2021). Several key factors driving the need for education to enhance digital literacy today include: (1) the information revolution and informationalism; (2) the emergence of a new technology-driven society; and (3) the rise of big data (Pérez-Escoda et al., 2019). Additionally, there are concerns about the negative effects of media and technology on society, particularly among learners (Pambudi & Windasari, 2022). The media will help to translate information into a consumer product. Although affected by mass culture, this will promote the shift to a knowledge society in the twenty-first century, where digitization will only be the beginning of transformation (Pérez-Escoda et al., 2019). They express themselves in a variety of ways, absorb multimodal and hypertextual material, and digest information quickly due to the numerous stimuli they experience. They are able to multitask, stay constantly connected (which allowing them to search for what they need instantly), and navigate cyberspace easily, without the limitations of time or distance (Pérez-Escoda et al., 2019). In today's digital landscape, the opportunities for self-directed learning and information retrieval are highly accessible thanks to current technologies (Imjai et al., 2024).

A study conducted by Ayun (2021) indicated that students' digital literacy levels fell into the "high" category, with a reported percentage of 69%. This was a result of their exceptional skill in locating precise information on Google. Another study conducted by Ririen and Daryanes (2022) showed that students' digital literacy was categorized as "good", achieving 81% in technology use. Nonetheless, their skills in online communication, critical thinking, and ethical technology use are classified as "moderate". This occurred due to students' exposure to the internet from their time in school (Ririen & Daryanes, 2022). On the other hand, previous research findings reported by (Sánchez-Cruzado et al., 2021) indicated that pre-service teachers or student teachers were not adequately prepared to integrate digital literacy into their teaching in a meaningful way and to engage their students effectively with technology. This is due to a lack of training, a lack of confidence in their digital skills, coupled with the challenges arising from the COVID-19 pandemic.

This study seeks to examine the digital literacy levels of prospective teacher students within the framework of the Industrial Revolution 4.0, with an emphasis on demographic factors including age, gender, and duration of study. It is important to understand the digital literacy profile of students at Universitas Insan Budi Utomo based on age, gender, and the length of study.

METHOD

This research employed survey research method, as the researchers aim to gain the description of students' the digital literacy skills. The respondents for this study were 120 students from Universitas Insan Budi Utomo. The data were collected by distributing a questionnaire with a Likert scale of 1-5 to second, fourth, and sixth-semester students for the academic year of 2023/2024 via Google Forms. The sampling method used was purposive sampling, resulting in a total of 120 respondents. Digital literacy encompasses various elements, including information and information literacy, effective communication and collaboration, the creation of digital content, safety considerations, and problem-solving related to knowledge and its application (Sánchez-Cruzado et al., 2021). Data analysis was conducted on the gathered responses. The analysis focused on the students' demographics, specifically age, gender, and length of study. Table 1 presents a summary of the demographic data of the respondents.

Table 1. The summary of students' demographic data

Characteristics	Frequency	Percentage
Gender		
Male	97	80.83
Female	23	19.17
Length of Study		
2 semesters	31	25.83
4 semesters	44	36.67
6 semesters	45	37.50
Age		
18-20	47	39.17
21-23	60	50.00
>24	13	10.83

According to Table 1, there were more male respondents than female respondents, with males comprising 80.83% and females 19.17%. Most respondents were in their sixth semester (37.5%) or fourth semester (36.67%). The predominant age group was 21-23 years, representing 50% of the respondents.

The data were analyzed using descriptive statistical techniques, which involved presenting data in form of table (calculating the means of achievement levels) and determining measures of central tendency. The categorization of respondents' achievement levels were based on the classification proposed by Fauzi and Usmeldi (2022), as presented in Table 2.

Table 2. Categories based on the means of digital literacy achievement levels

Means	Category
4.6-5	Very good
3.6-4.5	Good
2.6-3.5	Fairly good
1.6-2.5	Poor

RESULTS AND DISCUSSION

The digital literacy of university students is assessed based on their knowledge and application in information literacy, communication and cooperation, digital content creation, security, and problem-solving (Law et al., 2018). The summary of digital literacy results for Universitas Insan Budi Utomo students is presented in Table 3.

