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Analysis of Digital Literacy Among Final-Year PGSD Students at the University of Muhammadiyah Malang

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ABSTRACT

Digital literacy is an essential competency for prospective elementary school teachers in adapting to technological developments in education. This study aims to describe the development of digital literacy among final-year students of the Elementary School Teacher Education (PGSD) Study Program at the University of Muhammadiyah Malang. This research employed a descriptive qualitative approach. Data were collected through semi-structured interviews, observation, and documentation involving the head of the study program and three final-year students in semesters VII and VIII. The data were analyzed through data reduction, data presentation, and conclusion drawing, with triangulation used to ensure credibility. The findings indicate that students possess a fairly good understanding of digital literacy, including information searching, source evaluation, academic technology utilization, and responsible digital practices. However, their competencies remain suboptimal, particularly in operating reference management applications, critically assessing information credibility, and using digital tools effectively for academic purposes. Therefore, continuous training, curriculum integration, academic assistance, and independent learning are necessary to strengthen students' digital literacy and professional readiness as future elementary school teachers.

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1. INTRODUCTION

Technological developments have brought about significant changes in all aspects of life, including education. The rapid evolution of Information and Communication Technology (ICT) in the 21st century has not only transformed the way humans interact but also fundamentally demanded innovation in learning. With the advent of multimedia technology, various types of media, such as text, sound, and visuals (images, animation, and video), can be used to convey information [1]. The world of education today is

influenced by the demand for learning innovation due to the increasingly rapid development of technology and information [2].

Education is not only about transferring knowledge, but also about strengthening digital literacy, adaptive skills, and the critical, creative, and ethical use of technology. Digital literacy can be understood as an individual's ability to utilize information and communication technology to search, select, process, utilize, produce, and deliver content responsibly. This ability encompasses not only technical aspects but also cognitive, social, and emotional processes involved in technology use. Furthermore, digital literacy relates to an individual's awareness of attitudes and competencies in using digital devices and services to access, manage, assess, and integrate various resources. Digital literacy enables individuals to build new knowledge, express ideas through media, and communicate with others in specific contexts that support positive and constructive social action [3]. The University of Muhammadiyah Malang (UMM) is strongly committed to developing educational technology and digital transformation. UMM has developed various technology systems and platforms, such as the Learning Management System (LMS), Academic Information System, digital library, and other applications to support learning and academic services. The University of Muhammadiyah Malang (UMM) has demonstrated its commitment to digital transformation by providing infrastructure such as the LMS and digital library. However, for Elementary School Teacher Education (PGSD) students, digital literacy is not merely a technical skill, but also a determining factor in accelerating the completion of studies (thesis) and preparing them to face the ministry's digital ecosystem.

The rapid development of digital technology has brought significant changes to the world of education, including at the higher education level at the University of Muhammadiyah Malang. Students at the University of Muhammadiyah Malang, particularly final-year PGSD students or prospective elementary school teachers, are required to have digital literacy skills, including the ability to access, evaluate, process, and use digital information critically, ethically, and responsibly. Digital literacy is a crucial competency for prospective educators, enabling them to integrate technology into the learning process effectively and in accordance with student needs.

However, the digital literacy level of final-year PGSD students at the University of Muhammadiyah Malang does not necessarily align with the intensity of their daily technology use. Students are often considered digital natives, but this does not automatically guarantee their ability to sort valid information, understand digital ethics, and utilize technology for academic and professional purposes. Some students still tend to use technology only for communication and entertainment, while its use in academic activities, such as searching for scientific sources, writing papers, and developing learning media, is not optimal.

For final-year Elementary School Teacher Education (PGSD) students at the University of Muhammadiyah Malang, digital literacy is crucial because they are in the final stages of their education and will soon enter the workforce as educators. Prospective elementary school teachers are expected to be role models in the wise use of technology and to guide students in facing the challenges of the digital era. If the digital literacy of

final-year Elementary School Teacher Education (PGSD) students at the University of Muhammadiyah Malang remains low, it could affect the quality of their future learning after graduation.

