Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 15 No. 2. Juni 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

ANALYSIS OF DIGITAL LITERACY PROGRAMS TO IMPROVE ELEMENTARY SCHOOL STUDENTS' 4C SKILLS

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ARTICLE HISTORY
Received : 20-01-2026
Revised : 07-02-2026
Accepted : 25-05-2026

KEYWORDS
digital literacy;
critical thinking;
creativity;
collaboration;
communication;

ABSTRACT
The industrial revolution 4.0 is driving faster changes towards education by implementing digital literacy that can create students with 4C skills. This study aims to analyze the contribution of digital literacy programs in improving the 4C skills (critical thinking, creativity, communication, and collaboration) of students at Tegalgondo 1 Public Elementary School based on teacher perceptions. The research design used is descriptive quantitative with a survey approach. The research subjects consisted of ten teachers selected by purposive sampling. Data were collected through a closed-ended Likert-scale questionnaire distributed via Google Form and analyzed using descriptive statistics in the form of percentages. The results show that the digital literacy program most strongly encourages critical thinking (82.70%) and creative thinking (81.22%), while communication (80.35%) and collaboration (80.00%) skills are still lagging behind. These findings indicate that the integration of digital literacy in schools tends to strengthen individual cognitive competencies, but has not optimally developed social-interpersonal competencies. The implication is that teachers need to design ICT-based learning activities that are more collaborative and communicative to balance the mastery of the four 21st-century skills as a whole.

INTRODUCTION

The rapidly evolving digital era has brought significant changes to the education sector, demanding that every individual possess adequate literacy namely, the ability to understand, evaluate, and produce information responsibly (Iskandar et al., 2023). Although children are accustomed to using technological devices, this agility does not automatically reflect maturity in consuming and interacting with content (Azzahra & Amanta, 2021). Without in-depth digital literacy, they are vulnerable to hoaxes, cyberbullying, online fraud, and sexual exploitation.

The problem is exacerbated by the low level of basic literacy skills particularly reading and writing in Indonesia. One root cause is a learning approach that still emphasizes memorization and provides little room for the development of critical thinking (WENR, 2019). Research by Perdana et al., (2020) shows that Indonesian students' digital literacy levels are relatively low. However, digital literacy has been shown to enable students to select and use technology appropriately for communication (Amin & Adiansyah, 2023), improve the quality of learning (Kumar et

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Volume 15 No. 2. Juni 2026 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

al., 2023), strengthen cognitive understanding, and support academic achievement (Raygan & Moradkhani, 2022). Furthermore, digital literacy also serves as the foundation for the development of 21st-century skills critical thinking, creativity, communication, and collaboration, known as the 4Cs (Lumbanbatu & Mayasari, 2021).

Although the importance of the 4Cs skills in fostering student analysis, evaluation, and innovation is increasingly recognized (Antara et al., 2020), various findings indicate that these abilities are still far from adequate among Indonesian students. Effective communication, productive collaboration, critical thinking, and creativity are competencies that need to be developed intentionally through interactive learning experiences, not simply as byproducts of the learning process (Elisa & Wiratmaja, 2019; Fathurahman & Nila Puspitasari, 2023; Indrawan et al., 2021). However, educators' efforts to foster the 4Cs have not yet reached optimal levels, partly due to teachers' lack of ability to design relevant learning activities (Ramdiah et al., 2019).

As a result, students' communication, collaboration, critical thinking, and creativity skills remain relatively low(Husna et al., 2021; Prafitasari et al., 2021). This situation is evident at Tegalgondo 1 Public Elementary School, where learning activities still focus on achieving learning outcomes and competency targets, without balancing efforts to construct knowledge, practice thinking skills, and solve real-world problems appropriate to students' developmental levels. Consequently, very few students truly demonstrate the 4C skills in the learning process. This is despite digital literacy being an essential prerequisite for accessing relevant information, assessing the reliability of sources (Arifin & Merdekawati, 2020), learning effectively (Dehghani et al., 2023), and honing critical thinking, creativity, communication, and collaboration. This gap underlies the need for learning interventions that specifically integrate digital literacy to improve the 4C skills in elementary school students.