Table 3. The summary of students' digital literacy levels

Aspects	Knowledge		Usage	
	Mean	Category	Mean	Category
Information and Information Literacy	3.21	Fairly good	3.26	Fairly good
Communication and Collaboration	3.24	Fairly good	3.18	Fairly good
Digital content creation	2.96	Fairly good	3.15	Fairly good
Safety	3.12	Fairly good	3.21	Fairly good
Problem solving	3.16	Fairly good	3.20	Fairly good
Average	3.14	Fairly good	3.20	Fairly good

According to Table 3, the average score for the knowledge element is 3.14, classified as "fairly good," and the usage aspect similarly demonstrates a "fairly good" level with an average of 3.20. Overall, students' digital literacy level is categorized as "fairly good".

Digital literacy by gender

The following table shows the students' level of digital literacy based on gender.

Table 4. Digital literacy level by gender

Aspects	Male		Female	
	Knowledge	Uses	Knowledge	Usage
Information and Information Literacy	3.18	3.25	3.34	3.32
Communication and Collaboration	3.14	3.20	3.04	3.11
Digital content creation	2.96	3.17	2.94	3.10
Safety	3.13	3.21	3.05	3.21
Problem solving	3.17	3.20	3.14	3.18
Average	3.12	3.21	3.17	3.18
Total Average	3.16		3.17	
Category	Fairly Good		Fairly Good	

Table 4 indicates that, at the knowledge level, female students excelled in information, information literacy, and problem-solving, whereas male students were more proficient in communication, collaboration, digital content creation, and security. In terms of usage, female students showed a strong presence in information and literacy, digital content creation, security, and problem-solving, whereas male students demonstrated superiority solely in communication and collaboration. Overall, the level of digital literacy for both male and female students fell within the "fairly good" category, with an average score of 3.16 for males and 3.17 for females. This aligns with findings by Tan (2024), who noted that there were several factors contributed to the digital literacy gap, including economic status, gender, network infrastructure, and individual digital literacy. All of which were intensified by the pandemic.

Female students demonstrated a higher level of digital literacy knowledge, especially in the aspects of information and information literacy also problem-solving. This is attributed to their superior cognitive and metacognitive abilities compared to male students, which enhance their skills in solving problems and assessing or verifying incoming information. It is aligned with Zhou (2014) who stated that women have better strategies in seeking information than men. Women have better cognitive and metacognitive levels than men so that women perform more accurate information seeking (Zhou, 2014). This information-seeking technique is an important part of information literacy (Law et al., 2018). Therefore, performing effective information searches can enhance information literacy. Additionally, women generally have better multitasking skills than men. Muhammadiah et al. (2024) noted that women are often good at managing several tasks at once. This ability helps them solve complex problems (Kamberidou, 2020).

Male students possess a higher level of digital literacy in communication and collaboration, digital content creation, and security than female students. This is because men tend to participate more in online communities focused on technical topics, such as technology forums, gaming, or IT discussions, where communication and collaboration related to digital literacy frequently take place (Moravec et al., 2024). Their extensive understanding of digital content creation, security, and communication and collaboration is shaped by these variables.

Digital literacy by length of study

Table 5 data presents students' digital literacy levels based on the lesngth of study. Table 5 indicates that sixth-semester students exhibited superior knowledge and application compared to second- and fourth-semester students in all domains, including information and information literacy, communication and collaboration, digital content creation, security, and problem-solving. The digital literacy levels of second-semester, fourth-semester, and sixth-semester students fall within the "fairly good" category, with total average scores of 2.91 for second-semester students, 2.97 for fourth-semester students, and 3.54 for sixth-semester students.

