Elementary school student digital literacy framework: A Confirmatory Factor Analysis (CFA)

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Abstract

This research aims to produce a digital literacy framework for elementary school students. This framework refers to *Indonesia's Digital Literacy Roadmap 2020-2024*. A total of 28 indicators were adopted as a digital literacy framework for elementary school students. Furthermore, a confirmation factor analysis (CFA) was using 209 respondents of elementary school students. Based on the results of the initial CFA, the structure of the factors formed is fit. However, to obtain the structure of these factors, researchers must delete many items, thus giving rise to the assumption that there needs to be clarity in the structure of the factors formed. The researcher conducted an Explanatory Factor Analysis (EFA) test to obtain a new factor structure. After that, a second CFA test was carried out. Based on the results of the final CFA, 19 items were found whose factor structure was fit and became the framework for elementary school digital literacy.

Questa ricerca mira a produrre un framework di alfabetizzazione digitale per gli studenti della scuola elementare. Il framework fa riferimento alla *Roadmap per l'Alfabetizzazione Digitale dell'Indonesia 2020-2024*. Sono stati adottati un totale di 28 indicatori come framework di alfabetizzazione digitale per gli studenti della scuola elementare. Inoltre, è stata condotta un'analisi fattoriale confermativa (CFA) utilizzando 209 studenti della scuola elementare come rispondenti. Sulla base dei risultati della CFA iniziale, la struttura dei fattori formati risulta adeguata. Tuttavia, per ottenere tale struttura, i ricercatori hanno dovuto eliminare numerosi item, facendo sorgere l'ipotesi che vi sia una mancanza di chiarezza nella struttura dei fattori emersi. I ricercatori hanno quindi condotto un'analisi fattoriale esplorativa (EFA) per ottenere una nuova struttura fattoriale. Successivamente, è stato effettuato un secondo test CFA. Dai risultati della CFA finale, sono stati individuati 19 item la cui

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struttura fattoriale risulta adeguata, e che costituiscono il framework per l'alfabetizzazione digitale nella scuola elementare.

Keywords: digital literacy; digital literacy framework; students' digital literacy; elementary school; Confirmatory Factor Analysis.

Parole chiave: alfabetizzazione digitale; framework di alfabetizzazione digitale; alfabetizzazione digitale degli studenti; scuola elementare; analisi fattoriale di conferma.

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1. Introduction

Information communication technology (ICT) is increasingly developing and provides various information to help humans daily (Zulkarnain et al., 2024). The application of ICT in elementary schools in the industrial era 4.0 is urgently needed (Zuhri et al., 2024). Information and communication technology has transformed the educational process to be interactive and more focused on digital literacy, which is influenced by the skills of teachers and students (Stefkova et al., 2024). The first definition of digital literacy was introduced by Gilster in 1997, which is the ability to understand and use information in various formats from various sources when presented through a computer (López-Meneses et al., 2020). Digital literacy has become an indicator in today's life, involving digital technology in educational, family, and professional activities. Digital literacy has become an indicator of the socialization of modern individuals. Digital literacy can have an impact in the form of lifelong learning through access to trusted information (Huda et al., 2024).

Digital literacy has become a concern for education professionals such as students, teachers, and policymakers. Various educational institutions, professional organizations, and others have created digital literacy models or frameworks to answer the challenges of defining digital literacy. These frameworks can work to define digital literacy globally or to meet their specific needs. In addition to providing general definitions and language, digital literacy frameworks can be used to assess student and staff abilities, identify areas for expansion and growth, and strategize the implementation of digital literacy programming (Feerrar, 2019).

The Global Alliance for Monitoring Learning has examined the framework adopted at the national level by 43 countries to inform the development of UNESCO's Global Digital Literacy Framework (2018) (Feerrar, 2019). The proposed areas of competence for the Global Framework for Digital Literacy from UNESCO are six: information and data literacy, communication and collaboration, digital content creation, safety, problem-solving, and career-related competencies. Indonesia is one of the countries that use the UNESCO Digital Literacy Framework as a reference when compiling the Indonesian Digital Literacy Framework. The digital literacy framework in Indonesia is contained in the 2020-2024 Digital Literacy Road Map. This framework is used as a basis for designing programs and curricula for the Indonesian Digital Literacy National Movement Program 2020-2024. Indonesia's digital literacy framework consists of four pillars: *digital skills, digital culture, digital ethics,* and *digital safety* (Deloitte, 2021).

