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Digital literacy as a foundation for learning in undergraduate students

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Abstract: Digital literacy is crucial in accessing information, engaging in discussions, and developing relevant skills in the digital era. This research aims to analyze research trends regarding the digital literacy of undergraduate students, evaluate the level of digital literacy, and look for effective strategies to improve undergraduate students' skills. The research method used is Systematic Literary Review (SLR), with inclusion criteria focusing on documents discussing the digital literacy of undergraduate students, published between 2019 and 2024, using English, not pre-proof papers, and published in journals. The main findings of the research include a significant increasing trend in the study of undergraduate students' digital literacy over the past five years, peaking in 2023. In addition, differences in undergraduate students' digital literacy levels emphasize the importance of increasing digital literacy, especially for students with low literacy levels. Various strategies were also found that could increase undergraduate students' digital literacy, including increasing lecturer competence, involving undergraduate students in specific disciplines, and developing a curriculum that involved various parties. By paying attention to trends, literacy levels, and efforts to increase undergraduate students' digital literacy, it is hoped that they can be better prepared to face challenges in the ever-growing digital era.

Keywords: Digital literacy, undergraduate student

INTRODUCTION

Digital literacy has become an essential foundation in modern education. Digital literacy is vital to learning success (Feng & Liu, 2024; Holm, 2024; Imjai et al., 2024; Sriwisathiyakun, 2024; Zhdanov et al., 2023). Digital literacy includes understanding information and communication technology, evaluating online information, and developing critical skills (Kabakus et al., 2023; Lei et al., 2014; Neira-Piñeiro et al., 2013; Sánchez-Valle et al., 2017; Watermeyer et al., 2024). The evolution of digital literacy in educational curricula emphasizes the importance of adapting undergraduate students to the ever-evolving digital environment. Therefore, information about digital literacy, digital literacy levels, and empowering digital literacy in education are essential for developing undergraduate students to master technology and information.

The role of digital literacy in learning is very significant. Through good digital literacy skills, students can access appropriate sources of information and learning materials (Dewia & Alam, 2020; Masic et al., 2009; Vasilyeva & Vasilyeva, 2019). Furthermore, digital literacy skills can facilitate the development of critical skills that are important in understanding, interpreting, and evaluating information found online (Kamal Saeed et al., 2022; Rennstich, 2023; Tifferet, 2021; Watermeyer et al., 2024). Furthermore, good digital literacy encourages students to collaborate via digital platforms, enabling the exchange of ideas and richer learning

experiences (Elbarazi et al., 2022). Digital literacy also stimulates students' creativity in producing relevant and meaningful digital content (Alnasib, 2022; Riyadi et al., 2021; Siang See et al., 2023). The use of technology in learning can also influence students' learning styles by adopting learning models that are more interactive and adaptive to individual needs.

Many factors influence the development of digital literacy; one of the main factors is access to technology. Access to technology includes the availability of technological infrastructure and a stable internet connection (Adiningtyas & Gunawan, 2021; Tong et al., 2024; Tri Aji & Ramadani, 2024; Zhygalkevych et al., 2022). In addition, education and training on the effective use of technology also play an essential role in increasing digital literacy (Linde-Valenzuela et al., 2019; Lorenzo Álvarez et al., 2018). Digital cultural factors, such as habits in using social media or awareness of digital risks and ethics, can also influence digital literacy. The social environment, including support from family, peers, and educational institutions, can also affect how well undergraduate students develop their digital literacy.

However, the current reality in the field shows that people's digital literacy is still low (Atmajaya et al., 2022; Dratva et al., 2024; Kala et al., 2024; Loignon et al., 2021; Zallio et al., 2020), reflected in their low skills in critically evaluating information, sorting online resources, and participating in the digital environment (Chesire et al., 2022; Raghunathan et al., 2023). This can hinder students' ability to learn independently and contribute to an increasingly digitally connected society. Furthermore, current learning processes do not fully empower digital literacy (Kim, 2021; Martzoukou et al., 2023; Mesko et al., 2015; Patankar et al., 2017), with limited integration of technology in teaching, development of digital skills, and opportunities for undergraduate students to use technology in learning contexts (Armah & Westhuizen, 2020; Karroum & Elshaiekh, 2023; MacCallum, 2022; Pramasdyahsari et al., 2024). The lack of training or institutional support regarding digital literacy (Heena & Nidhi, 2022; Lv, 2022; Monteiro & Leite, 2021; Opeyemi et al., 2019) further adds to the complexity of this problem.

