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The Influence of Digital Literacy on the Computational Thinking Skills of Fifth Grade Elementary Students

Reza Vransiska[1*], Yasir Arafat[1], Murjainah[1]

[1] Universitas PGRI Palembang, Ulu Palembang, Indonesia

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ABSTRACT

The purpose of this study is to examine how digital literacy affects the computational thinking skills of fifth-grade students at SDN 140 Palembang. Digital literacy is becoming an increasingly important ability in the current era, particularly in facilitating logical thinking and problem-solving processes using technology gadgets. This study employs a quantitative approach with a quasi-experimental design of the Non-equivalent Control Group Type. The research subjects were divided into two groups: the experimental class (V.A), which received technology-based learning treatment, and the control class (V.B), which received conventional learning. The data collection tool was a computational thinking questionnaire with 20 statements based on four major indicators: issue decomposition, algorithmic thinking, pattern identification, and abstraction and generalization. Pretests and posttests were used to collect data, which was then analyzed with a t-test to see if there was a significant difference between the two groups. The study's findings reveal that digital literacy has a considerable impact on student computational thinking skills. Students who received technology-based learning demonstrated greater improvement in computational thinking skills than students who learned using traditional methods. This research suggests that digital literacy is vital in helping elementary school students acquire computational thinking skills.

1. Introduction

Digital literacy was initially conceptualized by Paul Gilster and has subsequently developed in its theoretical understanding(Amara et al., 2021). Digital literacy is the capacity to utilize digital technology and information in diverse formats from a broad array of sources accessed via computers(Chung & Yoo, 2021). Therefore, digital literacy should be regarded as more than merely the competence to operate digital tools proficiently; it also encompasses a particular mindset. Digital literacy is a skill that empowers individuals, including students, to comprehend, utilize, and responsibly handle digital information and technology effectively(Eguz, 2021). This literacy includes the ability to identify technology, fundamental skills in managing digital devices, and a rudimentary comprehension of ethics, security, and responsibility within the digital environment(Yuniar et al., 2025).

[*] Corresponding author.
E-mail address: rezavransiska293@gmail.com
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Traditionally, literacy denoted an individual's proficiency in reading and writing. Nevertheless, the term has expanded in modern usage to encompass the capacity to analyze and understand information across various contexts. In this context, literacy constitutes a cognitive process through which individuals analyze and derive meaning from information—be it textual, visual, or digital(Gao & Hew, 2022). For instance, digital literacy entails not only the ability of students to operate technology but also the capacity to analyze information critically and assess whether a particular paragraph or digital source is accurate and trustworthy(Kim et al., 2021).

Digital literacy is a fundamental indicator within education and culture that facilitates the development of students' critical and creative thinking abilities. Through engagement with digital platforms, students are motivated not merely to acquire information but also to analyze, assess, and reinterpret it in a meaningful manner(Dağ et al., 2023). This transition allows digital literacy to serve as a transformative instrument that transforms students from passive recipients of information into active participants in the learning process—individuals who query, create, and contribute to knowledge rather than simply absorb it(Yıldırım & Uluyol, 2023). Furthermore, digital literacy includes the capacity to access, comprehend, and effectively employ a broad spectrum of information readily accessible through digital technologies(Molina-Ayuso et al., 2023). It encompasses not only technical proficiency in operating devices and software but also intellectual engagement, including identifying credible sources, synthesizing information, and utilizing digital resources responsibly and ethically(Tsai et al., 2021). In this context, digital literacy constitutes a fundamental foundation for students to effectively navigate the progressively complex and information-intensive digital landscape(Yuliana et al., 2021).

