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The use of cloud-based learning media and its implications for elementary students' digital literacy

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Abstract

The use of cloud-based learning media is a relevant digital learning strategy for supporting the development of digital literacy among elementary students. This study aims to analyze the digital literacy skills of elementary school students using cloud-based learning media in Kulon Progo. The study employs a qualitative approach, involving elementary school students, classroom teachers, and ICT administrators as participants. Data were collected through in-depth interviews, learning observations, and documentation studies, subsequently analyzed through data reduction, data presentation, and conclusion drawing using source and technique triangulation. The results reveal that students are accustomed to using digital devices to support learning, especially in accessing information, taking online quizzes, and completing cloud-based assignments. The use of cloud-based media contributes to increased student engagement, motivation, and learning experiences. However, the ability to critically evaluate digital information, creativity in producing digital content, and the use of artificial intelligence-based technology still require strengthening. In addition, digital literacy development is influenced by the availability of ICT infrastructure, teacher competence, and family support. Thus, the use of cloud-based learning media has the potential to support the development of digital literacy in elementary students if balanced with appropriate guidance and support from schools and families.

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1. Introduction

Advancements in Information and Communication Technology (ICT) have significantly transformed various aspects of society, particularly the field of education (Kumara et al., 2025; Isfold Sigurdardottir & Sørensen, 2025). In elementary education, ICT has been integrated into the learning process as an innovation that aligns with the demands of 21st-century education. The use of technology enables the creation of more engaging, interactive, and meaningful learning experiences for students (Aviva & Mukhlishina, 2026). Furthermore, advancements in ICT have highlighted the need for students to develop digital literacy skills to effectively address the challenges of the 21st century (Isfold Sigurdardottir & Sørensen, 2025). Digital literacy encompasses students' abilities to access, evaluate, create, and communicate information through digital technology (Utami et al., 2018; Teo et al., 2021; Bygstad et al., 2022; Nichols Hess et al., 2025). Mastering this skill is increasingly crucial given the increasing number of digital learning resources and their integral role in the learning process in schools (Susilowati et al., 2025; Bulus et al., 2022; Sezgin, 2022).

Elementary schools, as the primary level of education, play a crucial role in building the foundation of students' digital literacy from an early age. Digital literacy is a fundamental skill that not only enhances students' academic abilities but also promotes the development of critical, logical, and creative thinking from an early age (Kamila & Mukhlishina, 2026; Ahsan et al., 2022; Ryberg et al., 2010). Various studies have demonstrated that digital literacy extends beyond the ability to use digital devices, contributing to the development of critical thinking, problem-solving skills, and a deeper understanding of learning materials (Laar et al., 2019; Förster et al., 2022; Falloon, 2020). Despite its importance, implementing digital literacy in elementary schools remains challenging. A number of students have not been able to make optimal use of digital media for learning purposes, which limits the development of their digital literacy competencies (Putri & Febrilia, 2023; Salam et al., 2024; Darnawati et al., 2025).

In the context of digital learning, cloud-based learning media represent an innovative tool that teachers can utilize to support a more effective and interactive learning process (Rocha Estrada et al., 2022). Through a technology-based Cloud platform, teachers can provide learning materials that are easily accessible, flexible, and appropriate for students' needs. In addition, the use of this media underscores the role of teachers not only as transmitters of knowledge but also as facilitators and motivators who can increase students' enthusiasm for learning (Kernelia & Dafit, 2026). Apart from providing easy access to learning resources without limitations of space and time, web-based media cloud allows teachers and students to share materials and work results collaboratively in one centralized platform (Zulaichah et al., 2025). Research reveals that the use of digital learning platforms can increase elementary students' interaction and learning motivation through the presentation of more engaging and easily accessible materials (Mustika, 2022). One implementation of cloud-based learning media is the use of interactive reading platforms, which have been proven effective in improving elementary students' reading motivation and comprehension through their interactive features (Zulaichah et al., 2025; Hu & Li, 2017). With these characteristics, interactive learning media based on the cloud provide opportunities for students to learn independently and collaboratively inside and outside the classroom; hence, it is relevant in supporting the development of 21st-century digital literacy (Lovia et al., 2024).

However, it is necessary to analyze students' digital literacy in relation to their use of digital learning media. Cloud as part of digital learning in elementary schools (Kvåle, 2023). Various studies have revealed that digital literacy plays a crucial role in supporting the learning process, strengthening student character, and improving overall learning outcomes (Situmorang, 2024).

Digital literacy encompasses not only technical skills in using technology but also the ability to evaluate information from various digital sources, actively participate in learning, and adapt to various forms of available digital media (Naila et al., 2021; Arkan & Bal, 2025). Therefore, the development of digital literacy requires adequate technological support and the implementation of pedagogical approaches that are appropriate to the characteristics of digital learning (Musanna et al., 2026; Farias-Gaytan et al., 2022). This condition is both a challenge and an opportunity for teachers to design and facilitate problem-based learning, which not only presents information but also encourages students to think critically, reflectively, and actively throughout the learning process.