Previous research has touched on the relationship between 21st-century skills and digital literacy, but has not yet positioned digital literacy as a mandatory competency for elementary school students to develop the 4Cs in a structured manner. A study by Ratama et al., (2021) discussed teaching the 4Cs in English literacy activities, but did not make digital literacy the primary focus of 4C improvement. Meanwhile, action research by (Sriyanto, 2021) focused more on improving teachers' 4Cs through digital literacy, rather than students'. Neither study addressed the assumption that digital literacy is a fundamental skill that elementary school students must master for optimal 4C development.

The novelty of this research lies in its specific position of examining and developing digital literacy as an essential tool for elementary school students to develop the four 21st-century competencies (critical thinking, creativity, communication, and collaboration) in a contextual learning process that aligns with the developmental stage of concrete thinking. This study offers a previously unavailable framework—a digital literacy integration model aimed directly at strengthening elementary school students' 4Cs. Its scientific contribution is expected to provide more concrete guidance for educators in designing effective learning experiences, while also filling the research gap that has so far been minimal in examining the direct relationship between digital literacy and the 4Cs at the elementary school level.

METHOD

This study adopted a quantitative descriptive design with a survey approach to analyze teachers' perceptions of the digital literacy program in improving students' 4C skills at Tegalgondo 1 Public Elementary School. The study took place from early November to late December. The sampling technique used purposive sampling, deliberately selected to capture participants who met criteria relevant to the research topic and were able to provide in-depth information (Fitriati et al., 2024; Villamin et al., 2025; Wannenburg & Curlewis, 2023). The study sample consisted of 10 teachers at Tegalgondo 1 Public Elementary School. The research instrument was a validated closed-ended questionnaire compiled in Likert scale format, distributed online via Google Form and shared via WhatsApp groups to facilitate data access and management (Aliwan et al., 2025; Sumintono, 2018). The collected questionnaire data were processed using descriptive statistical analysis techniques by calculating the percentage of respondents' answers. The presentation of the analysis results was carried out in narrative form that describes, explains, and interprets the survey findings based on the percentage distribution obtained.

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RESULTS AND DISCUSSIONS

Digital literacy means that everyone must equip themselves with the skills to use and understand information obtained from various digital sources, and it is the ability to use digital tools in everyday life. According to Al-Otaibi (2025), developing digital literacy involves eight essential elements: cultural, cognitive, constructive, communicative, self-confident, creative, critical, and socially responsible. Digital literacy encompasses a person's ability to understand digital content (Safitri et al., 2020).

According to Alobaid (2025), there are four basic principles for developing digital literacy: understanding, interdependence, social factors, and curation. Two aspects of the approach applied to digital literacy are conceptual and operational. The conceptual approach focuses on cognitive aspects and social-emotional development, while the operational approach focuses on technical skills.

The implementation of digital literacy at Tegalgondo State Elementary School requires the development of integrated programs with the Independent Curriculum. This activity aims to improve the competence of human resources and resources in schools (principals, teachers, and students). According to Pusvitasari et al., (2025) there are 5 (five) strategies that can be implemented in the digital literacy movement in schools, as follows: (1) strengthening the capacity of facilitators; (2) increasing the number and variety of quality learning resources; (3) expanding access to quality learning resources and the scope of learning participants; and (4) strengthening governance.

Improving 4C skills is closely linked to high literacy levels. These 21st-century competencies are essential for students to master, enabling them to face life's challenges independently. The following are measurement results showing how digital literacy can contribute to improving 4C skills (Kardina, 2024). The following percentage results from the digital literacy questionnaire for improving 4C skills are presented in Table 1.

Table 1. Percentage Results of the Digital Literacy Questionnaire to Improve 4C Skills

Aspect	Indicatir	Persentase	Kategori
Critical thinking skills	Providing simple explanations using ICT Building basic skills by utilizing ICT Drawing conclusions by utilizing ICT Provide further explanation by utilizing ICT Organize strategies and tactics by utilizing ICT	82,70%	High
Communication skills	Skill in articulating ideas and thoughts by utilizing ICT Skills in active listening through the use of ICT	80,35%	High
Creative thinking skills	Fluency in using ICT Flexibility in utilizing ICT	81,22%	High
Collaboration skills	Cooperation in utilizing ICT Responsibility in using ICT	80%	High

Source: Processed primary data, 2026

The findings in Table 1 indicate a clear hierarchy in the mastery of ICT-based 4C skills according to teachers' perceptions, with students tending to excel more in the cognitive-individual aspect (critical and creative thinking) than in the social-interpersonal aspect (communication and collaboration). This finding confirms that although all aspects are in the "High" category, the gap between aspects indicates that digital literacy integration has not fully encouraged the balanced development of the 4Cs.