Moreover, digital knowledge is an essential life skill that encompasses more than merely the technical proficiency required to operate information and communication technology devices(Yuan et al., 2021). It also encompasses competencies such as social engagement, ongoing learning, analytical thinking, innovation, and the ability to motivate others within digital settings(Iordache et al., 2017). In the realm of education, student ability pertains to the knowledge and skills that individuals possess and exemplify through their performance in task completion or problem-solving activities(Reddy et al., 2023). This capability can be assessed through students' active participation in learning activities and their proficiency in overcoming challenges. From this perspective, ability denotes a competence that enables individuals to perform specific tasks efficiently; furthermore, robust abilities can enhance self-confidence, permitting students to engage with learning experiences more confidently(Allmann & Blank, 2021).

Computational thinking, as articulated by Jeanette Wing, is a core skill encompassing the analysis of problems and the development of solutions in the form of algorithms that can be executed by a computer(Livingstone et al., 2023). It functions as a problem-solving framework that employs principles of computer science and logical reasoning to analyze and address complex challenges(Schirmer et al., 2022). Computational thinking includes skills such as abstraction, decomposition, pattern recognition, system design, and the analysis of human behavior through the perspective of computational processes(Bulganina et al., 2021). As both a mindset and a versatile skill, computational thinking can be adopted by all learners, and it is especially crucial for elementary school students as they build the fundamental reasoning and problem-solving skills necessary in a progressively digital environment(Jayasree & Murugeswari, 2022).

According to observations made at SDN 140 Palembang, the learning medium utilized in classrooms continue to rely heavily on textbooks and teacher-led lectures. Many educators still utilize routine and repetitive tasks and have not fully integrated computational thinking into the learning process. Students with excellent digital literacy abilities may be better prepared to grasp computational thinking principles since they are used to using technology for learning and reasoning.

However, field research indicates that pupils continue to face difficulties as a result of variable levels of digital literacy, particularly in primary school. This situation raises worries about how low digital literacy may impede pupils' computational thinking abilities. As a result, students require systematic direction and support to increase their digital literacy, allowing them to better interact with computational thinking principles.

The theoretical reasoning above leads to the conclusion that computational thinking is a problem-solving method based on fundamental computer science principles. This ability is not just related to the use of technology, but also to students' logical, methodical, and structured thinking while assessing and solving problems. As a result, improving digital literacy is critical in helping students build computational thinking abilities during the learning process.

2. Methodology

The research methodologies employed in this study adhere to rigorous scientific protocols to gather data consistent with the research aims. An experimental methodology was used as it facilitates the discovery of causal linkages in quantitative research contexts. This study used a quasi-experimental design, notably the nonequivalent control group design, commonly utilized when random assignment of participants is impractical and complete equivalence between groups cannot be guaranteed. Two groups were chosen as research samples without randomization. Before the intervention, both groups undertook a pretest to assess their baseline conditions and identify any disparities between the experimental and control groups. The data collection method was meticulously organized to guarantee the acquisition of pertinent information that corresponded with the research objectives. This study utilized questionnaires and documentation as the principal data gathering methods.

2.1 Data Collection Techniques

Data collection methods are essential to the research process and necessitate meticulous planning to guarantee that the information gathered aligns with the research objectives. These procedures function as methodologies employed by researchers to collect requisite data according to the specified study issues. This study included three data collection methods: observation, testing, and documentation.

Koesioner

A questionnaire is a data collection tool comprising a systematic sequence of inquiries aimed at gathering information directly from participants. The questionnaire was distributed during the trial phase of the fraction board learning material in this study. The instrument was disseminated to three groups of evaluators: media specialists, content authorities, and practitioners, to evaluate the feasibility and practicality of the media. A Likert scale was utilized to systematically and quantifiably assess respondents' impressions and evaluations.

Table.1 Grid of the Computational Thinking Questionnaire Instrument for Student Responses

No	Variable	Computational Thinking Indicators	details
1	Computational Thinking	Decomposition	1,2,3, 4,5
2	Computational Thinking	Generalization and Abstraction	6,7,8, 9,10

3	Computational Thinking	Pattern Recognition	1,12,13,14,15
4	Computational Thinking	Algorithmic Thinking	6,17,18,19,20
		Quantity	20

Source: Researcher, modified, (*Komariah*, 2023)

documentation

This study involved the documenting of research activities through the collection of images. These images function as visual documentation that encapsulates students' interactions and learning activities inside their authentic classroom setting, offering supplementary support and contextual proof for the findings.