This research is fundamental because, until now, no documents have been recorded in the Scopus database that specifically examine the digital literacy of undergraduate students. In this research, the problems discussed focus on three main aspects, namely: 1) What are the research trends regarding the digital literacy of undergraduate students?, 2) How high is the digital literacy level of undergraduate students currently?, and 3) What are effective ways to increase digital literacy of undergraduate students? By exploring information about research trends, evaluating current literacy levels, and developing strategies for improvement, this research is expected to provide valuable insight into understanding and improving digital literacy among undergraduate students.

METHOD

This research method adopts the approach used by (Rahmawati et al., 2024). Furthermore, the inclusion criteria applied include articles discussing the digital literacy of undergraduate students, published between 2019 and 2024, using English, not being pre-proof papers, and published in journals. Articles that did not meet the inclusion criteria were then excluded from the analysis as an exclusion criterion. The document identification process is carried out through several steps. First, a search was conducted in the SCOPUS database, focusing on article titles, abstracts, and keywords using "DIGITAL LITERACY" and "UNDERGRADUATE STUDENTS." The second step is the screening process, which involves applying filters to select relevant documents, including criteria such as open access and year of publication between 2019 and 2024. After that, documents that meet the requirements are identified as documents that meet the Eligibility criteria, with the document type being an article and having reached the final publication stage. The final step is the selection

of documents to be included in the research, provided the documents are in English. The results of the document identification process were 107 documents. The screening process produced 34 documents. Document eligibility was obtained from 29 documents. A total of 23 final documents from journals were selected by the researchers to be included in the analysis. Each selected article was further analyzed within the framework of this systematic literature study. Researchers considered several questions as a guide in choosing relevant articles, such as whether the article discusses the digital literacy of undergraduate students, whether the research objectives in the article are clear, and whether the researcher provides adequate explanations of research methods, conclusions, and recommendations for undergraduate students.

RESULTS AND DISCUSSION

The research results are answers to research questions from the literature review process, namely: 1) what are the trends in undergraduate students' digital literacy, 2) the digital literacy level of undergraduate students, and 3) how to increase undergraduate students' digital literacy, the findings are further explained in several separate subchapters. The results and discussion will provide a deeper analysis of the implications, research gaps, and relevance of the findings in a broader context and offer a comprehensive understanding of the contribution of this research to the field of undergraduate student digital literacy.

What are the trends in undergraduate student digital literacy research?

Based on the Scopus database, research trends on digital literacy among undergraduate students have shown significant growth in the last five years, as depicted in Figure 2. Attention to digital literacy among undergraduate students reached its peak in 2023. In 2023, research trends will be based on common keywords used in documents: e-learning, social media, online learning, and internet literacy. The results of this research reveal various findings related to the use of technology in educational contexts. It was further reported that undergraduate students' ICT skills are low (Nilaphruek & Charoenporn, 2023), so a digital literacy integration approach becomes important in facing digital developments (Abdul Aziz et al., 2023). Research results also report that undergraduate students are currently involved in online collaboration via social media but still have difficulty evaluating the authenticity of information (Wada et al., 2023). Furthermore, digital literacy is recognized as a critical element in the lives and learning of undergraduate students (Smith & Storrs, 2023), especially during the COVID-19 pandemic, where independent learning and digital literacy have become determining factors for student success (Thamrin et al., 2023). Digital technology skills help undergraduate students manage interactions with teachers, peers, and online content (Kayaduman et al., 2023). The use of podcasting software and the influence of browser extension guides on information-seeking also show significant implications (Efendioğlu & Sendurur, 2023; Lloyd et al., 2023).