Students' ability to utilize cloud-based learning media is influenced by various factors within both the school and family environments. These factors include the availability of technological infrastructure in schools, teachers' competence in integrating ICT into learning, and family support for students' use of technology (Lin et al., 2022). The support established between schools and families can foster a sense of shared responsibility for the educational process; thus, the development of student competencies is not only the teacher's task but also involves parents' active role (Emynorane et al., 2026). Therefore, an analysis of students' digital literacy in the use of web-based learning media Cloud. It is crucial to provide an overview of the extent to which integrating digital technology contributes to the development of elementary students' digital literacy skills. This condition is relevant to Kulon Progo as the research location. This is because the region is predominantly semi-rural, with heterogeneous social, economic, and educational conditions. In the context of primary education, there is significant variation between schools in the availability of ICT infrastructure, such as internet access and digital devices, as well as in teacher competence in integrating technology into learning (Tsortanidou et al., 2019). Furthermore, a student's family's socioeconomic background influences the intensity and quality of digital technology use in learning activities, both at school and at home. This directly impacts how students access, understand, and utilize digital-based learning media cloud effectively (Cajavilca Reyes et al., 2025; Tsortanidou et al., 2019).

Previous research has shown that regional characteristics and local educational readiness influence the successful implementation of digital learning and the development of digital literacy in elementary students (Rofiah et al., 2024). However, most research still focuses on the implementation of learning technology or teachers' perceptions of technology use. Studies specifically analyzing students' digital literacy skills in using cloud-based learning media, especially in semi-rural areas, are still relatively limited (Li et al., 2021). Furthermore, essential aspects of digital literacy, such as the ability to evaluate information, use digital media productively, and digital ethics, have not been widely studied in the context of elementary school learning (Haeroni et al., 2023). This situation indicates the need for research examining elementary students' digital literacy skills in utilizing cloud-based learning media, particularly in Kulon Progo.

Therefore, this study aims to provide an empirical picture of students' digital literacy skills, the use of cloud-based learning media, and the factors that support and inhibit their implementation in elementary schools in Kulon Progo. The novelty of this research lies in its focus on students as the primary subjects of analysis, examining their ability to access, evaluate, utilize, and create digital information through cloud-based media. This research, in addition, examines aspects of digital ethics and digital creativity, which are rarely the focus of research at the elementary school level. The results are expected to provide an overview of the digital literacy status of elementary students and serve as a basis for teachers, schools, and policymakers in designing more effective, contextual, and sustainable cloud-based digital learning strategies.

2. Method

This research is a qualitative study aimed at gaining an in-depth understanding of the phenomenon under study. Qualitative research involves obtaining data in the form of words, actions, and meanings from research subjects holistically and contextually (Moleong, 2017). Qualitative research was selected to understand and analyze in depth the digital literacy skills of elementary students through the use of digital learning media in a natural learning context. The research was conducted in two elementary schools in Kulon Progo, Yogyakarta Special Region, that have utilized digitally based learning media in the learning process. The research subjects consisted of 28 and 25 fifth-grade students, respectively. For students, a saturated sampling technique, or total sampling, was used within the class. Other informants (teachers and ICT administrators) were selected through purposive sampling, with 2 class teachers and 2 ICT administrators as supporting informants. To maintain the confidentiality of participants' identities, the researcher assigned a code to each informant. The code S is used for students, G for teachers, and T for school ICT administrators. The numbering of each code is adjusted to the order of informants in the data collection process, for example, S1 (Student 1), G1 (Teacher 1), and T1 (ICT Administrator 1).

Data collection was conducted through in-depth interviews, observations, and documentation studies. The interviews were semi-structured, using an interview guide containing questions about experiences with media, cloud use, digital literacy skills, and barriers to digital learning. Interviews were conducted in person at the school and lasted 20–30 minutes for each participant. Observations were made during the learning process to examine students' activities in using digital devices, accessing information, and interacting with web-based media and the cloud, as well as student engagement in digital learning. Observations were conducted non-participatorily using pre-prepared observation sheets. Documentation studies were conducted by collecting teaching modules, students' digital assignments, screenshots of digital learning activities, photographs of learning activities, and data on the school's ICT infrastructure. Documentation was used to underscore the results of interviews and observations. Data analysis used the interactive analysis model of Miles, Huberman, and Saldaña (2014), which includes data reduction, data presentation, conclusion drawing, and verification. In the analysis stage, data from interviews, observations, and documentation were coded based on research themes such as digital device use, digital information access, information evaluation, and media utilization (Cloud), digital ethics, and the supporting and inhibiting factors in implementing digital literacy. Data validity was assessed through source and technical triangulation. Source triangulation was carried out by comparing information from students, teachers, and ICT administrators, while technical triangulation was carried out by comparing the results of interviews, observations, and documentation. In addition, researchers conducted member checking with several informants to ensure that the data interpretation results aligned with actual conditions.