Analyzing digital literacy in final-year students (semesters 7 and 8) is crucial because of disparities in graduation timelines. Field observations indicate that students who graduate on time or earlier (3.5 years) generally have higher digital literacy efficacy. They tend to be more proficient in using reference management applications such as Mendeley or Zotero, as well as optimizing scientific journal databases (Sinta, Scopus, and Google Scholar) to support systematic thesis preparation. Conversely, students who complete studies for four years or more often struggle with technical aspects of research data processing (such as using SPSS/Jamovi) and digital document management, which directly hinders their academic productivity.

Beyond thesis challenges, final-year PGSD students are on the verge of entering the professional world, which demands mastery of ministry applications. Prospective graduates are expected to be not only pedagogically proficient but also adaptable to the Merdeka Mengajar (PMM) Platform, the Dapodik system, and the Belajar.id account. This analysis is necessary to map the extent to which final-semester students can transform digital habits initially dominated by entertainment and social media into professional skills in creating interactive learning media using Canva, Quizizz, or other digital simulations.

The novelty of this research lies in the focus of the study and the context of the research subjects. Previous studies generally discussed digital literacy among university students in general or prospective teachers at various levels without emphasizing the final stage of study. This study specifically analyzes the digital literacy of final-year students in the Elementary School Teacher Education (PGSD) Study Program at the University of Muhammadiyah Malang, who are transitioning from the academic world to the professional world as educators.

Another novelty lies in the institutional context, namely the University of Muhammadiyah Malang, which has not yet been studied specifically in digital literacy research on final-year PGSD students. Therefore, this study is expected to provide new empirical contributions to curriculum development and learning strategies in the PGSD environment, particularly by strengthening the digital literacy competencies of prospective teachers in the digital era. Understanding and using digital technology appropriately supports the development of cognitive, affective, and psychomotor aspects, as the learning process becomes more structured, flexible, easily accessible, and presented interactively within the digital learning ecosystem. Furthermore, digital literacy plays a role in developing higher-order thinking skills, as it can encourage students to achieve academic success while supporting future professional readiness [4]. The use of digital technology in learning has a positive impact on the effectiveness of material delivery and student engagement. Through wider accessibility, teachers have the opportunity to reach students in various geographic areas, including remote areas that were previously difficult to access directly. The integration of digital media in learning provides an interactive, visual, and contextual representation of concepts, thereby making abstract ideas more accessible and fostering deeper cognitive engagement [5]. In addition, interactive learning media such as

videos, animations, and simulations can enrich the learning experience, optimizing information absorption [6]. This multimodal approach, which combines various learning modes and media, not only improves students' understanding and communication skills but also reflects the real-life digital environments they will face in the 21st century [7].

To address the challenges of education, learning technology can make the learning process more varied, interactive, and efficient. However, it also requires teacher support to develop innovative teaching materials based on needs [8]. Educational technology helps prepare students for future challenges amid rapid technological developments that require complex skills such as data analysis, literacy, and programming [9].

Based on the research results above, it can be concluded that digital literacy is a crucial competency for final-year PGSD students at the University of Muhammadiyah Malang in facing the transition to the professional world as educators. Although PGSD students are very familiar with technology, a gap exists between using technology for entertainment and using it for academic and learning purposes. Therefore, an in-depth analysis of the digital literacy level of final-year PGSD students at UMM is necessary as a basis for the PGSD study program to design strategies for strengthening the curriculum that are right on target, in order to produce prospective teachers who are not only technically competent, but also critical, ethical, and innovative in integrating technology in Elementary Schools.

2. METHOD

This study employed a qualitative descriptive approach to explore the digital literacy development of final-year students in the Primary School Teacher Education (PGSD) Study Program at the University of Muhammadiyah Malang (UMM). A qualitative approach enables researchers to examine participants' perspectives, experiences, behaviors, and interactions within their institutional context [10], [11].

The research was conducted at UMM, located in Lowokwaru, Malang, East Java, in February 2026 during the 2025/2026 academic year. Researchers purposively selected participants based on their involvement, experience, and understanding of digital technology in academic activities. They included the PGSD head of the study program and final-year students, particularly those in semesters seven and eight.

Primary data were obtained through semi-structured interviews and direct observation. Interviews explored students' digital literacy, use of academic technologies, challenges in completing their final projects, and preparedness to integrate technology into future teaching. The head of the study program provided information about curriculum, institutional policies, and technology integration. Observations examined students' use of digital tools and learning platforms. Secondary data include institutional documents, policies, reports, the university's Learning Management System (LMS), Academic Information System (SIA), digital library, and relevant scholarly literature.