The four pillars of digital literacy – *digital skills, digital culture, digital ethics,* and *digital safety* – are described as indicators. The pillar of Digital skills consists of nine indicators: digital ethics, seven indicators; digital safety, eight indicators; and digital culture 7, indicators. Thirty-one indicators are used to measure the status of digital literacy in Indonesia in 2022. The profile of respondents in the Indonesian Digital Literacy Status Survey in 2022 is dominated by Gen Y (24-39 years old), as much as 43% with a high school education background or equivalent (Kominfo, 2022). The other percentage of respondents is Gen Z (<24 years old), as much as 25%; Gen X (40-45 years old), as much as 27%; and Boomer (>55 years old), 5%.

The status of digital literacy for Gen Z or young people has yet to receive special attention in the Indonesian Digital Literacy Status Survey in 2022. However, the government continues striving to improve students' digital literacy by launching the Digital Literacy Module in Elementary Schools (Kemendikbudristek, 2021). The Digital Literacy Module in Elementary Schools contains materials, types of digital literacy activities, and good practices for digital literacy in elementary schools. In the context of elementary school, the digital literacy possessed by students can be interpreted as basic digital literacy, namely the ability to complete tasks using the tools available in elementary schools, information and communication technology on computers, the use of digital

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information and digital communication tools competently in the context of educational and cognitive activities according to the needs and abilities of elementary school students (Tsvetkova et al., 2022).

Increasing digital literacy in elementary schools needs to refer to a framework. This research focuses on digital literacy among primary school students and how this framework can be measured effectively. However, there needs to be more literature regarding the practical implementation of this digital literacy framework in primary school settings. Many previous studies have focused more on middle school or higher education students, while the needs and abilities of elementary school students have yet to be explored in depth. In addition, existing literature often needs more explicit guidance on integrating digital literacy into the primary school curriculum systematically and sustainably.

Another gap is the need for valid, reliable measurement tools to assess primary school students' digital literacy. Although this study uses confirmatory factor analysis (CFA) to evaluate the proposed framework, more empirical studies are still needed to test the external validity of this measuring tool in various educational contexts. Most existing measurement tools have been tested in developed countries, so there is an urgent need to adapt and validate these frameworks in different contexts, including in developing countries, to ensure their relevance and effectiveness in improving primary school students' digital literacy. Therefore, this research aims to propose a digital literacy framework for elementary school students. This framework was adopted from the digital literacy framework in Indonesia in 2022, referring to the 2020-2024 Digital Literacy Roadmap, with four pillars and 31 indicators. Four pillars are part of the digital literacy curriculum development framework: Digital Skills, Digital Ethics, Digital Safety, and Digital Culture. Of the 31 indicators, 28 were adopted as a digital literacy framework for elementary school students. Next, the framework was tested with confirmatory factor analysis (CFA) to determine its validity and reliability.

2. Digital literacy framework reviewed by the DigiLit Team

DigiLit Leicester Team (Fraser &; Reedy, 2018) has reviewed nine digital literacy frameworks for students, teachers, and institutions, as shown in Table 1. Of the nine frameworks, 3 include teachers, 4 include students, and 2 include institutions. The digital literacy framework that includes teachers is DECK (2012), UNESCO (2008), and the Professional Development Matrix (2002). The digital literacy framework that includes students is DIGCOMP (2012), DigEuLit (2007), The ICT Framework (2007), and iSkill Assessment (2002). Meanwhile, the frameworks that cover institutions are the Digital Literacies Organisational Review (2012) and The Self-Review Framework (2012). Due to scope limitations, the study only reviewed four digital literacy frameworks for students that the DigiLit Leicester Team ever presented.