3. Results

The research was obtained through data triangulation from interviews, observations, and documentation. Interviews were conducted with teachers, students, and ICT administrators. Observations were conducted during the learning process and documentation studies. This triangulation was conducted to ensure the consistency and validity of the findings on elementary students' digital literacy skills using the web-based learning media Cloud in Kulon Progo. The results were subsequently analyzed based on several key themes related to elementary

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students' digital literacy. The documentation used in this article has been obtained with permission from the school and parents in accordance with research ethics regulations. Photos are used solely for academic purposes and scientific publications. Students' personal identities are not explicitly displayed to maintain the privacy and confidentiality of research participants. A summary of the research findings is presented in Table 1.

Table 1. Summary of research findings

Themes	Data Sources	Statements	Interpretations
Use of a digital device	Student interviews	"Yes, I use my cell phone more often for entertainment and for studying." (S1)	Students utilize digital devices to support learning.
Access to digital information	Student interviews	"Yes, I usually search for it on the internet using Google and AI, and YouTube is usually for watching tutorials." (S2)	Students can access digital information but still need guidance in determining search keywords.
Understanding and evaluating information	Student interviews	"Not all information on the internet is true. I usually read a lot of information from various sources, checking whether each source is valid. If the source is valid, then I use the information." (S1)	Students are beginning to verify digital information, but their evaluation skills remain limited.
Utilization of cloud-based learning media	Teacher interview	“Yes, sometimes I use Wordwall, Canva, and Quizizz, although several students prefer to have it explained using a board.” (G1)	Digital media is used to support learning in the classroom.
Digital ethics and security	Student interviews	“Yes, the teacher reminded me not to say rude things or copy other people's work on the internet. If I suddenly find something bad on the internet, I won't look at it, skip it, sometimes I'll report it or block it.” (S2)	Students have demonstrated awareness of digital ethics and security.
Supporting and Inhibiting Factors for the Implementation of Digital Literacy in Elementary Schools	Teacher interview	"The obstacles we face are preparing for digital learning, mentoring students, and unstable internet connections. School facilities are adequate, but parental support still needs to be improved." (G2)	The implementation of digital literacy is influenced by infrastructure readiness, teacher mentoring, and family support.

3.1. Use of digital devices by students

Based on interviews, data reveal that most students are accustomed to using digital devices, particularly mobile phones, for both entertainment and learning. These devices are used for independent study, assignments, and accessing various learning applications. One of the students stated, *"Enough, I use my cell phone more often for entertainment and for studying"*(S1). This finding implies that digital devices have become part of students' daily activities, including supporting their learning. Observations also indicate that students were able to operate digital devices independently during learning, such as opening learning applications, accessing digital materials, and taking teacher-prepared online quizzes. These findings were supported by documentation studies in the form of photographs of learning activities, which reveal students actively using digital devices in the classroom with teacher guidance. Documentation of student activities with digital devices during the learning process is shown in Figure 1.

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Figure 1. Student activities using digital devices in classroom learning

Students use Chromebooks to access digital learning materials, complete assignments, and participate in interactive learning activities. These activities demonstrate students' basic skills in operating digital devices as learning support tools.

3.2. Access and search for digital information

The results of interviews with students underline that information searches were carried out through various sources, ranging from books and parental assistance to the internet via Google, YouTube, and artificial intelligence (AI)-based applications. One of the students stated, *"Yes, searching on the internet is usually done by Google and AI, while YouTube is usually used to watch tutorials"*(S2). This statement indicates that students have used various digital sources to obtain information to meet their learning needs. Google and AI are used to quickly search for information, while YouTube is utilized to obtain visual explanations through tutorials. Learning observations reveal that students were able to search for information independently when given digital-based assignments. Numerous students still needed guidance from the teacher in formulating search keywords. Documentation studies, including student assignments and screenshots of information-search activities, reveal a variety of sources used by students, both print and digital. The research results indicate that students' digital information access skills have developed, but they still need reinforcement in effective information-search strategies. Documentation of student learning activities using Chromebooks to search for information to complete assignments using Google is shown in Figure 2.

Figure 2. The process of students searching for digital information to complete lesson assignments

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As illustrated above, students search for information online using Google as a digital learning resource. This activity demonstrates their ability to access digital information to support learning assignments.

3.3. Understanding and evaluating digital information

The results of interviews with students underscore that they realized that not all information available on the internet can be trusted. One of the students stated, *"Not all information on the internet is true. I usually read a lot of information from various sources and check whether the source is valid or not. If the source is valid, then I use the information"*(S1). This statement implies that students are aware of the need to verify digital information before using it. Observations also indicate that teachers actively guided students to read more than one source and discuss the accuracy of the information obtained. This finding was reinforced by a documentation study of teaching modules containing digital literacy materials and digital information evaluation activities with teacher guidance. Based on triangulation of data from interviews, observations, and documentation, students' digital information evaluation skills were beginning to develop. However, these skills were still at a basic level and needed improvement, especially when dealing with information obtained through artificial intelligence (AI)-based technology. Documentation, learning activities, and evaluation of digital information with teacher assistance are shown in Figure 3.