The researcher served as the main research instrument, supported by interview guidelines, observation sheets, and documentation guidelines. Data collection and analysis progressed through planning, fieldwork, and reporting stages. Data were analyzed interactively through data reduction, narrative data presentation, and conclusion drawing

and verification. Information from interviews, observations, documents, and literature was selected, organized, interpreted, and checked throughout the research process to identify patterns and understand students' digital literacy practices.

Trustworthiness was strengthened through triangulation, prolonged engagement, and persistent observation. Triangulation compared interview findings with observations and institutional documentation to assess consistency. Prolonged engagement supported a deeper understanding of digital learning practices, while persistent observation carefully and repeatedly examined technology use and supporting facilities. These procedures were intended to produce credible findings on students' abilities to locate and evaluate information, use digital academic tools, and prepare for technology-integrated teaching.

3. RESULTS AND DISCUSSION

3.1. Research Results

Before describing the research results based on each focus, a description of the research informants is first presented. This study included four informants: one Head of the Elementary School Teacher Education Study Program at the University of Muhammadiyah Malang (UMM) as a key informant, and three final-year students in the same program as primary informants. The Head of the Study Program was chosen because he understands policies, curriculum, and technology integration strategies within the study program. Meanwhile, the final-year students were chosen because they were compiling their final assignments and therefore had direct experience using digital technology for academic activities.

To maintain confidentiality, informants' names are presented in initial form. A description of the research informants is presented in Table 1 below.

Table 1. Research Informant Data

No	Initials	Informant Status	Information
1	BUS	Head of the UMM Elementary School Teacher Education Study Program	Key informant; provides information on policies, curriculum, and technology integration within the study program environment.
2	NF	Final-year students of PGSD UMM	Currently writing a thesis; using a reference management application since semester III.
3	HAR	Final-year students of PGSD UMM	Currently at the stage of drafting the thesis title
4	NISJ	Final year students of PGSD UMM	Currently writing a thesis while working

Source: Primary Research Data.

Data from the four informants were analyzed and compared as a form of source triangulation. This comparison was conducted to obtain an overview of study program policies, student experiences using digital technology, digital literacy readiness to support teacher professionalism, and challenges and opportunities for development.

1. Profile and Digital Literacy Level of Final Year Students

The results show that digital literacy is a crucial competency for final-year PGSD students at UMM, particularly as they prepare to become prospective elementary school teachers. Technological advancements have changed academic activities, requiring students not only to operate digital devices but also to search, evaluate, and use information appropriately, wisely, and responsibly.

From a study program perspective, digital literacy development is achieved through the integration of technology into learning activities. The Learning Technology course teaches students how to use technology to develop media and teaching materials. Furthermore, applying Technological Pedagogical Content Knowledge (TPACK) in learning planning and implementation, along with using a Learning Management System (LMS), helps create an academic environment that supports the development of students' digital competencies.

At the student level, digital literacy is understood as the ability to use technology to obtain information according to academic needs. NF demonstrates an understanding of the importance of using technology wisely, while HAR tends to seek information through digital sources and compare several references before using it. The NISJ emphasizes the importance of operating technology correctly and responsibly. This difference in emphasis suggests that students' understanding of digital literacy includes technical skills, information retrieval, source evaluation, and ethical technology use.

Students' ability to evaluate information is evident in their use of Google Scholar and Google Books to search for scientific references. Students not only rely on online information but also consider the source's credibility, relevance, and publication year. This practice is crucial in the preparation of scientific papers, as the quality of research is determined by the accuracy of the choice of references used.

However, students' mastery of digital literacy is not yet fully distributed. NF students still face limitations in using some digital application features, while HAR and NISJ students still require learning opportunities to improve their skills in utilizing technology to support academic activities. This situation demonstrates a gap between conceptual understanding of digital literacy and technical mastery in its application.

