



Digital Literacy Dimensions in High School Education: From Operational Skills to Privacy Awareness

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ABSTRACT

Purpose of the study: This study aims to measure digital literacy, encompassing operational skills, content creation, information search, information evaluation, and privacy protection, providing insights for targeted educational interventions.

Methodology: A quantitative survey using a 21-item structured questionnaire based on established digital literacy frameworks was conducted with 898 students through Google Forms. Content validity was confirmed by expert review, and reliability by Cronbach's Alpha (>0.80). Data analysis employed SPSS 25 with t-test, ANOVA, and correlation.

Main Findings: Students showed consistently high operational skills, content creation, and information evaluation (100% "Good"); information search scored Very Good 16.67% and Good 83.33%. Privacy protection varied (Very Good 11.11%, Good 66.67%, Fair 22.22%). Operational skills correlated moderately with privacy protection ($R=0.437$; $R^2=0.191$), indicating that technical proficiency alone does not ensure secure online behavior.

Novelty/Originality of this study: This study uniquely integrates privacy protection as a central dimension of digital literacy and analyzes its relationship with operational skills among high school students. It advances knowledge by linking technical ability to safe online behavior, offering evidence-based insights for curriculum design, teacher training, and policies promoting digital resilience.

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1. INTRODUCTION

The rapid development of digital technology has fundamentally transformed various aspects of human life, including how education is delivered. Technological progress not only drives economic growth but also indirectly contributes to improving the Human Development Index [1]. In the field of education, however, these advancements come with new challenges. Educators are required to continuously adapt to evolving digital tools, while at the same time managing digital distractions that may hinder student engagement and learning outcomes [2], [3]. For students, the challenges are equally complex not only must they learn to operate digital devices, but they are also expected to critically evaluate the credibility of information, understand age-appropriate content, and navigate privacy concerns in the online space [4], [5]. This complexity underscores the urgent need for digital literacy, a form of literacy that extends beyond the ability to use devices and includes critical thinking, ethical communication, and responsible digital behavior [6].

In today's digital society, students must possess not only technical proficiency but also cognitive and socio-emotional competencies in order to participate fully and safely in digital environments [7], [8]. However, despite the growing global emphasis on digital skills, there is a lack of studies focusing specially on high school

students in developing countries, particularly in Indonesia. This gap makes it difficult for educators and policymakers to design interventions that address students' real competencies and privacy practices.

Research shows that digital literacy contributes directly to reducing educational inequality. According to [9]. Digital literacy encompasses advanced skills such as photo-visual literacy, information literacy, and real-time reasoning—skills that are essential for navigating a knowledge-based economy. Students who lack these competencies are at greater risk of being left behind, especially in countries with uneven infrastructure development. In fact, a study by [10] found a strong correlation between digital competence and student engagement and performance in digital learning settings. In Indonesia, the importance of digital literacy became particularly evident during the COVID-19 pandemic. The shift to online learning accelerated the need for students, teachers, and parents to adapt to digital platforms. While the pandemic increased public exposure to digital tools, it also exposed significant disparities in digital readiness. As a developing country, Indonesia still faces a digital divide, particularly between urban and rural areas, due to geographic and infrastructural inequalities [11]. According to the [12], Indonesia's digital literacy index in 2021 stood at 3.49 out of a maximum score of 5.00, indicating room for substantial improvement. Although several studies have examined digital literacy in higher education or among teachers, few have systematically investigated digital literacy among high school students, particularly in relation to operational skills and privacy protection behavior. This represents the key research gap addressed in the present study.

Despite growing awareness of digital transformation in education, few studies have focused specifically on the digital literacy levels of high school students, who represent a critical demographic in the national education system. High school students are expected to be independent learners, yet many still struggle with the responsible and effective use of digital tools. Online learning environments demand not only basic operational skills, but also the ability to manage information critically and maintain personal privacy. Students who lack digital literacy may experience low confidence or become disengaged due to difficulties navigating digital platforms [13]. This situation highlights the urgency of evaluating not only students' technical skills but also their awareness of privacy protection. By mapping these competencies, this study seeks to provide actionable insights for curriculum development, teacher training, and digital citizenship policies.