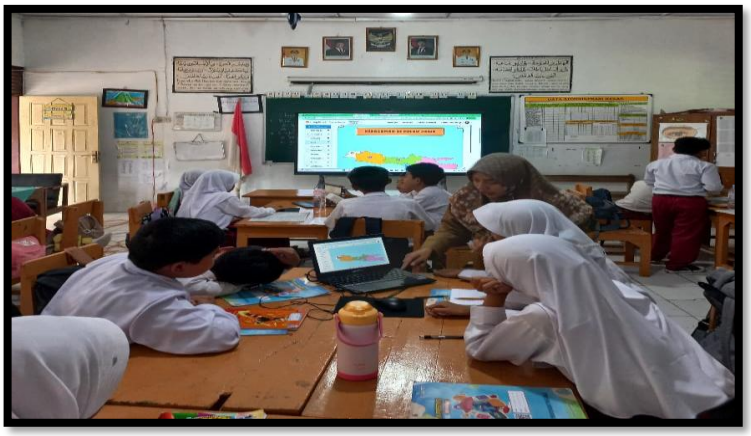

Figure 3. Teacher assistance in guiding students to evaluate digital information

As shown in Figure 3, the teacher provides guidance to students in comparing various digital information sources and verifying the accuracy of the information obtained. This activity aims to develop students' critical thinking and digital information evaluation skills.

3.4. Utilization of cloud-based learning media

Cloud-based learning media, such as Quizizz, Wordwall, Canva, Google Workspace, and *Ruang Guru*, are utilized in various subjects to support the learning process. Interviews with teachers indicate that these media have been implemented in learning activities, although they are not always the primary choice for all students. One teacher stated, *"Yes, sometimes I use Wordwall, Canva, and Quizizz, although some students prefer to have it explained using a board"* (G1). This statement indicates that cloud-based learning media have been utilized as a learning support tool. However, students' diverse learning preferences indicate that digital media should be integrated into conventional learning methods to enhance learning.

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Observations indicate that students are more enthusiastic and active when participating in learning activities that use digital quizzes and interactive visual media. Documentation studies, including digital quiz results, Canva-based assignments, and digital class archives, demonstrate the consistent use of cloud-based learning media in the learning process. Based on interviews, observations, and documentation, cloud-based learning media positively contribute to students' learning experiences and support the development of digital literacy. These findings are also supported by documentation of learning activities showing students using Wordwall media during the learning process. The use of Wordwall in classroom learning activities is shown in Figure 4.

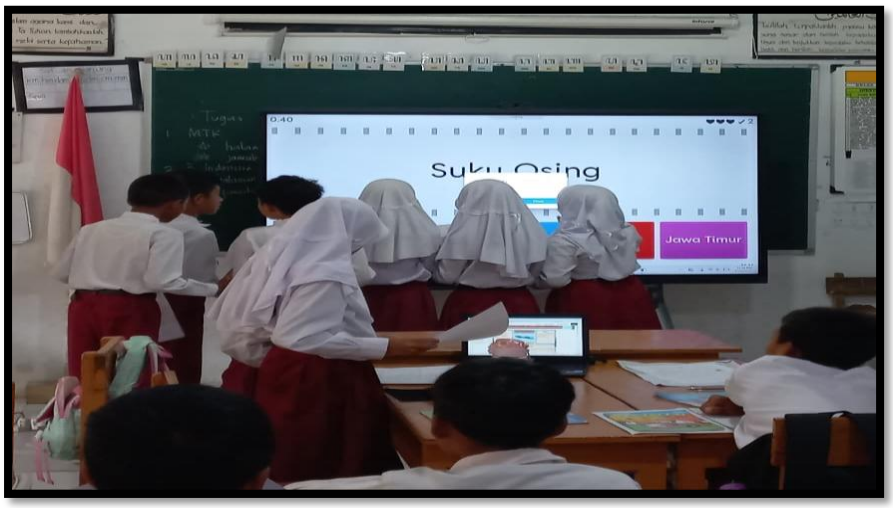

Figure 4. Students evaluate their learning using a digital Wordwall quiz

As shown in Figure 4, students participate in learning evaluations using digital quizzes on Wordwall. The use of cloud-based learning media helps increase student participation, motivation, and engagement in the learning process.