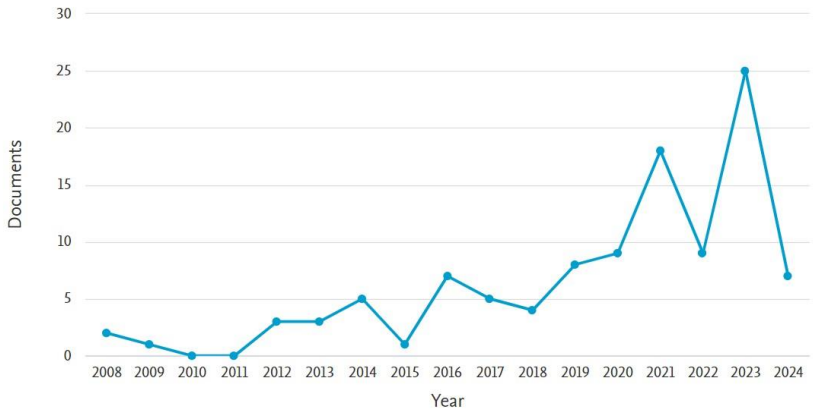


Figure 1. Documents by year

The analysis results were based on the predetermined inclusion and exclusion criteria, namely that 23 documents were obtained that were suitable for analysis to be carried out. Furthermore, the digital literacy trends of undergraduate students can be seen based on the keywords frequently used by researchers. Keywords that often appear in documents are: 1) Thailand, 2) E-learning, 3) social media, 4) effectiveness, 5) digital devices, 6) digital competencies, and 7) teaching profile. Thailand is the country that publishes the most results related to undergraduate students' digital literacy. The ICT skill level of undergraduate students in Thailand is low, so education needs to improve digital literacy (Nilaphruek & Charoenporn, 2023). The digital literacy skills of non-STEM undergraduate students, namely language majors, are higher than management students (Saetang et al., 2023). Undergraduate students' digital citizenship skills show positive things, so agencies and ministries can better design digital citizenship skills development programs (Saetang et al., 2023). The following document highlights E-learning and social media. Regarding e-learning, academics and practitioners state that digital literacy is critical in learning, so it is necessary to improve the learning experience of undergraduate students (Nilaphruek & Charoenporn, 2023). The most appropriate increase in the learning experience of undergraduate students is through the learning process and academic specialization (Al-Abdullatif & Gameil, 2020). The Critical Inquiry Through Digital Storytelling (CIDST) learning model can be a reference for lecturers in planning and implementing learning activities to increase undergraduate students' digital literacy (Kaeophanuek et al., 2019). Regarding social media, the ability of undergraduate students to use social media and access digital information is good. However, evaluating the authenticity of information still needs to be improved (Wada et al., 2023). So, the digital literacy of undergraduate students needs to be paid attention to because digital literacy is the key to undergraduate students' success both in learning and everyday life (Smith & Storrs, 2023).

The keywords that get a lot of attention are effectiveness, digital devices, digital competencies, and teaching profile. Effectiveness relates to research results that test learning methods and models on the digital literacy of undergraduate students. This is similar to the report which stated that the Concept Mapping Strategy increased undergraduate students' digital literacy (Smith & Storrs, 2023). Furthermore, research reports show that 46.21% of undergraduate students consider online learning quite effective, 34.09% are effective, and 19.70% are ineffective (Rahman, 2021). Digital devices, namely technology courses such as Educational Technology, influence undergraduate students' knowledge and skills in digital communication, digital literacy, digital etiquette, digital law, digital rights and responsibilities, digital health and welfare, and digital security (Al-Abdullatif & Gameil, 2020). Undergraduate students' digital literacy in the learning process can also be empowered with the CIDST learning model. The CIDST learning model is a learning model that can improve undergraduate students' digital literacy (Kaeophanuek et al., 2019). Digital competencies, namely digital literacy of undergraduate students, can be improved using "Digital Culture" (Shelyugina et al., 2022). Distance learning can provide opportunities for undergraduate students to improve undergraduate students' digital competencies, including adaptability, conceptual thinking, and digital literacy (Shelyugina et al., 2022). Teaching profile A good educator is like a professor with competencies such as innovation, complex problem solving, entrepreneurship, collaboration, international perspective, leadership, and connection with community needs (Shelyugina et al., 2022).

Trends in undergraduate students' digital literacy are essential information in educational research. Research results have highlighted various aspects of digital literacy, including e-learning, social media, and online learning. Even though there has been growth in research on the digital literacy of undergraduate students, there

is still a critical need for information regarding the level of digital literacy. This is to obtain further information regarding the digital literacy level of undergraduate students and what factors influence the digital literacy level of undergraduate students.

What is the digital literacy level of undergraduate students?