Table 1. Digital literacy framework reviewed by Leicester's DigiLit team

Name	Author/s	Scope	Structure
DECK	Fisher et al. (2012)	Teachers	None
DIGCOMP	Ala-Mutka (2011); Ferrari (2012)	Learners	3 levels
DigEuLit	Martin & Grudziecki (2007)	Learners	3 levels
Digital Literacies Organisational Review	JISC (2012a)	Institution	None
ICT Competency Standards for Teachers	UNESCO (2008)	Teachers	3 levels

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The ICT Framework	National Council for Curriculum and Assessment (NCCA), Ireland (2007)	Learners	3 levels
iSkills Assessment	Educational Testing Service (2002)	Learners	2 levels
The Professional Development Matrix	Martin (2002)	Teachers	4 levels
The Self-Review Framework	National Association of Advisors for Computers in Education (NAACE) (2012)	Institution	4 levels

The Educational Testing Service (ETS) in 2002 offered the iSkills Assessment at two levels: core and advanced. The core level is designed to assess the ICT literacy readiness of universities. High school students and first-year college students are targeted in this assessment. The Advanced Level assesses readiness for ICT literacy challenges in transitioning to higher-level college courses. Students in the second or third year of post-secondary school studies are targeted in this assessment (Katz, 2007). Meanwhile, the DigEuLit project in 2006 developed a digital literacy framework for Europe. The framework incorporates digital elements of ICT and other relevant digital literacy and looks at it through the organizing perspective of thirteen processes. The processes are statement, identification, accession, evaluation, interpretation, organization, integration, analysis, synthesis, creation, communication, dissemination, and reflection (Martin, 2006).

The National Council for Curriculum and Assessment, Ireland, in 2007 proposed The ICT Framework (NCCA, 2007). The purpose of the ICT Framework is to enable teachers to support students in four ways: exploring the potential of ICTs to create, communicate, and collaborate to organize and produce information (Area C); understanding and apply knowledge of ICT functions including safe practices, maintenance and ergonomics (Area F); using ICT to think and learn including managing investigations, assessing information, solving problems, and expressing ideas in various areas of the curriculum (Area T); develop a critical appreciation of the role of ICT in society and habits that reflect the ethical and responsible use of ICT (Area S).

In 2013, the European Commission's Joint Research Centre (JRC) launched DigComp as a common framework to assist Europeans and the workforce in evaluating skills, setting learning objectives, identifying training opportunities, and opening up broader career opportunities. DigComp 2.0 defines key digital competencies in five areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. In 2022, this framework was updated to DigComp 2.2. (Vuorikari et al., 2022). Update 2.2 provides more than 250 new examples of knowledge, skills, and attitudes that help citizens confidently, critically, and safely engage with new digital technologies and systems driven by artificial intelligence (AI).

Digital literacy frameworks in each country can differ in their emphasis on specific topics such as citizen engagement, identity, health, ethical or legal issues, copyright and privacy, and the role of technical skills. Researchers can choose digital literacy skills for frameworks and models according to the specific study context, social or economic needs, and background (Reddy et al., 2022). From the four digital literacy frameworks with the scope of students reviewed by the DigiLit Leicester team, it can be seen that the iSkills Assessment (2002) is targeted at secondary school students and college students. DigEulit (2006) is a general digital literacy framework for Europe. The ICT Framework (2007) developed in Ireland allows teachers to support students exploring ICT in four areas—the last one, DigComp 2.0 (2013), which has been updated to DigComp 2.2. (2022) is targeted not specifically for students but to help Europeans and the workforce in digital competence.

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3. Proposed digital literacy framework for Indonesian elementary school students

A total of 28 digital literacy indicators were adopted from 31 indicators contained in the Indonesian Digital Literacy Framework and adjusted to the context for elementary school students. All indicators from the pillars of digital skills (9 indicators), digital safety (8 indicators), and digital culture (7 indicators) were adopted as the framework for elementary school digital literacy. Meanwhile, the indicators adopted from the digital ethics pillar are 4 out of 7 existing indicators. The next step is to code each item to facilitate further analysis. The adopted pillars and indicators are outlined in Table 2.