Based on these findings, UMM's final-year PGSD students' digital literacy level can be described by their ability to operate technology, search for and evaluate information, select relevant scientific sources, and use technology wisely and responsibly. However, these competencies still require strengthening through continuous learning, academic experience, application training, and mentoring tailored to student needs. Thus, digital literacy is not only about using devices, but also about using technology critically and productively in academic activities.

2. Utilization of Digital Technology in Academic Activities of Final Year PGSD Students at the University of Muhammadiyah Malang

The results show that digital technology has become a crucial part of UMM final-year PGSD students' academic activities. Technology is utilized to support the learning process, scientific reference searches, citation management, document preparation, learning media creation, and thesis completion. This use shows that technology serves not

only as a means of communication but also as a support tool across various stages of academic work.

Support for technology utilization is evident in the integration of technology into the curriculum and learning processes of study programs. Through the Learning Technology course, students gain experience in identifying and developing technology-based media and teaching materials. Lecturers' implementation of TPACK and the use of a Learning Management System (LMS) also give students opportunities to become familiar with digital platforms in their lectures. This environment fosters digital experiences relevant to prospective teachers' academic and professional needs.

In their implementation, students use various applications based on their functions and needs. NF uses Google Scholar to search for scientific references, Mendeley and Zotero to manage references, and ChatGPT and Gemini to support academic activities. HAR utilizes Canva, Google Books, Google Scholar, Scopus AI, Mendeley, and PhET Simulation. Meanwhile, NISJ uses Microsoft Word to compile documents, Canva to develop visual media, Google Scholar to search for references, and Mendeley to manage scientific sources.

The diversity of these applications shows that students use digital technology to meet several key needs. First, scientific information searches are conducted through platforms like Google Scholar, Google Books, and Scopus AI. Second, citation and bibliography management is assisted by reference management applications like Mendeley and Zotero. Third, academic document preparation is supported by Microsoft Word, while learning media development can be done through Canva and PhET Simulation. Fourth, artificial intelligence-based applications like ChatGPT and Gemini are utilized as supporting tools in academic activities.

Technology also supports students' strategies for finding references for their theses. NF and HAR use scientific search platforms to find articles relevant to their research needs. Students also consider the publication's novelty, the topic's relevance, and the source's credibility before using a reference. Meanwhile, Mendeley and Zotero help manage sources and compile citations and bibliographies, making the writing process more structured.

For students still in the title development stage, such as HAR, technology helps them review previous research and identify potential topics. For students working on their theses, such as NF and NISJ, technology helps manage references, write documents, and meet the technical requirements for scientific papers. These differences in thesis development stages demonstrate that technology needs can vary depending on the academic process students are currently undergoing.

Despite its many benefits, digital technology still presents several obstacles. One is limited access to paid journals needed to strengthen the theoretical foundation and discuss research. Furthermore, suboptimal mastery of application features means some students still need to learn certain functions independently. Using new technology also requires time to understand and adapt features to academic needs.

Thus, UMM's final-year PGSD students' use of digital technology has evolved from simply accessing information to using various digital devices to support the academic

process. Technology helps students find references, manage citations, compile documents, develop learning media, and complete their theses. However, its effectiveness still depends on students' ability to select credible sources, understand application functions, and use technology critically and responsibly.

3. The Role of Digital Literacy in Writing Final Student Theses

The results show that digital literacy supports the thesis writing of UMM Elementary School Teacher Education (PGSD) students. The ability to use technology helps students navigate various research stages, from idea generation and reference searching to citation management and document preparation and manuscript refinement. Digital tools make these processes more practical and structured.

In the early stages of research, scientific search platforms like Google Scholar, Google Books, and Scopus AI help students find references related to their topic. Digital sources expand students' opportunities to explore previous research and assess the topic's relevance and novelty. The ability to search for this information is crucial so that research problem determination is not based solely on personal opinion but also reflects developments in published knowledge.

During the writing stage, Mendeley and Zotero applications help students manage references, compile citations, and create bibliographies. Microsoft Word supports manuscript preparation, including document structure and formatting. Using these applications can reduce manual work and help students organize their scientific papers more systematically. However, these benefits depend on mastery of the application's features, especially when students must adapt their writing format to academic requirements.