The knowledge and usage of digital literacy among sixth-semester students were higher than those of fourth- and second-semester students. This is because sixth-semester students are more familiar with online learning and course assignments that require them to conduct online literature searches. Additionally, the ease of using the internet and its

usefulness in finding information, creating digital content, and solving problems are key factors that enhance students' digital literacy levels (Yao & Wang, 2024).

Table 5. Digital literacy levels by length of study

Aspects	2nd Semester		4th Semester		6th Semester	
	Knowledge	Usage	Knowledge	Usage	Knowledge	Usage
Information and Information Literacy	2.90	3.03	3.11	3.05	3.53	3.63
Communication and Collaboration	2.99	2.87	3.11	3.11	3.55	3.48
Digital content creation	2.69	2.88	2.74	2.92	3.35	3.57
Safety	2.85	3.02	2.87	2.92	3.54	3.63
Problem solving	2.79	3.04	3.00	2.94	3.58	3.56
Average	2.85	2.97	2.96	2.99	3.51	3.57
Total Average	2.91		2.97		3.54	
Category	Fairly Good		Fairly Good		Fairly Good	

The length of study is closely linked to the digital literacy that students acquire. Sixth-semester students have more experience using the internet for finding information, so their literacy skills are better than those of second- and fourth-semester students. Additionally, students who have studied longer tend to communicate and collaborate more easily because they are used to working with their colleagues. However, some believe that as people get older, their digital literacy skills may decrease due to more responsibilities and concerns (Saikkonen & Kaarakainen, 2021).

Digital literacy by age

Table 6 presents students' digital literacy based on age. Table 6 shows the digital literacy levels of students based on age. The ages were grouped into three categories: 18-20 years, 21-23 years, and over 24 years. Students aged 21-23 years acquired more knowledge in information literacy than those who aged 18-20 and over 24 years. Meanwhile, students aged 18-20 years were better in communication, collaboration, and security skills. This is likely because younger students are very active on social media. Being active online helps them communicate in different ways in digital worlds, such as chat, video, and voice. They also connect with friends and groups online, which improves their digital collaboration skills (Moravec et al., 2024).

Table 6. Digital literacy levels by age

Aspects	18-20 years		21-23 years		>24 years	
	Knowledge	Usage	Knowledge	Usage	Knowledge	Usage
Information and Information Literacy	3.22	3.22	3.25	3.26	3.04	3.43
Communication and Collaboration	3.31	3.11	3.19	3.21	3.26	3.34
Digital content creation	2.90	3.05	2.91	3.15	3.33	3.53
Safety	3.12	3.14	3.11	3.17	3.12	3.63
Problem solving	3.17	3.18	3.13	3.12	3.30	3.62
Average	3.14	3.15	3.12	3.18	3.21	3.51
Total Average	3.14		3.15		3.36	
Category	Fairly Good		Fairly Good		Fairly Good	

The digital literacy levels of students aged 18-20 years, 21-23 years, and over 24 years were categorized as "Fairly Good". Their average scores were 3.14 for 18-20 years old, 3.15 for 21-23 years old, and 3.36 for those over 24 years old. Age influences students' digital literacy due to different thinking patterns from older generations. Younger students, who have easy and unlimited access to digital technology, are expected to use it to help with their learning. The research findings by Raharjo and Winarko (2021) showed that young people still possess good digital literacy skills. Given this phenomenon, digital literacy education for young people is expected to become a crucial initiative since young individuals are the group that mostly affected by media consumption. Furthermore, youth are anticipated to serve as catalysts for change in tackling diverse challenges within the digital society.

CONCLUSION

The average score for knowledge was 3.14 and for usage was 3.20, putting the digital literacy level of Universitas Insan Budi Utomo students in the "fairly good" category. To improve these overall results and to achieve the "very good" level, it is recommended to use technology-based learning methods or media in education to enhance digital literacy. This study faced the limitation of its research sample being confined to active students of Universitas Insan Budi Utomo in semesters 2, 4, and 6 for the 2023/2024 academic year.

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