Critical thinking skills recorded the highest percentage (82.70%), indicating that ICT-based learning activities implemented by teachers such as problem-based assignments, case analysis, and repetitive exercises—effectively facilitated the development of students' analytical abilities. The dominance of critical thinking skills in this finding aligns with a study(Weng et al., 2022) which showed that the use of digital tools such as Scratch for problem simulations encourages students to develop ideas independently, test hypotheses, and question existing systems. A similar mechanism was also identified by (Song et al., 2025), where activities such as summarizing readings, receiving teacher and peer feedback, and revising work became vehicles for sharpening critical thinking. Furthermore,

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Wannapiroon & Pimdee (2022), found that an ICT-supported problem-based learning model significantly improved students' analytical and evaluative abilities because it required them to analyze complex information, distinguish facts from opinions, and formulate evidence-based solutions.

In the context of Tegalgondo 1 State Elementary School, this dominance can be explained by three factors. First, the school's learning culture still relies on structured cognitive tasks such as analytical exercises, problem-solving assignments, and ICT-based conclusion-drawing activities. Second, teachers consistently provide reinforcement through repeated exercises that enable students to internalize logical and systematic thinking patterns. Third, as (Yang & Wang, 2022) noted, digital project-based instruction that emphasizes individual investigation tends to be more effective in fostering self-regulated critical thinking than social skills that require peer interaction. In other words, the prevailing learning design despite utilizing ICT is still oriented toward individual cognitive achievement, so it's natural that critical thinking is honed most effectively.

Creative thinking skills ranked second (81.22%). This achievement indicates that the use of ICT in learning, such as logo design projects, digital poster creation, or educational videos, has opened up space for students to explore new ideas. This is consistent with research by Tasquier et al., (2022) and Gunawan et al., (2022), which found that digital content production tasks such as 3D modeling and creative presentation creation can represent and foster student creativity. However, the achievement, which remains below critical thinking, indicates that students' creative exploration in this school may still be within the framework of structured assignments and has not yet fully become an independent initiative that demands high originality.

Communication skills (80.35%) and collaboration (80.00%) ranked in the bottom two. This finding aligns with the research of (Maulana & Sopandi, 2022), who reported that communication skills achieved the lowest achievement (27.3%) in the context of presentation evaluation and problem-solving discussions. This gap can be explained by the learning context at Tegalgondo 1 Public Elementary School. Fan et al., (2025) emphasized that true collaboration requires intensive communication, both verbal and digital, to articulate ideas, actively listen, and align understanding between members. A study by Chan & Sung (2025), added that digital literacy allows students to choose the right way to communicate, but these skills do not develop automatically without deliberate practice. Tegalgondo 1 Public Elementary School, the lack of cross-group dialogue and the absence of explicit strategies to practice the articulation of persuasive arguments resulted in communication and collaboration not being optimally developed.

Second, the low level of collaboration is indicated by the uneven distribution of roles in group work. Discussion practices at this school are still conventional and incomplete: less motivated students tend to rely on other, more active members. This finding contradicts the theoretical expectation that digital literacy should create a more collaborative and interactive learning environment (Chew et al., 2023; Simanjuntak, 2019). A study by Partono et al. (2021) emphasized that superior products cannot be produced alone, but rather through multi-party collaboration. However, at Tegalgondo 1 Public Elementary School, collaboration achievement was the lowest (80.00%). This gap confirms the findings of Maulana and Sopandi (2022), who reported that Indonesian students' communication and collaboration skills are often lower than cognitive aspects in project-based learning evaluations.