Based on the results of the 23 documents that have been analyzed, seven documents provide information regarding the digital literacy level of undergraduate students. Digital literacy levels are divided into low, medium, and high (Rahmawati et al., 2024). Research documents stating that undergraduate students' digital literacy is low were reported by (Dawadi et al., 2024; Dolu & Çelik Durmus, 2023; Nilaphruek & Charoenporn, 2023). Research documents stating the digital literacy of undergraduate students are being reported by Medium (Al-Abdullatif & Gameil, 2020; Ruenphongphun et al., 2021; Sari & Wahyudin, 2019; Wada et al., 2023). Research documents stating that the digital literacy of undergraduate students is high was reported by Tinggi (Dawadi et al., 2024). The distribution of undergraduate students' digital literacy levels based on the document analysis results is explained in Figure 2.

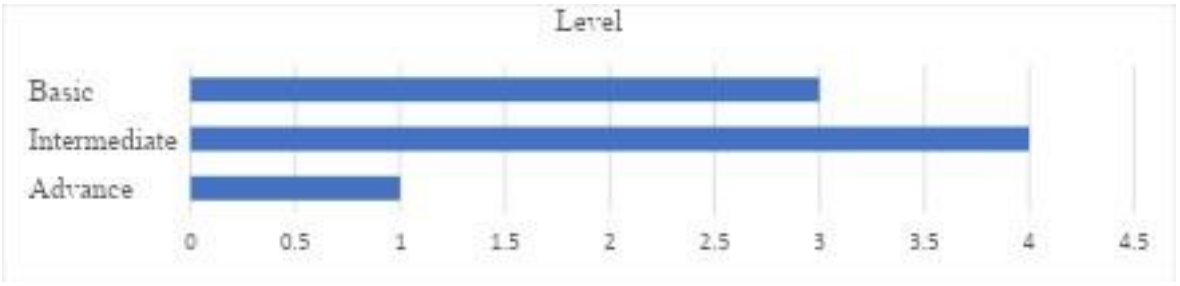


Figure 2. Digital literacy level summary

Several things can cause the low digital literacy of undergraduate students, namely: 1) the absence of a curriculum that includes the development of digital literacy for undergraduate students (Dolu & Çelik Durmus, 2023), 2) the current learning process has not yet carried out appropriate digital literacy empowerment (Nilaphruek & Charoenporn, 2023), 3) further One of how the low ability of undergraduate students can be seen is in the online learning process (Dawadi et al., 2024). The level of digital literacy skills of undergraduate students is also reported to be moderate. This can be seen from several report results such as: 1) undergraduate students can find and evaluate quality online sources and utilize digital tools and collaborative social and digital media, but undergraduate students still often have difficulty evaluating the authenticity of information online (Wada et al., 2023), 2) digital citizenship skills (DCS) of undergraduate students moderate, further several things need to be considered such as literacy, empathy, ethics, collaboration and thinking, 3) undergraduate students often experience miscommunication of material and assignment instructions (Ruenphongphun et al., 2021; Sari & Wahyudin, 2019), 4) there are no courses that study and apply literacy digital [56]. The digital literacy level of undergraduate students is also reported to be high. This can be seen in several undergraduate students with excellent literacy abilities and skills in online learning (Dawadi et al., 2024).

The differences in digital literacy levels of undergraduate students show a great need for increasing digital literacy, especially at low digital literacy levels. The low digital literacy of undergraduate students is caused by several factors, such as learning processes and curricula that are not yet supportive, undergraduate students often experience difficulties in evaluating the authenticity of online information, low empathy, ethics, collaboration and thinking skills, miscommunication. Learning processes and curricula not designed to encourage and empower digital literacy can hinder undergraduate students' ability to develop the skills needed in a digital

environment. Difficulty evaluating the authenticity of online information can result in undergraduate students being exposed to invalid or unreliable information, which can affect their understanding and views on a topic. Low levels of empathy, ethics, collaboration, and thinking skills can hinder undergraduate students' ability to participate effectively in online discussions or collaborate with others in a digital context. Miscommunication in assignment materials and instructions can make it difficult for undergraduate students to understand what is expected of them regarding digital literacy. Finally, the lack of courses that specifically address digital literacy and apply the concepts in practical contexts can also lead to a lack of awareness and skills in digital literacy among undergraduate students. All of these factors can contribute to undergraduate students' low digital literacy.