In addition to reference search and management applications, Artificial Intelligence (AI)-based technology is also becoming part of the student academic environment. AI can help students understand information and support the assignment-completion process. From a program perspective, using this technology must maintain student responsibility for the content, analysis, and originality of the research. Therefore, AI use must be accompanied by checking the accuracy of the information, critical evaluation, and student understanding of the material used.

Support for academic responsibility is evident in the use of plagiarism checks through Turnitin and the study program's attention to AI use in academic work. This policy shows that technology use should be assessed not only for ease of use and speed, but also for adherence to principles of scientific honesty. Students remain responsible for ensuring that their work reflects their own understanding, analysis, and intellectual contributions.

The research findings also show that students' levels of technological mastery vary. NF has used reference management applications since their third semester, while HAR still focuses on Mendeley's basic features and needs to improve their understanding of other functions. NISJ also needs to strengthen document-processing skills, particularly in structuring and formatting their thesis. These differences suggest that early exposure to technology can be a valuable asset in meeting the demands of a final project, but ongoing skill development remains necessary.

Beyond technical skills, the ability to evaluate information is crucial to thesis writing. Students need to compare sources, assess the relevance of references, and determine research methods based on the characteristics of the problem being studied. The abundance of digital information does not always facilitate decision-making, as students must still understand the source's content and adapt it to their research needs.

Based on these findings, digital literacy increases the effectiveness of the thesis writing process by facilitating reference searches, citation management, document preparation, and the use of writing support tools. However, this effectiveness cannot be separated from critical thinking skills, technical mastery, academic ethics, and scientific responsibility. Therefore, technology use in thesis writing should be directed not only to expedite completion of the final assignment, but also to support the quality, accuracy, and integrity of students' scientific work.

4. Digital Literacy Readiness for Teacher Professionalism

The digital literacy readiness of UMM's final-year Elementary School Teacher Education (PGSD) students needs to be assessed not only by their ability to use technology in academic activities, but also by their readiness to use technology to support learning. As prospective elementary school teachers, students need to develop digital skills that can be applied in finding learning resources, developing learning media, managing information, and adapting learning strategies to students' needs.

From an institutional perspective, the UMM Elementary School Teacher Education Program has provided support through TPACK training for lecturers, the use of a Learning Management System (LMS), technology integration in Semester Learning Plans (RPS), and the implementation of Learning Technology courses. These supports create an academic environment that allows students to gain experience using technology in educational contexts. Integrating technology into learning also helps students recognize the relationship between digital devices, pedagogical strategies, and the material being studied.

Students' experience using technology for learning, information retrieval, media creation, reference management, and thesis writing provides them with the skills needed to meet the demands of the teaching profession in the digital era. However, exposure to interactive media alone is insufficient without the pedagogical skills to integrate it. As emphasized by [12], it is important to equip teachers with the skills to use interactive media effectively and to improve teaching through engaging, student-centered methodologies. Therefore, digital literacy for teacher professionalism is measured not only by the number of applications mastered, but also by the appropriate and pedagogical use of technology to support the educational process.

Digital literacy readiness is also evident in students' ability to search for and evaluate information. For prospective teachers, comparing references and considering source credibility is crucial when selecting teaching materials. Teachers need to ensure that the information used aligns with learning objectives, student characteristics, and the material being presented. Therefore, digital literacy for teacher professionalism is measured not only by the number of applications mastered, but also by the appropriate use of technology to support the educational process.

However, research results indicate that student readiness is not yet optimal. Some students still struggle to master application features, understand new technologies, and maximize digital device use for academic purposes. This shows that experience using technology does not always translate directly into mastery of all necessary digital skills. Students still need opportunities to practice, receive mentoring, and apply technology in various learning situations.

A willingness to learn independently is also a crucial aspect of prospective teachers' professional readiness. The ongoing development of educational technology requires students to update their knowledge and skills continually. Adaptability is essential so prospective teachers cannot only use the technology they learned during their studies but also learn new tools tailored to their schools' needs.

Thus, the digital literacy readiness of UMM's final-year PGSD students is supported by academic experience and technology integration within the study program. This readiness is reflected in their ability to use digital applications, search for and evaluate information, and recognize how technology supports learning. However, these competencies still need further development through training, practical learning media development, assistance with application use, and strengthened independent learning skills. These efforts are crucial for students to integrate technology effectively, critically, ethically, and responsibly in their profession as elementary school teachers.