4. Method

4.1 Research design

This study uses a quantitative approach with a survey method. The research stages include essential steps to ensure the validity and reliability of the results. First, the digital literacy indicators of elementary school students are determined based on literature reviews and consultations with education experts. Furthermore, research models and hypotheses were developed. The questionnaire is prepared with the principles of making a valid survey instrument, such as the items' clarity and relevance to the measured indicators. The collected data was processed using confirmation factor analysis (CFA) with JASP 0.17.1 software. CFA tests the suitability of theoretical models with empirical data, allowing validation of the measured constructs. Model conformance indices such as Chi-square, RMSEA, and CFI are analyzed to evaluate the model. Strengthening statistical theory ensures that the measuring tool has high construct validity and reliability so that it can be relied on to accurately assess the digital literacy of elementary school students.

4.2 Participants

Inferential statistical techniques were used to determine the number of samples to ensure representativeness. This study involved 209 respondents from 13 schools from 8 districts in Central Java province: Purworejo, Kebumen, Magelang, Wonosobo, Purbalingga, Banjarnegara, Sukoharjo, and Wonogiri. The respondents in this study consisted of 90 male students and 119 female students. There are 34 grade 4 students, 70 grade 5 students, and 105 grade 6 students. The age ranges of respondents in this study were nine years (24 children), ten years (39 children), 11 years (109 children), and 12 years (37 children).

4.3 Measurement

Data was collected using a questionnaire sent via Google Forms in September 2023. A total of 28 questionnaire items were distributed to elementary school students who were respondents. The scaling method used in the digital literacy scale is the summated ratings (Likert) method with five response options, namely strongly disagree (score 1), disagree (score 2), neutral (score 3), agree (score 4), and strongly agree (score 5). The data analysis technique in this study aims to test the validity of the construction of digital literacy instruments using the confirmatory factor analysis (CFA) method. Confirmation factor analysis aims to evaluate the suitability of a single-group measurement model using SEM procedures. The model is suitable if the covariance structure of the model is similar to the covariance structure of the sample data, as indicated by the acceptable goodness-of-fit index (GFI) value.

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This study's digital literacy measurement instrument was adopted from the framework in Indonesia's digital literacy roadmap for 2020-2024. Although the validity and reliability tests' results are not explained, the digital literacy framework used in Indonesia in 2022 has gone through various quality control processes with four stages: pilot survey, witness process, callback process, and statistical testing process on survey results in the form of reliability and validity (Kominfo, 2022). The measurement instruments adopted for this study are presented in Table 2.

Table 2. Digital literacy measurement instrument

No	Pillar	Item
1	Digital Skill	1, 2, 3, 4, 5, 6, 7, 8, 9
2	Digital Ethics	10, 11, 12, 13
3	Digital Safety	14, 15, 16, 17, 18, 19, 20, 21
4	Digital Culture	22, 23, 24, 25, 26, 27, 28
	Total	**28**

4.4 Data analysis

Two interrelated stages are carried out when conducting a CFA construct validity test. The first stage is to conduct a Goodness of Fit (GOF) test to ensure that the model is based on the data taken from the field. When the GOF criteria meet the standard, the second step is to look at the valid items. Evaluation using the CFA model can generally use four criteria, namely (1) Model convergence and acceptable parameter estimation range, (2) Conformity index, (3) Significance of parameter estimation and related diagnostics, and (4) Measurement invariance in several samples. The goodness of fit data from CFA and related indices can be classified into absolute, comparative, or incremental and parsimony fit indices.

5. Results

Initial Confirmatory Factor Analysis (CFA) is conducted to determine if the instrument is fit. The criteria for a fit factor structure is if the CFI and TLI values are $\alpha > 0.90$, and the RMSEA and SRMR values are $\alpha < 0.08$. The initial CFA results are shown in the following Table 3.