3.5. Digital ethics and security

Interviews with students indicate that they understood the basic rules for using the internet and digital devices, particularly regarding polite language and avoiding negative content. One student stated, *"Yes, my teacher reminded me not to use foul language or copy other people's work online. If I suddenly find something inappropriate online, I won't look at it, just ignore it, and sometimes report or block it."*(S2). This statement indicates that students have developed an awareness of digital ethics and security. Students not only understand the importance of using polite language and respecting others' work, but are also able to take simple steps to avoid or address negative content on the internet. In observations, teachers routinely remind students about digital ethics before learning activities begin. They emphasize the importance of using polite language, respecting others' work, and being vigilant when accessing information online. These findings are supported by documentation studies of classroom rules and regulations for the use of digital devices, which demonstrate the existence of school regulations regarding digital ethics and security. Based on triangulation of data from interviews, observations, and documentation, students' understanding of digital ethics has begun to develop. However, this understanding still needs to be strengthened through ongoing familiarization, mentoring, and

supervision. Documentation of learning activities that demonstrate the application of digital ethics and security in the school environment is shown in Figure 5.

Figure 5. Interactive whiteboard and Chromebook for learning

As shown in Figure 5, the use of interactive whiteboards and Chromebooks as tools to support digital learning in schools. The availability of these facilities supports the development of students' digital literacy by enabling the use of technology in learning activities.

3.6. Supporting and inhibiting factors for the implementation of digital literacy in elementary schools

Interviews with teachers and ICT administrators indicate that schools have relatively adequate ICT facilities and infrastructure, such as Chromebooks, computer labs, and digital literacy support programs. The ICT administrators stated that *"The facilities are sufficient, the extra ICT Chromebook program is in the lab" (T1).* Observations also indicate that these facilities have been utilized in learning, although not evenly across all classes. Documentation studies, including inventory data on ICT facilities and school programs, corroborate these findings. The main obstacles identified include limited teacher preparation time, internet network stability, and limited parental support at home. Data triangulation indicates that optimizing students' digital literacy requires a relationship between schools, teachers, and the family environment.

4. Discussion

Findings reveal that cloud-based learning media have been used in various learning activities and have contributed to the development of digital literacy among elementary school students. Interview and observation findings indicate that digital devices have become part of daily learning activities, whether for searching for information, completing assignments, or participating in interactive learning. However, the intensity of digital device use is not always accompanied by deeper digital literacy skills. Most students can operate devices and access information independently, but their ability to evaluate the credibility of information remains at a basic level. This finding suggests that mastery of technical skills has not yet fully developed into critical thinking skills in a digital environment. Therefore, cloud-based learning needs to be

designed not only to provide access to technology but also to encourage students to reflect, analyze, and evaluate the information they obtain.

The use of cloud-based media such as Google and YouTube, as well as artificial intelligence (AI)-based technology, demonstrates a shift in elementary students' learning patterns. Students are no longer reliant on a single source of information, but instead utilize multiple digital platforms simultaneously to acquire knowledge. This situation expands learning opportunities while increasing access to diverse information sources. However, the increasing number of information sources also demands that students be able to distinguish between valid and invalid information. Therefore, digital literacy in the era of AI utilization encompasses not only the ability to search for information but also to verify, compare, and use it responsibly.

In addition to serving as sources of information, digital media such as Quizizz, Wordwall, and other online learning platforms are being used to create more interactive learning experiences. Consistent with research by Pramusti et al. (2024) and Saputri et al. (2021), the use of technology in learning has been shown to increase student engagement and support the development of digital literacy. Most students reveal greater enthusiasm when the material is presented through visual media, interactive quizzes, or project-based assignments. However, numerous students still felt more comfortable with direct explanations using a whiteboard. These findings suggest that technology cannot completely replace pedagogical interaction between teachers and students. The effectiveness of cloud-based media is greatly influenced by teachers' ability to integrate technology with learning strategies appropriate to the characteristics of elementary students. In other words, technology serves as a supporting tool that enriches the learning process, not as a substitute for the teacher's role.

Based on a digital ethics perspective, students have demonstrated a basic understanding of the responsible use of digital devices and the internet. Teachers actively remind students to maintain polite communication and avoid negative content during digital learning. These findings indicate that students' digital literacy is beginning to encompass ethical dimensions in technology use. Consistent with Rizka et al. (2025), the use of digital learning media can support active student engagement while enhancing critical thinking skills. However, students' digital creativity remains at a basic level. Although students can produce simple digital products such as posters and documents, they still predominantly use conventional media to complete learning assignments. This situation indicates that the use of technology is still dominated by operational skills, while productive and creative abilities have not yet developed to their full potential.

In addition, the research results underscore that the development of digital literacy is influenced by various factors, including the availability of ICT facilities and infrastructure, teacher competence, and family environmental support. Although digital facilities in schools are relatively adequate, their utilization is not evenly distributed across classes. This finding indicates that the availability of devices and internet access is a crucial prerequisite, but not sufficient, to ensure the development of students' digital literacy. Strengthening digital literacy requires ongoing teacher support and parental involvement in guiding positive technology use. Without such support, technology use risks producing only operational skills without the critical thinking, digital ethics, and creativity skills that are at the heart of 21st-century digital literacy (Putri et al., 2021).