5. Integration and Policy Support of UMM's PGSD Study Program

The research results show that the UMM Elementary School Teacher Education Program supports students' digital literacy development by integrating technology into the curriculum, learning plans, lecture delivery, and academic policies. This support demonstrates that digital competency development depends not only on individual student initiative but also on an academic environment that provides opportunities to use and learn technology.

Technology integration is achieved through providing lecturers with TPACK training, developing lesson plans that incorporate technology elements, and utilizing an LMS. However, integrating technology and academic policies does not automatically guarantee equitable digital literacy for all students. In line with [13], teachers must guide interaction by prompting questions, encouraging peer collaboration, and clarifying misunderstandings. This facilitative communication enables students to manipulate learning media confidently while engaging in dialogue with peers and the teacher. Therefore, study program support must go beyond providing platforms; lecturers must actively facilitate students' digital practices to ensure they use technology critically and responsibly in academic activities.

Study program support is also reflected in students' experiences using various digital applications for academic purposes. Google Scholar, Google Books, and Scopus AI assist with reference searches; Mendeley and Zotero support citation management; Microsoft Word facilitates document creation; and Canva and PhET Simulation can be used to develop media or learning resources. These applications give students opportunities to develop diverse digital skills tailored to their studies and thesis preparation.

In addition to supporting technical skills, the study program also considers academic ethics in the use of technology. Plagiarism checks through Turnitin and attention to AI use are part of efforts to maintain the originality of students' scientific work. This policy shows that using technology requires responsibility for the work's content, the accuracy of the information, and honesty in the academic process. AI-based technology can be used as a tool, but it does not replace students' responsibility to understand, analyze, and account for research results.

However, integrating technology and academic policies does not automatically guarantee equitable digital literacy for all students. Some students still need time to learn application features, adapt to new technologies, and improve their skills in compiling scientific documents. This situation highlights the need for continuity between study program policies, practical learning, and mentoring tailored to student needs.

Therefore, study program support can be strengthened through training in reference management applications, academic document processing, scientific source evaluation, responsible AI use, and the development of digital learning media. Ongoing mentoring can also help students overcome technical difficulties that arise when writing their theses and preparing to become teachers.

Overall, the integration of technology into the curriculum, the implementation of TPACK, the use of an LMS, the Learning Technology course, and the academic ethics policy represent institutional support for developing digital literacy among UMM PGSD students. This support aims not only to improve technical skills but also to build awareness of the appropriate, critical, and responsible use of technology. Further strengthening is needed so the study program's learning opportunities are matched by a more equitable increase in students' digital competencies.

6. Challenges and Opportunities for UMM PGSD Final Year Students in Implementing Digital Literacy

The research results show that UMM's final year PGSD students have utilized digital technology in their academic activities, but their mastery of this technology has not been fully optimized. Challenges faced include technical skills, information retrieval and evaluation, limited access to scientific references, adaptation to technological developments, and time management for learning.

The first challenge is technical skills in using digital applications. Some students still struggle to use certain features, resolve application glitches, and format number, and lay out their thesis documents in Microsoft Word. This shows that academic digital literacy requires not only the ability to use devices but also the technical skills needed to write scientific papers.

The second challenge relates to information retrieval and evaluation. The abundance of information available online makes it easy to find references, but students still need critical thinking skills to assess the credibility, relevance, and suitability of sources to the research problem. Furthermore, limited access to paid scientific articles can hinder thesis preparation, requiring students to find credible alternative references.

The next challenge is the rapid development of technology and differences in students' experiences using it. Using technology for entertainment does not always support academic skills. Workloads and time constraints can also hinder independent learning and adapting to new applications.

On the other hand, there are significant opportunities to develop students' digital literacy. Integrating technology into the curriculum, implementing *Technological Pedagogical Content Knowledge* (TPACK), using *a Learning Management System* (LMS), and incorporating Learning Technology courses can support the development of digital competency. Various digital platforms can also be utilized to search for scientific references, manage citations, compile documents, and develop learning media.

Students' awareness of their limited abilities provides an opportunity to develop independent and sustainable learning habits. Study program support through plagiarism checks, monitoring of artificial intelligence (AI) use, and technology integration in learning can also strengthen technical skills and academic ethics.