The low level of digital literacy of undergraduate students indicates that they are not yet ready to face the changes and demands of digital literacy, which continue to grow. This shows that undergraduate students still have limited understanding, evaluating, and using digital information effectively. Therefore, current research should focus on empowering undergraduate students and educators to develop strong digital literacy, which includes not only understanding technology but also critical and creative skills in using that technology. In addition, there is a need to improve the overall quality of education, which includes developing a curriculum that pays attention to digital literacy as an integral part of learning. Recent research results suggest that the necessary solutions may involve developing programs that are more flexible and tailored to the individual needs of undergraduate students, which can help them acquire and improve digital literacy skills relevant to an ever-changing digital world.

How to increase undergraduate students' digital literacy?

Digital literacy is currently an essential key in the world of education. Digital literacy is the primary competency of undergraduate students when facing digital transformation. So, increasing the digital literacy of undergraduate students is a significant concern. Research reports with multiple designs have been carried out to achieve this goal. The analysis results of 23 documents are several recommended strategies for increasing undergraduate students' digital literacy. Firstly, data analysis is carried out regarding undergraduate students' digital literacy to enable more precise research and empowerment of undergraduate students' digital literacy (Nilaphruek & Charoenporn, 2023). Then, there is increasing the ability of lecturers to learn (Ramírez-Montoya et al., 2021; Sari & Wahyudin, 2019). Furthermore, the implementation of online learning (Barber, 2021; Dawadi et al., 2024) further engaged and motivated undergraduate students in other disciplines (Smith & Storrs, 2023; Thamrin et al., 2023).

In addition to these strategies, other approaches include developing a digital literacy approach, namely by applying scientific concepts (Bhatt & MacKenzie, 2019) and "Digital Culture" (Al-Abdullatif & Gameil, 2020), as well as using concept mapping strategies (Mohammad Alharbi, 2024). E-reading is also a focus in developing digital literacy (Vuorinen et al., 2024), as are gamification approaches (Kaeophanuek & Chaisriya, 2022) and providing authentic assignments (Tiernan, 2021). Podcast-based assignment exercises (Lloyd et al., 2023) and the "Critical Inquiry through Digital Storytelling" (CIDST) learning model (Kaeophanuek et al., 2019) are also effective methods in increasing undergraduate students' digital literacy. Curriculum development that includes digital literacy is also essential to pay attention to (Dolu & Çelik Durmus, 2023; Nithyanandam et al., 2022; Rahman, 2021). Furthermore, stakeholders, including educators, are critical for establishing strategies, policies, and plans to develop undergraduate students' digital skills (Ruenphongphun et al., 2021; Saetang et al., 2023).

Based on the results of the research analysis, various strategies have been found to increase the digital literacy of undergraduate students. These strategies include increasing lecturer capabilities, implementing online learning, involving undergraduate students in specific scientific disciplines, developing digital literacy approaches, applying scientific concepts and digital culture, and various active learning strategies such as concept mapping, e-reading, gamification, and providing authentic assignments. Curriculum development that includes digital literacy is also an important focus, with stakeholders, including educators, playing an essential role in designing strategies, policies, and plans to improve undergraduate students' digital skills. By adopting and implementing these various strategies, it is hoped that undergraduate students' digital literacy can be significantly improved

CONCLUSION

Research trends in undergraduate students' digital literacy show a significant increase in the last five years, especially in 2023. The document analysis results highlight the importance of digital literacy in the educational context, especially in the use of social media and e-learning. This reflects increasing awareness of the need for undergraduate students to have strong digital skills to face challenges in the digital world. The differences in the digital literacy levels of undergraduate students show a considerable need to improve and encourage the digital literacy of undergraduate students, especially for low-level undergraduate students. Several factors cause the low digital literacy of undergraduate students, including unsupportive learning processes and curricula; undergraduate students often have difficulty evaluating online information. Furthermore, various strategies can be implemented to increase undergraduate students' digital literacy, such as increasing lecturer competence, implementing online learning, integrating undergraduate students in particular disciplines, and developing a curriculum that involves all related parties. By implementing these strategies, it is hoped that undergraduate students' digital literacy can be significantly improved to be better prepared to face challenges in the ever-growing digital era.

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