This study aims to: (1) measure the level of digital literacy among high school students in Indonesia, especially given the country's diverse regional characteristics and varying school quality. By identifying the strengths and weaknesses in students' digital literacy across five key indicators—operational ability, content creation, information search, information evaluation, and privacy protection—this research aims to provide data-driven insights that can support targeted interventions by educators, parents, and policymakers. (2) Understanding the digital literacy profile of this age group is essential to ensuring they are adequately prepared to meet the demands of modern education and to participate meaningfully in a digitally connected society. This study addresses three key research questions: (1) What are the levels of operational skills, content creation, information search, information evaluation, and privacy protection among Indonesian high school students?; (2) How are operational skills related to privacy protection behaviors among these students? and (3) What implications can be drawn to inform interventions aimed at enhancing students' digital literacy and privacy awareness?.

2. RESEARCH METHOD

This study employed a quantitative survey research design to evaluate the digital literacy of high school students. A stratified random sampling technique was used to ensure proportional representation of students from Java and non-Java regions, reflecting geographic and infrastructural diversity in Indonesia. The final sample comprised 898 students (49.11% from Java and 50.89% from non-Java areas). This study used a stratified random sampling technique to recruit 898 high school students from different regions of Indonesia, ensuring proportional representation between Java and non-Java areas. A structured questionnaire was developed to measure students' digital literacy based on five core indicators adapted from established digital literacy frameworks (Table 1). The instrument consisted of 21 items, grouped under these indicators (4–5 items per dimension). All items were rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree).

Table 1. Framework for the Instrument

Indicator	Definition	Number of Items	Sample Item
Operational Skills	Ability to operate devices and use digital tools effectively	4	I can install and update apps on my device.
Content Creation	Skill in producing and sharing digital content responsibly	4	I can create a simple infographic or video for school tasks.
Information Search	Capability to search and locate accurate, relevant information online	4	I use advanced search filters to find reliable sources.
Information Evaluation	Ability to assess credibility and relevance of online information	4	I check the author and publication date before using online data.
Privacy Protection	Awareness and practice of securing personal data and privacy on digital platforms	5	I use strong, unique passwords for different accounts.

The instrument underwent expert review for content validity and a pilot test ($n = 30$) for clarity and readability. The instrument underwent a two-stage validation process: (a) content validation by three experts in educational technology and digital literacy to assess item relevance, wording clarity, and construct alignment; and (b) a pilot test with 30 students to evaluate readability and response time. Internal consistency was confirmed with Cronbach's Alpha > 0.80 for all dimensions, indicating high reliability. All items were measured using a Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The validity and reliability of the questionnaire were evaluated using SPSS with analytic (t-test and ANOVA) and descriptive (mean, standard deviation, frequency, and percentage) data regression analysis. SPSS was chosen due to its suitability for large-sample survey data and its robust options for correlational and comparative analyses. This study applied five categories of measurement levels of the respondents [14], shown in Table 2.

$$\text{Level of achievement of respondents} = \frac{\text{average score}}{\text{maximum ideal score}} \times 100$$

1)

Table 2. Level of Respondent Achievement

Percentage (%)	Categories
90 – 100	Very Good
80 – 89	good
65 – 79	Fair
55 – 64	Bad
0 – 54	very bad

3. RESULTS AND DISCUSSION

The total sample in the study was 898 respondents (Table 3), with an almost equal proportion of participants from Java (49.11%) and outside Java (50.89%). Selection of samples evenly outside Java because there has been a dichotomy and inequality between Java and outside Java is an undeniable fact [15]. This inequality impacts the quality of education outside Java due to massive infrastructure developments. Although at this time, this cannot be generalized to all regions in Indonesia outside Java. According to the results of a survey conducted by [16], the digital literacy index in Indonesia does not show significant differences between several provinces in Java and regions outside Java.

Table 3. Demographics of the recruited students (N=898)

Variables	Participants, n(%)
Gender	
Male	366 (40,76)
Female	532 (59,24)
Regions	
Java Island	441 (49,11)
Outside of Java Island	457 (50,89)
Ownership of a personal computer/gadget in accessing the internet	
Yes	615 (68,49)
No	283 (31,51)
I access the internet for more than 3 hours every day (<i>daily use</i>)	

Variables	Participants, n(%)
Yes	701 (78.06)
No	197 (21.94)

The findings provide valuable insights into the state of digital literacy among Indonesian high school students, enhancing our understanding of how digital competence is distributed across diverse regional and educational settings. As outlined in the introduction, this study was designed to address the existing knowledge gap regarding students' preparedness to engage with digital learning platforms in an effective and responsible manner. The results indicate that, although operational skills and general internet access appear to be largely sufficient—supported by the fact that most respondents own digital devices and access the internet for more than three hours daily—significant gaps remain, particularly in terms of awareness regarding data privacy and protection.