Table. 2 Measurement Scale

No	Question	Treatment
1	Strongly Agree (SA)	5
2	Agree (A)	4
3	Doubt (RR)	3
4	Disagree (D)	2
5	Strongly Disagree (STS)	1

3. Results

This study was carried out at SD Negeri 140 Palembang during the second semester of the 2025 academic year. The research participants included Grade V students, with class V.A designated as the experimental group and class V.B as the control group, each consisting of 25 students. Technology-driven educational media were utilized in the experimental group, and data were gathered through pretest and post-test questionnaires. This study aimed to investigate the impact of digital literacy on students' computational thinking skills after the introduction of technology-based learning.

In the initial meeting, the experimental group underwent educational intervention utilizing digital media, comprising presentation slides and interactive films. Conversely, the control group was instructed utilizing traditional teaching methods that had been utilized in two prior sessions. During the third meeting, both groups completed a post-test questionnaire comprising 20 statements aimed at assessing the computational thinking skills of fifth-grade kids.

Pretest and posttest data for both the experimental and control groups were obtained by administering a computational thinking abilities questionnaire to students in classes V.A and V.B, each including 25 students. The pretest was conducted before the learning intervention, and the posttest was provided thereafter to assess alterations in students' computational thinking skills. The subsequent graph illustrates the comparison of pretest and posttest scores between the experimental and control groups.

Figure 1 demonstrates that the experimental class achieved a pretest score percentage of 54.76%, whereas the control class attained 52.24%. The results reveal that both groups initially exhibited minimal ability in employing technology to facilitate learning, highlighting the necessity for technology-based instructional resources, such as presentation slides. Post-treatment, the experimental class's posttest score percentage rose to 87.64%, indicating a significant enhancement in students' computational thinking abilities subsequent to the introduction of digital learning resources.

Simultaneously, the posttest percentage in the control group was 53.28%. The results indicate a significant enhancement in the experimental group, where students originally attained a pretest score of 54.76% and subsequently increased to 87.64% following the implementation of technology-based instructional media, such as presentation slides and interactive films. Conversely, the control group exhibited minimal enhancement, rising from 52.24% in the pretest to 53.28% in the posttest following instruction with traditional pedagogical techniques. This comparison demonstrates that technology-based learning media significantly enhanced students' computational thinking skills more than traditional educational methods.