Overall, this study underlines that cloud-based learning media provide opportunities for students to develop various aspects of digital literacy through more interactive, collaborative, and technology-based learning activities. However, information evaluation and digital creativity skills still require strengthening. Continuous efforts to improve teacher competency, support

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parents, and implement learning that fosters critical thinking and creativity are needed to sustain the development of students' digital literacy. This research also has several limitations. First, the study was conducted only at two elementary schools in Kulon Progo; hence, the results cannot represent the conditions of all elementary schools, each with its distinct characteristics. Second, the use of a qualitative approach with a limited number of informants led the findings to focus more on an in-depth understanding of the phenomenon under study rather than on generalizing the research results. Third, the study only examined the use of cloud-based learning media in a school context and did not examine in depth students' use of digital technology outside of school or the influence of family socioeconomic conditions. Furthermore, the study did not quantitatively measure students' digital literacy levels; thus, the achievement of each dimension could not be compared statistically. Therefore, further research is recommended that involves more diverse participants, uses a mixed-methods approach, and examines the influence of the family environment, socio-economic factors, and the use of artificial intelligence-based technology on the development of digital literacy in elementary students.

5. Conclusion

This study underscores that the digital literacy skills of elementary students in Kulon Progo have developed through the use of cloud-based learning media. Students have been able to use digital devices to support the learning process, particularly in accessing information, participating in interactive learning activities, and demonstrating an initial understanding of information verification and ethical technology use. However, their critical evaluation of information and digital creativity still requires strengthening so that students are not only users of technology but also able to use it productively and responsibly. Research findings also indicate that cloud-based learning media offer students more interactive and flexible digital learning experiences. Its use is supported by the availability of ICT facilities and infrastructure and by teachers' competence in integrating technology into learning. However, several challenges remain, such as internet network stability and parental involvement in supporting technology use at home. Therefore, developing students' digital literacy requires a sustained and collaborative effort among schools, teachers, parents, and policymakers to ensure the optimal use of technology in learning and to meet the needs of 21st-century education.

Credit authorship contribution statement

First Author: Conceptualization, research methodology, data collection, data analysis, and drafting the initial article. **Second Author**: Manuscript review and editing. **Third Author**: Methodology and instrument development. **Fourth Author**: Data validation, research result visualization, and **Last Author**: Final manuscript review and editing.

Declaration of competing interest

The authors declare no conflicts of interest, financial or non-financial, that could affect the results or interpretation of this study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The datasets were collected and analyzed exclusively for this research. Access to the data will be granted in accordance with ethical guidelines and participant confidentiality requirements.

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Ethical Declaration

This study was conducted in accordance with research ethics principles. All participants, including elementary school teachers and students, gave their consent after receiving an explanation of the study's purpose, and procedures, and their right to withdraw at any time without consequences.

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Declaration of AI statement

The authors declare that artificial intelligence (AI)-assisted tools were used solely to improve the language, grammar, and readability of this manuscript. All scientific content, data analysis, interpretation of results, and conclusions were developed and verified by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the manuscript.

References

Ahsan, M. H., Ismail, S. A., Ahmad, M., & Nurhayati, S. (2022). Digital literacy research in Scopus: A bibliometric analysis between 1997 and 2021. *Business, Management and Economics Engineering*, *20*(2), 1–30.

Arkan, Z., & Bal, M. (2025). The relationship between school-age students' literacy skills and digital well-being: A systematic review. *BMC Psychology*, *13*, 1240. https://doi.org/10.1186/s40359-025-03573-4

Aviva, A. A., & Mukhlishina, I. (2026). Analysis of the plugged-in method through Wordwall in teaching procedure text writing at the elementary level. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *10*(2), 229–239. https://doi.org/10.33578/pjr.v10i2.1313

Bulus, B., Yilmaz, M. M., Isik, M., & Birinci, U. K. (2022). The implementation of adult digital literacy: Analysis of the adult digital literacy in South Korea and Turkey. *Media Education (Mediaobrazovanie)*, *18*(4), 531–545. https://doi.org/10.13187/me.2022.4.531

Bygstad, B., Øvrelid, E., Ludvigsen, S., & Dæhlen, M. (2022). From dual digitalization to digital learning space: Exploring the digital transformation of higher education. *Computers & Education*, *182*, 104463. https://doi.org/10.1016/j.compedu.2022.104463

Cajavilca Reyes, K., Perez-Hernandez, E., & Cerrillo Martin, R. (2025). Critical digital literacy in non-formal educational spaces. *Digital Education Review*, *47*, 29–43. https://doi.org/10.1344/der.2025.47.29-43

Darnawati, Sutopo, H., Sahran, L. O., & Jamiludin. (2025). Exploring the development of a game-based education: History learning for elementary school students. *International Journal of Digital Multimedia Broadcasting*, *2025*, Article 3600683. https://doi.org/10.1155/ijdm/3600683