As presented in Table 3, geographic parity indicates that digital literacy development initiatives have begun to reach broader segments of the population. Nonetheless, challenges related to equitable resource distribution persist. This pattern is consistent with global trends, where regional disparities continue to influence the acquisition of digital competencies, particularly in developing countries [17]. Digital inequality extends beyond issues of access, encompassing disparities in the quality of usage and digital skills. Consequently, even with similar levels of access, the effectiveness of digital engagement may vary significantly depending on contextual socio-economic conditions [18], [19]. This broader context of global digital disparities is similarly reflected in the Indonesian context, as evidenced by the present study.

The results of the respondent data survey in Table 3 show that most respondents have personal gadgets to access the internet, with an average access time of more than 3 hours a day. The ability to access the internet is very closely related to operational skills in using gadgets because people with suitable device operational skills have a lot of knowledge in internet access [20]. This is in line with the work of [21] who categorized operational digital literacy as the foundational layer necessary for achieving higher-order skills such as critical thinking and privacy management. In fact, recent studies show that increased frequency of digital tool usage correlates with improved confidence and skills among students [22], though not necessarily with critical awareness or responsible use. This gap indicates the need for holistic literacy programs that go beyond just access and usage frequency.

Based on data analysis, the average student has a good level of ability, namely operational ability (Good = 100%), information search (Very Good = 16.67%; Good = 83.33%), evaluating the relevance of information (Good = 100%), adding content (Good = 100%), and protecting privacy (Very Good = 11.11%, Good = 66.67%, and Fair = 22.22%). These results are shown in Figure 1. The analysis of the relationship between privacy protection and operational skills is shown in Table 3.

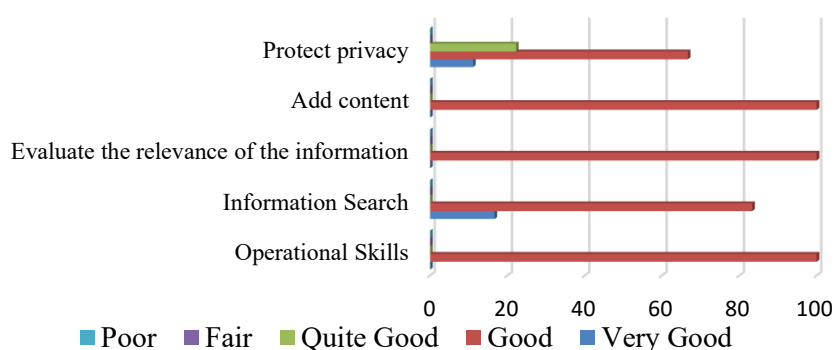


Figure 1. Percentage of students' digital literacy abilities

Table 4. Relationship between protecting the privacy and operational skills

Summary models									
Mode l	R	R Square	Adjusted R Square	std. Error of the Estimate	Change Statistics R Square Change	FChang e	df1	df2	Sig. FChang e
1	.437 ^a	.191	.191	4.52309	.191	212,09 6	1	896	.000
a. Predictors: (Constant), operational_skill									
ANOVA ^a									
Model		Sum Squares	df	MeanSquare	F				Sig.
1	Regression	4339.137	1	4339.137	212,096				.000 ^b
	residual	18330689	896	20,458					
	Total	22669826	897						

a. Dependent Variable: protecting_privacy

b. Predictors: (Constant), operational_skill

Table 4 shows the R-value of 0.437, indicating that operational skills have a reasonably strong relationship with protecting privacy. The coefficient of determination (R^2) is 0.191, indicating that the effect of the independent variable (operational skill) on the dependent variable (protecting privacy) accounts for 19.1%, while other factors influence the remaining 80.9%. These results suggest that individuals with strong digital technology literacy skills may not always be able to maintain online privacy. Many studies have shown consistently a positive relation between high level of digital literacy and safe online behavior [23]. Even other researchers mentioned that time spent on social media and experience with privacy regulation did not directly increase security and privacy behavior [4]. Understanding privacy is important to prevent misuse of personal data on online platforms, it makes the role of digital literacy very important in maintaining privacy protection [24]. These findings align with the digital competence framework proposed by UNESCO, especially in browsing, searching, and evaluating online information.