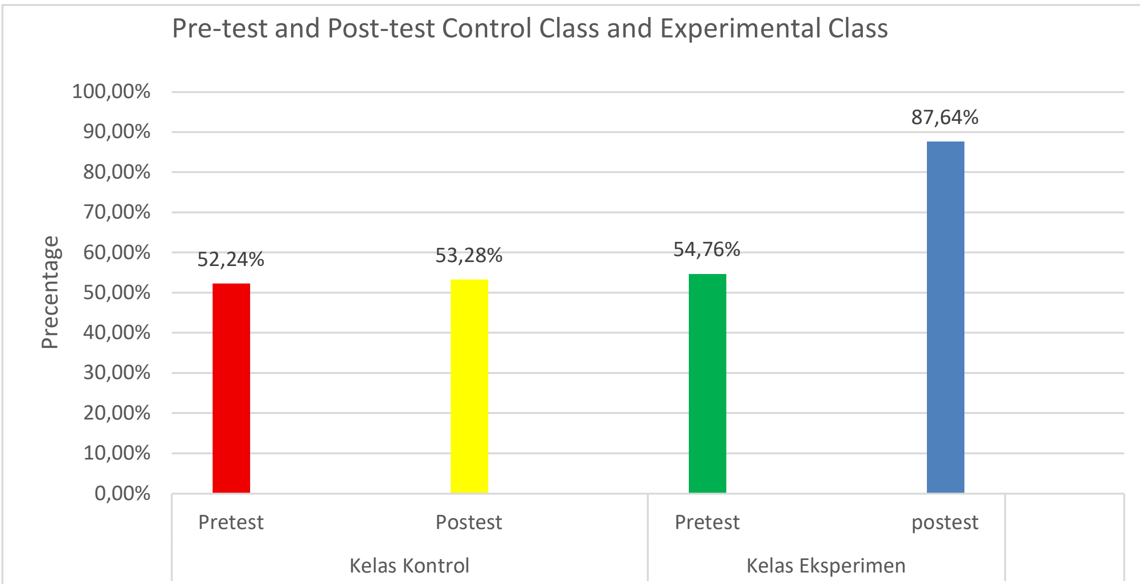

Fig.1. Pretest-Post-test Graph of Control and Experimental Classes

3.1 Normality Test Results Data

A normality test was performed to ascertain if the data collected from the research sample exhibited a normal distribution. For this, we employed the Kolmogorov–Smirnov test in SPSS version 26. When the significance value (p-value) is higher than the alpha threshold of 0.05, the data is believed to be regularly distributed. The table below shows the results of the normality test:

Table 4.3 Normality Test Results

		Kolmogorov-Smirnov[a]		
	class	Statistic	df	Sig.
pretest	1	.148	25	.164
	2	.138	25	.200*
postest	1	.102	25	.200*
	2	.162	25	.088

Source: SPSS Data Processing, (2025)

The normality test showed that the significant values for the pretest and posttest data in both the experimental and control classes were 0.164, 0.200*, 0.200*, and 0.088. The data are categorized as normally distributed because all of the significance values are higher than the alpha level of 0.05.

4.2 Homogeneity Test Results Data

The homogeneity test was used to see if the starting and final data were spread out evenly throughout the research samples. Levene's Test of Homogeneity of Variances was utilized in this study to evaluate the equality of variances among groups. If the significance value (p-value) is higher than 0.05, the sample variances are seen as homogeneous. We used SPSS version 26 to analyze the data. The table below shows the results of the homogeneity test:

Table 4.4 Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Students' Computational Skills	Based on Mean	.664	1	48	.419
	Based on Median	.498	1	48	.484
	Based on Median and with adjusted df	.498	1	46.817	.484
	Based on trimmed mean	.665	1	48	.419

Source: SPSS Data Processing, (2025)

The findings for the questioner data, shown in SPSS Table 4.4, show that the data meet the homogeneity criteria, which stipulate that the significance value based on the mean must be more than 0.05. The significance value we got was 0.419, which is higher than 0.05. So, we may say that the data are evenly spread out.

4.3 Hypothesis Test Results Data

In this work, hypothesis testing utilized the independent samples t-test to compare the post-test results of students between the experimental and control groups. The analysis utilized SPSS version 26. The independent samples t-test's decision rules are as follows: if the significance value (2-tailed) is greater than 0.05, the null hypothesis (H_0) is accepted; if the significance value (2-tailed) is less than 0.05, the null hypothesis (H_0) is rejected. The table below shows the results of the hypothesis test:

Table 4.5 T-test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std.Error Difference
pretest	Equal variances assumed	.664	.419	-.950	48	.000	-2.720	2.862
	Equal variances not assumed			-.950	46.998	.000	-2.720	2.862
postest	Equal variances assumed	19.012	.000	-15.613	48	.000	-33.840	2.167
	Equal variances not assumed			-15.613	29.666	.000	-33.840	2.167

Source: SPSS Data Processing, (2025)