Based on these findings, UMM needs to develop digital literacy among final-year Elementary School Teacher Education (PGSD) students sustainably through application training, mentoring in preparing scientific papers, evaluating information sources, developing digital learning media, and strengthening academic ethics. These efforts are expected to improve final assignment completion while also preparing students to meet the demands of the elementary school teaching profession in the digital era.

3.2. Discussion

The research results show that final-year PGSD students at the University of Muhammadiyah Malang still face various obstacles in developing digital literacy. These obstacles are no longer related to limited access to technology, but rather to the ability to operate various digital applications, understand the features of continuously evolving technology, select credible information sources, and utilize technology optimally in writing their theses. In addition, students face obstacles such as limited access to paid scientific journals, difficulty using Microsoft Word to write scientific papers, and limited time to learn new technologies because of activities outside lectures. These findings came from interviews with the Head of the PGSD Study Program and seventh- and eighth-semester students [14].

These findings suggest that digital device ownership or high levels of technology use do not necessarily reflect a person's high digital literacy skills. This is reinforced by [15], which found that students often rely solely on mobile applications for entertainment or socialization, not for more productive educational purposes. This shows a gap in understanding and applying mobile applications for learning in ways that build digital literacy. Although most final-year PGSD students use technology daily, they still struggle to use it for more complex academic tasks, such as searching for scientific references and evaluating the quality of information sources [16].

Digital literacy is the ability and skill to manage digital media, digital devices, or networks to find, evaluate, create, and use information responsibly to foster communication relationships in everyday life. Digital literacy is not just reading and

writing skills, nor is it merely adding technology to the learning process, but utilizing it to improve the quality of learning and enhance other skills [16]. Digital literacy encompasses an individual's awareness, attitude, and ability to use digital devices appropriately to access, manage, evaluate, and communicate information effectively in specific life contexts. Digital literacy is not only related to technical skills, but also includes the ability to think critically and reflectively about the information consumed [17].

Digital literacy is an individual's ability to access, manage, evaluate, integrate, and utilize digital information critically, ethically, and responsibly. This capability requires not only technical mastery of digital devices but also cognitive skills to select valid information that supports the learning process. Therefore, students who can use technology but cannot evaluate information cannot be said to have optimal digital literacy [18].

The findings of this study also support [19], which state that digital literacy contributes to the development of higher-order thinking skills through the ability to analyze information, solve problems, and make critical decisions. In this study, students who are not accustomed to using various academic applications or critically evaluating information sources tend to face obstacles in the thesis-writing process compared with students with stronger digital literacy skills [20].

Digital technology can improve learning effectiveness if users have sufficient competence in using it. Conversely, if user skills are limited, technology cannot be used to its full potential, and various digital platforms may not fully support the learning process or the completion of academic assignments [21].

The rapid development of technology presents a unique challenge for students. Various Artificial Intelligence (AI)-based applications, scientific reference search platforms, and academic software are constantly being updated, requiring students to update their competencies continually. Using educational technology requires human resource readiness through continuous competency development so technology can be used effectively in learning [22].

Motivation for independent learning is a crucial factor in improving students' digital literacy. This aligns with the findings of [23], which state that education-based mobile applications can improve students' skills in seeking information, managing digital media, and interacting safely in cyberspace. Students who use applications with interactive features, such as quizzes and learning materials, have experienced significant improvements in their understanding of digital literacy [24]. Therefore, final-year PGSD students should shift their habit of using technology for entertainment toward using interactive academic applications to maximize their digital competencies. This demonstrates that developing digital literacy is a shared responsibility between educational institutions and students as lifelong learners [25]. In the context of teacher professionalism, the ability to utilize digital and multimodal media is not merely an optional skill but a fundamental requirement for fostering student engagement and accommodating diverse learning styles [26]. Unfortunately, the literature highlights a gap: research rarely focuses on developing teacher resources tailored to multimodal and digital instruction. Therefore, continuous support from study programs is essential to equip prospective teachers with the

skills and tools needed for digital instruction, ensuring that educational practices remain innovative and inclusive [27].