Referring to [25] model which divides digital literacy levels into three (digital competence, digital usage, digital transformation), Indonesian students are primarily situated at Level 1, *digital competence*, indicating the acquisition of basic digital skills and awareness. They are also progressing towards Level 2, *digital usage*, as seen in their ability to apply digital tools for searching and creating content. However, a critical gap exists at the level of *digital transformation*, particularly regarding the ethical and responsible management of digital identity and personal data. Digital literacy can build confidence in finding and evaluating the information they find online [26]. It is also supported by [27], who found that critical digital skills, including information evaluation and content creation, contribute to students' academic engagement and civic participation. However, the disparity observed in the ability to protect privacy suggests a cognitive gap in understanding digital risks. According to [28], young users often underestimate privacy risks and lack the necessary mental models to navigate complex privacy settings effectively. Therefore, while operational and evaluative competencies are strong, protective behaviors still require targeted intervention.

Among the five measured variables, privacy protection received the most varied responses. Although some students demonstrated reasonably good awareness, the overall findings suggest a lack of consistent understanding of digital privacy. This supports the argument that technical proficiency does not automatically translate into ethical or safe digital behavior [29]. This concern echoes [30] theory of identity management, where individuals must learn to control their self-presentation and information disclosure in both private and public digital spaces. The gap between operational ability and privacy awareness highlights the need for more holistic digital literacy education that not only teaches students how to use technology but also fosters a deeper understanding of digital rights, responsibilities, and risks.

Another aspect worth highlighting is the role of digital resilience—defined as the ability to understand, cope with, and recover from digital challenges [31]. Digital resilience is shaped by education, institutional support, and personal experience. In the Indonesian context, integrating resilience training within digital literacy curricula could be a strategic approach to enhance students' critical awareness and personal data protection behaviors. Additionally, teacher competencies significantly affect students' literacy acquisition. According to [32], digitally competent educators can model appropriate online behavior and guide students in understanding privacy and security online. Thus, professional development for teachers becomes essential in achieving comprehensive student literacy outcomes.

This study's results underscore the importance of embedding privacy and cybersecurity education into broader digital literacy curricula. While improvements in Indonesia's digital infrastructure have enabled greater access, they have not been matched by adequate awareness of online risks. As [33] note, managing one's digital

identity securely is a critical aspect of literacy in the digital age. The positive correlation between literacy and privacy-protective behavior [34] reinforces the urgency of this issue. Digital literacy must therefore be seen not merely as a functional skill, but as a means to empower individuals to navigate digital ecosystems critically and ethically.

Ultimately, this research contributes to the ongoing discourse on digital literacy by offering empirical evidence from a developing country context. It confirms prior studies [13], [26], [35] while extending the conversation toward practical implications. Educators, parents, and policymakers must collaborate to create learning environments that enhance not only students' technical skills but also their awareness of data protection, digital identity, and online behavior. This study provides a foundation for developing such targeted educational frameworks and interventions.

4. CONCLUSION

This research contributes to efforts aimed at bridging the digital divide in developing countries. By evaluating current digital literacy level. Study identifies key areas requiring intervention to enhance students' digital competencies and foster equitable educational opportunities. The findings reveal that digital literacy challenges primarily stem from two factors: (1) difficulties in assessing information relevance, and (2) widespread sharing of online content without adequate understanding of privacy protection measures. While most respondents demonstrate basic operational skills, the study highlights a critical need to strengthen awareness of digital privacy principles when using technological tools. The correlation between operational skills and privacy awareness, although statistically significant, suggests that technical proficiency alone does not guarantee safe online behavior. Digital literacy must be developed holistically, encompassing not only skills but also attitudes, critical thinking, and awareness of digital ethics. This comprehensive approach will help students navigate digital platforms more effectively and responsibly.

This study provides theoretical contributions by integrating privacy protection as a core dimension of digital literacy and empirically linking it with operational skills. From a policy perspective, these findings offer actionable insights for curriculum development, teacher training, and national digital literacy programs, highlighting the urgency of embedding privacy, security, and digital resilience into education at the high school level. Such policies can help transform students from merely competent users into ethical and responsible digital citizens. In conclusion, promoting digital literacy among Indonesian high school students is not only a matter of teaching technical skills but also fostering informed, critical, and ethical digital citizens. Educational institutions, policymakers, and communities must collaborate to design inclusive and adaptive programs that bridge regional gaps and address key literacy challenges. By integrating these recommendations, Indonesia can develop a generation that not only participates fully and safely in the digital era but also contributes to shaping new concepts of digital citizenship and privacy protection aligned with global standards.

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