The independent samples t-test revealed a significance value (2-tailed) of 0.000, which is less than 0.05. The null hypothesis (H_0) is rejected, while the alternative hypothesis (H_1) is accepted. This study demonstrates that technology-enhanced learning tools, specifically laptops and projectors, significantly impact the computational thinking skills of fifth-grade students at SD Negeri 140 Palembang.This study utilized a quantitative methodology with a quasi-experimental design, comprising two classes: V.A as the experimental group and V.B as the control group, each containing 25 students. The experimental class utilized PPT and video-assisted educational media, whereas the control class got traditional instruction devoid of digital media support. Data were gathered via surveys and documentation to assess pupils' computational thinking abilities. The pretest findings indicated that the experimental group attained an average score of 54.76%, whilst the control group secured 52.24%. After two sessions of traditional training in the control group, the researcher conducted a posttest, yielding an average score of 53.28%. Conversely, following the integration of technology-based media in the experimental class, the students' average posttest score rose to 87.64%. This significant enhancement indicates that digital learning media played a crucial role in advancing students' computational thinking skills. In the learning process, students in the experimental class demonstrated increased activity and engagement, reflecting enhanced motivation and participation facilitated by the interactive digital medium. These results align with prior research.

Mufidah and Majid (2024) indicated that foundational coding-based education enhances the development of computational thinking skills, equipping students with future-oriented competencies such as creativity and collaboration. Despite the N-gain percentage in their study being below 40%, the research underscores the significance of incorporating computational thinking into elementary education to cultivate problem-solving abilities beyond mere passive engagement with games. Research conducted by Ririn Gumay Tri, Yasir Arafat, and Susanti Faipri Selegi (2025) indicated that mind mapping grounded in digital literacy significantly influenced learning results in Indonesian language education. Their analysis indicated a uniform data distribution and a t-test significant value of 0.000 < 0.05, affirming the superiority of new digital learning tactics compared to traditional methods. The experimental group achieved an average score of 81.33, whereas the control group scored 71.50, thereby substantiating that training focused on digital literacy improves student performance and motivation. Hidayatulla and Murjainah (2024) give additional findings, demonstrating that Make Belief Comix media markedly enhanced computer literacy in fifth-grade children. The study demonstrates that digital comic media enhances engagement and aids comprehension through visual narrative, as seen by posttest averages of 80.00 in the experimental class compared to 65.00 in the control class.

Furthermore, Khauzanah and Wardani (2024) discovered that project-based learning improved creative thinking abilities and academic performance in fifth-grade pupils. The indications of creative thinking rose from 36.8% in the pre-cycle to 73.7% in Cycle I, ultimately achieving 100% in Cycle II, whilst student learning outcomes enhanced from 47.37% in the pre-cycle to 94.74% in Cycle II. These findings confirm that digitally enhanced and student-centric learning approaches foster higher-order thinking abilities. Veronica et al. (2022) underscored the significance of computational thinking in mathematics education. Their research determined that the incorporation of computational thinking enhances students' logical reasoning, problem analysis, and solution design, along with Polya's problem-solving paradigm, and underscores the need of early computational skill acquisition in elementary education. The outcomes of this study corroborate the increasing evidence that technology-based learning media significantly improve computational thinking skills, learning engagement, and cognitive development. The notable enhancement in student performance in the experimental class validates that digital media not only enhances the learning environment but also offers students substantial experiences that cultivate critical, logical, and organized thinking.

4. Conclusions

The analysis of the problem formulation and research findings indicates that the implementation of PPT-assisted technology-based learning media significantly enhances the computational thinking skills of elementary school children. The hypothesis test reveals a significant value (2-tailed) of 0.000, which is less than 0.05, signifying the rejection of Ho and the acceptance of Ha. Consequently, it can be asserted that PPT-assisted technology-based learning media substantially improves students' computational skills.

The enhancement of students' computational thinking skills is ascribed to the utilization of computers and projectors, which provide a more engaging, pleasant, and dynamic teaching environment. Furthermore, PPT-assisted media aids educators in delivering instructional content more efficiently, fostering student engagement, participation, and involvement in the learning process. The incorporation of technology-assisted instructional media enhances learning efficacy and elevates student performance in computational thinking.

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