The low level of collaboration in this school can be traced to three interrelated root problems. First, group discussion practices are still conventional and incomplete. Teachers admit that the division of tasks within groups is often unclear, resulting in the free-rider phenomenon less motivated students relying on more dominant members. This contradicts the principle of positive interdependence proposed by Johnson & Johson (2009), where effective collaboration requires each member to feel responsible for the overall success of the group. Second, Kreijns et al., (2003) caution that mastery of ICT does not automatically lead to meaningful collaboration; task designs that structurally encourage interaction, negotiation of meaning, and the construction of shared knowledge are required. Unfortunately, ICT-based assignments in this school are more often individual such as creating summaries, posters, or personal presentations rather than collective projects that require role synergy. Third, Voogt and Roblin, (2012) found that many schools still face a gap between the rhetoric of the importance of the 4Cs and their practical implementation. Schools tend to emphasize aspects that are easily measured individually (critical and creative

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thinking) and leave less room for more complex collaborative assessment processes. This is evident at Tegalgondo 1 Public Elementary School, where learning evaluations are still oriented toward individual cognitive outcomes.

When compared to a different context, these findings are interesting to contrast. Tasquier et al., (2022) research in European schools found that ICT-based creative projects such as 3D modeling and mobile app development actually encouraged collaboration on a par with critical thinking because the task design inherently required multidisciplinary teamwork. In contrast, at Tegalgondo 1 Public Elementary School, although students were accustomed to digital projects such as poster design or educational videos (which boosted creativity by 81.22%), these tasks were carried out individually or, if in groups, without a clear role structure. This is what distinguishes "group work" from true "collaboration"—a crucial distinction highlighted by (Dillenbourg, 1999), where collaboration requires equal roles, shared responsibility, and ongoing negotiation of meaning.

Furthermore, this low level of collaboration can also be linked to the findings of Rahmatiani et al., (2024), who emphasized that practical communication skills are essential for conveying ideas and collaborating through digital platforms. Without structured communication, digital collaboration becomes merely a technical activity lacking in the depth of social interaction. This is precisely what happened at Tegalgondo 1 Public Elementary School: students are able to operate ICT, but are not yet skilled at using it as a productive collaborative tool.

These findings confirm that the digital literacy movement in schools has made a positive contribution to the development of the 4Cs, but remains unequal: technological advances tend to strengthen individual cognitive competencies first, while social-interpersonal competencies require more deliberate pedagogical intervention. This gap is not simply a student weakness, but rather a reflection of a learning ecology still dominated by individual tasks and assessment mechanisms focused on cognitive achievement. As (Lumbanbatu & Mayasari, 2021; Siregar, 2024) remind us, the digital literacy movement should ideally be synonymous with the development of critical, creative, collaborative, and communicative thinking synergistically, not in isolation. Therefore, going forward, teachers need to design ICT-based collaborative projects that structurally distribute roles, encourage positive interdependence, and provide space for intensive peer communication. In this way, digital literacy not only strengthens thinking skills but also builds the collaborative and communicative character traits essential for the 21st-century generation.

CONCLUSION

Berdasarkan persepsi guru SD Negeri 1 Tegalgondo, program literasi digital paling kuat mendorong keterampilan berpikir kritis (82,70%) dan berpikir kreatif (81,22%), sedangkan keterampilan komunikasi (80,35%) dan kolaborasi (80,00%) masih perlu mendapat penguatan lebih serius karena aktivitas pembelajaran berbasis TIK belum secara sengaja dirancang untuk melatih interaksi sosial dan kerja sama terstruktur. Hal ini memberi makna bagi guru dan sekolah bahwa integrasi literasi digital ke depan harus secara eksplisit mendesain proyek kolaboratif yang mendistribusikan peran, mendorong dialog antarsiswa, dan menumbuhkan tanggung jawab bersama, tidak hanya bertumpu pada tugas-tugas kognitif individual. Meskipun demikian, simpulan ini perlu disikapi secara berhati-hati mengingat keterbatasan penelitian, yaitu jumlah responden yang terbatas, data yang sepenuhnya bersumber dari kuesioner persepsi tanpa observasi langsung terhadap kinerja siswa, serta desain deskriptif survei yang belum memungkinkan penarikan hubungan kausal antara program literasi digital dan peningkatan 4C.

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