Emynorane, R. H., Urbain, M. J., Giovanni, R., Ratna, H. E., & Léa, S. (2026). Community involvement and its impact on school success in Madagascar. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *10*(1), 119–127. https://doi.org/10.33578/pjr.v10i1.345

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency framework. *Educational Technology Research and Development*, *68*(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Farias-Gaytan, S., Aguaded, I., & Ramirez-Montoya, M. S. (2022). Digital transformation and digital literacy in the context of complexity within higher education institutions: A systematic literature review. *Education and Information Technologies*, *27*, 1417–1437. https://doi.org/10.1007/s10639-021-10624-x

Förster, M., Maur, A., Weiser, C., & Winkel, K. (2022). Pre-class video watching fosters achievement and knowledge retention in a flipped classroom. *Computers & Education*, *179*, 104399. https://doi.org/10.1016/j.compedu.2021.104399

Haeroni, R., Saptono, B., Kawuryan, S. P., & Sayekti, O. M. (2023). Digital literacy and its impact on reading interest in prospective elementary school teachers. *International Journal of Elementary Education*, *7*(3), 478–484. https://doi.org/10.23887/ijee.v7i3.61819

Hu, M., & Li, H. (2017). Student engagement in online learning: A review. *International Symposium on Educational Technology (ISET)*. https://doi.org/10.1109/ISET.2017.17

Isfold Sigurdardottir, H. D., & Sørensen, K. H. (2025). Mediating and managing: Envisioning digital game-based learning in schools. *Nordic Journal of Digital Literacy*, *20*(2), 87–98. https://doi.org/10.18261/njdl.20.2.3

Kamila, K., & Mukhlishina, I. (2026). Qualitative analysis of the literacy and numeracy habituation program on the critical thinking skills of grade III students at SDN Pendem 01. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *10*(1), 26–34. https://doi.org/10.33578/pjr.v10i1.515

Kernelia, S., & Dafit, F. (2026). Role of teachers in motivating students to learn motivation in class IV of SDN 003 Tambun Pelalawan. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *10*(2), 191–203. https://doi.org/10.33578/pjr.v10i2.1001

Kumara, P. P. N. V., Hinze, A., Vanderschantz, N., & Timpany, C. (2025). Online reading lists: Evaluating students experience. *International Journal on Digital Libraries*, *26*(2), 1–31. https://doi.org/10.1007/s00799-025-00422-y

Kvåle, G. (2023). Critical literacy and digital stock images: The interests of the uninteresting images. *Nordic Journal of Digital Literacy*, *18*(3), 173–185. https://doi.org/10.18261/njdl.18.3.4

Laar, E. van, Deursen, A. J. A. M. van, Dijk, J. A. G. M. van, & Haan, J. de. (2019). Determinants of 21st-century digital skills: A large-scale survey among working professionals. *Computers in Human Behavior*, *100*, 92–104. https://doi.org/10.1016/j.chb.2019.06.017

Li, H., Zhao, C., Long, T., Huang, Y., & Shu, F. (2021). Exploring the reliability and its influencing factors of peer assessment in massive open online courses. *British Journal of Educational Technology*, *52*(6), 2263–2277. https://doi.org/10.1111/bjet.13143

Lin, R., Yang, J., Jiang, F., & Li, J. (2022). Does teacher's data literacy and digital teaching competence influence empowering students in the classroom? Evidence from China. *Education and Information Technologies*, *28*, 2845–2867. https://doi.org/10.1007/s10639-022-11274-3

Lovia, S., Kwame, O., Penu, A., Boateng, R., Budu, J., Serbe, J., & Asamoah, P. (2024). Educational technology in primary and elementary education: A bibliometric review. *Heliyon*, *10*(7), e28101. https://doi.org/10.1016/j.heliyon.2024.e28101

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.

Moleong, L. J. (2017). *Metode Penelitian Kualitatif*. Remaja Rosdakarya.

Musanna, A., Herwanis, D., Zakaria, R., & Wahyuni, S. (2026). Digital literacy in Islamic higher education instruction: Exploring innovative approaches to curriculum integration.

Jurnal PAJAR (Pendidikan Dan Pengajaran), *10*(2), 250–260. https://doi.org/10.33578/pjr.v10i2.1099

Mustika, T. N. (2022). Pengembangan media video pembelajaran daring di sekolah dasar. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *6*(2), 531–541. https://doi.org/10.33578/pjr.v6i2.8614

Naila, I., Ridlwan, M., & Haq, M. A. (2021). Literasi digital bagi guru dan siswa sekolah dasar: Analisis konten dalam pembelajaran. *Jurnal Review Pendidikan Dasar*, *7*(2), 116–122. https://doi.org/10.26740/jrpd.v7n2.p166-122

Nichols Hess, A., Benoit, E. R., Krystyniak, R. M., & Williams, S. (2025). "What is one takeaway you've gotten from this learning experience?" Analyzing student reflections on introductory information literacy instruction. *Communications in Information Literacy*, *19*(2), 153–178. https://doi.org/10.15760/comminfolit.2025.19.2.2