Based on the overall research results, it is understood that developing digital literacy in final-year PGSD students at the University of Muhammadiyah Malang requires a comprehensive strategy. Study programs play a role in providing a technology-integrated curriculum, training in using academic applications, mentoring in thesis preparation, and strengthening digital ethics. Meanwhile, students need to improve their independent learning skills, broaden their experience with various academic applications, and become familiar with using technology for scientific purposes [28]. With this synergy, students' digital literacy is expected to develop not only in technical aspects but also in critical thinking skills, problem-solving, scientific communication, and responsibility in using technology as preparation for becoming professional teachers in the digital era.

4. CONCLUSION

Based on the results of research on digital literacy among final-year students of the Elementary School Teacher Education (PGSD) Study Program at the University of Muhammadiyah Malang, obtained through interviews with the Head of the PGSD Study Program and seventh- and eighth-semester students, it can be concluded that students' digital literacy has developed and become an important part of the implementation of academic activities. Students understand that digital technology is not only used to access information but also needs to be used appropriately, critically, responsibly, and in accordance with academic needs.

First, the digital literacy skills of final-year PGSD students at the University of Muhammadiyah Malang are considered quite good but not yet fully optimal. Students can use various digital technologies to search for and evaluate information, obtain scientific references, manage bibliographies, compile academic documents, create learning media, and support thesis preparation. The use of Google Scholar, Google Books, Mendeley, Zotero, Canva, Microsoft Word, Scopus AI, and other artificial intelligence-based technologies indicates that students use technology to support academic needs. However, some students have not yet mastered all application features and still experience difficulties using certain technologies. Thus, student digital literacy is not only related to the ability to operate devices or applications, but also to the ability to select, evaluate, and use information and technology appropriately.

Second, digital technology plays a crucial role in supporting academic activities, particularly thesis writing. Students utilize technology from the reference search stage, selecting relevant sources, managing bibliographies, compiling documents, and through the thesis revision process. Technology provides convenience and efficiency in obtaining information and meeting various academic needs. However, using technology, including artificial intelligence, still requires critical thinking skills, academic responsibility, ethics, and originality. Students remain responsible for understanding, analyzing, and developing their research results.

Third, students' digital literacy is supported by the academic environment of the Elementary School Teacher Education Program at the University of Muhammadiyah

Malang. This support is evident through the integration of technology into learning, the implementation of TPACK (Integrated Learning Management System), the use of LMS (Learning Management System), the inclusion of technology in the Lesson Plan (RPS), and the existence of a Learning Technology course that provides students with experience utilizing technology for media and teaching materials. Furthermore, the use of various academic applications, the implementation of Turnitin audits, and the use of AI (Intelligible Message) demonstrate the program's efforts to guide technology use while maintaining academic ethics and integrity. This support gives students opportunities to develop digital literacy skills gradually throughout their studies.

Fourth, students' digital literacy readiness as prospective elementary school teachers has been established through their experience using technology in academic activities, but it still needs continuous development. Students' experience using technology for learning, information retrieval, media creation, reference management, and thesis writing provides them with the skills needed to meet the demands of the teaching profession in the digital era. This readiness is demonstrated not only through their ability to use technology but also through their ability to integrate it with learning needs. Therefore, digital literacy is a key component in supporting students' readiness to fulfill their role as prospective teachers who can use technology in the educational process.

Fifth, the main challenge students face is no longer limited access to technology, but limited competence in using it effectively. These challenges include less-than-optimal mastery of application features, difficulty selecting relevant information from a multitude of digital sources, limited access to some scientific journals, difficulty using applications to support academic writing, and the need to keep up with constant technological developments. Furthermore, individual factors such as limited study time due to busy work schedules and technology use habits previously directed mainly toward entertainment can also affect students' development of digital literacy skills.

Overall, the results indicate that digital literacy among final-year PGSD students at the University of Muhammadiyah Malang has become an important part of supporting academic activities and their readiness as prospective teachers, but their mastery still needs continuous improvement. This can be achieved by familiarizing students with technology in learning activities, providing training in academic applications, mentoring them in preparing scientific papers, strengthening their ability to evaluate information, and increasing students' motivation for independent learning. Thus, students cannot only use technology technically, but also use it effectively, critically, ethically, and responsibly in academic activities and in carrying out their profession as prospective elementary school teachers.

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