Pramusti, R. A., Ulum, B., & Kumalasani, M. P. (2024). Exploration of TPACK in IPAS subjects in optimizing digital literacy of students with special needs. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *8*(6), 555–563. https://doi.org/10.33578/pjr.v8i6.10108

Putri, F. Y., Hakim, R., Desyandri, Arief, D., Amini, R., & Erita, Y. (2021). Pengembangan bahan ajar menyimak berbasis media audio visual dengan pegintegrasian pendidikan karakter positif peserta didik kelas V sekolah dasar. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *5*(6), 1638–1647. https://doi.org/10.33578/pjr.v5i6.8325

Putri, R. D. P., & Febrilia, Y. (2023). Pembelajaran bahasa dan sastra indonesia berbasis literasi digital ditinjau dari kurikulum merdeka. *Scholarly Journal of Elementary School*, *3*(2), 146–159. https://doi.org/10.21137/sjes.2023.3.2.8

Rizka, M., Permatasari, S., Arianto, J., Sari, F. A., Isjoni, M. Y. R., & Sahara. (2025). Case study-based learning media innovation integrated with Lumi Education to improve student critical thinking. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *9*(2), 243–249. https://doi.org/10.33578/pjr.v9i2.10139

Rocha Estrada, F. J., George-Reyes, C. E., & Glasserman-Morales, L. D. (2022). Security as an emerging dimension of digital literacy for education: A systematic literature review. *Journal of E-Learning and Knowledge Society*, *18*(2), 22–33. https://doi.org/10.20368/1971-8829/1135440

Rofiah, N. H., Restiana, R., & Dewi, R. (2024). Promoting digital literacy: Assessing teachers readiness in utilizing information and communication technology for learning in rural area. *Jurnal Prima Edukasia*, *12*(1), 41–51. https://doi.org/10.21831/jpe.v12i1.63968

Ryberg, T., & Georgsen, M. (2010). Enabling digital literacy: Development of meso-level pedagogical approaches. *Nordic Journal of Digital Literacy*, *5*(2), 88–100. https://doi.org/10.18261/ISSN1891-943X-2010-02-02

Salam, N., Suyanto, S., & Ningsih, S. N. (2024). Maximizing the potential of digital learning media in primary education: Insights from a systematic literature review. *Indonesian Journal of Educational Research and Review*, *7*(3), 615–629. https://doi.org/10.23887/ijerr.v7i3.80617

Saputri, D. Y., Atmojo, I. R. W., & Ardiansyah, R. (2021). The expert validation of game-based interactive multimedia in the digitalization era for elementary school students. *Jurnal PAJAR (Pendidikan Dan Pengajaran)*, *5*(4), 918–931. https://doi.org/10.33578/pjr.v5i4.8375

Sezgin, Z. Ç. (2022). Systematic analysis of digital reading studies in the digital age. *Participatory Educational Research*, *9*(1), 233–250. https://doi.org/10.17275/per.22.13.9.1

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Situmorang, D. Y. (2024). Penggunaan teknologi pendidikan untuk meningkatkan literasi digital di sekolah dasar. *Jurnal Teknologi Pendidikan*, *3*(2). https://doi.org/10.56854/tp.v3i2.289

Susilowati, D., Saputro, B. A., & Sutono, A. (2025). The effect of strengthening the literacy movement in natural and social sciences (IPAS) learning on improving students' scientific literacy and critical thinking skills. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, *14*(1), 11–28. https://doi.org/10.33578/jpfkip-v14i1.p11-28

Teo, T., Unwin, S., Scherer, R., & Scherer, R. (2021). Initial teacher training for twenty-first century skills in the Fourth Industrial Revolution (IR 4.0): A scoping review. *Computers & Education*, *170*, 104223. https://doi.org/10.1016/j.compedu.2021.104223

Tsortanidou, X., Daradoumis, T., & Barberá, E. (2019). Connecting moments of creativity, computational thinking, collaboration and new media literacy skills. *Information and Learning Sciences*, *120*(11), 704–722. https://doi.org/10.1108/ILS-05-2019-0042

Utami, R. D., Wibowo, D. C., & Susanti, Y. (2018). Analisis minat membaca siswa pada kelas tinggi di Sekolah Dasar Negeri 01 Belitang. *Jurnal Pendidikan Dasar PerKhasa*, *4*(1), 179–188.

Zulaichah, L., Ekawati, R., & Kusumaningrum, S. R. (2025). Efektivitas Literacy Cloud dalam meningkatkan motivasi dan pemahaman membaca siswa SD: Studi kasus di SDN Percobaan 2 Malang. *Literasi: Jurnal Ilmu Pendidikan*, *16*(1), 102–110. https://doi.org/10.21927/literasi.2024.16(1).102-110

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]