Table 3. Initial Confirmatory Factor Analysis

Index	Value
Comparative Fit Index (CFI)	0.979
Tucker-Lewis Index (TLI)	0.968
Root mean square error of approximation (RMSEA)	0.037
Standardized root mean square residual (SRMR)	0.035

The table above shows that the CFI and TLI values of the formed factor structure are 0.979 and 0.968 simultaneously (meet the criteria). Meanwhile, the RMSEA and SRMR values are 0.037 and 0.035, which also meet the criteria. Thus, the structure of factors formed from the instrument's analysis is fit.

Nevertheless, researchers removed 18 out of 28 items to obtain this structure, leaving only 10 items. The large number of items that must be removed raises the assumption from researchers that the structure of the formed

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factors needs to be clear, even more so because all items in *the Digital Ethics Dimension* must be deleted. Therefore, the researcher conducted an Explanatory Factor Analysis (EFA) test to obtain a new factor structure.

Table 4. Explanatory Factor Analysis (EFA) results

Factor Loadings				
Item	**Factor 1**	**Factor 2**	**Factor 3**	**Uniqueness**
DE1	0.796			0.436
DS8	0.776			0.506
DS6	0.702			0.554
DS3	0.675			0.541
DE3	0.671			0.475
DS5	0.668			0.564
DE2	0.661			0.581
DS7	0.628			0.658
DE4	0.608			0.624
DS4	***0.581***			0.62
DS2	***0.491***			0.617
DS1	***0.478***			0.604
DS9	***0.462***			0.75
DC5		0.785		0.46
DC6		0.755		0.51
DSF1		0.74		0.528
DC8		0.657		0.578
DSF3		0.594		0.644
DSF2		0.547		0.651
DC7		***0.355***		0.747
DSF5			***1.021***	0.235
DSF7			0.97	0.296
DC1			0.434	0.818
DSF6			***0.393***	0.684
DC4			***0.39***	0.738
DSF4			0.379	0.64
DC2			***0.342***	0.787
DC3			0.337	0.816

Note. Applied rotation method is promax.

From the results of EFA, the researchers found that the new factor structure formed has three dimensions. After searching for each item, the researcher gave a name for each dimension, namely, (1) Digital Skills and Ethics Dimension with 13 items; (2) Digital Security Dimension with seven items; and (3) Digital Culture Dimension with eight items. The basis for naming the digital skills and ethics dimensions is because the 13 items in these

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dimensions combine digital skill indicators (9 items) and digital ethics (4 items). The digital security dimension consists of digital safety indicators (4 items) and digital culture (3 items). The digital culture dimension consists of digital safety indicators (4 items) and digital culture (4 items). The researcher again conducted a CFA test on the new factor structure to ensure that the factor structure had been formed properly. Table 5 below presents the factor loadings of the structures generated after the EFA stage.

Table 5. Factor loadings

Factor loadings							
						95% Confidence Interval	
Factor	**Indicator**	**Estimate**	**Std. Error**	**z-value**	**p**	**Lower**	**Upper**
Factor 1	DS1	0.441	0.044	10.099	< .001	0.355	0.526
	DS3	0.625	0.053	11.814	< .001	0.521	0.729
	DS5	0.563	0.049	11.526	< .001	0.467	0.659
	DS6	0.708	0.056	12.624	< .001	0.598	0.818
	DS7	0.56	0.053	10.66	< .001	0.457	0.663
	DE1	0.767	0.056	13.727	< .001	0.657	0.876
	DE2	0.679	0.059	11.475	< .001	0.563	0.795
	DE3	0.646	0.047	13.726	< .001	0.554	0.739
	DE4	0.537	0.052	10.365	< .001	0.436	0.639
Factor 2	DC5	0.752	0.059	12.742	< .001	0.636	0.867
	DC6	0.707	0.057	12.321	< .001	0.594	0.819
	DC8	0.569	0.053	10.797	< .001	0.466	0.672
	DSF1	0.771	0.061	12.618	< .001	0.651	0.89
	DSF2	0.556	0.055	10.092	< .001	0.448	0.663
	DSF3	0.61	0.058	10.497	< .001	0.496	0.724
Factor 3	DC3	0.47	0.062	7.603	< .001	0.349	0.592
	DSF4	0.527	0.054	9.757	< .001	0.421	0.632
	DSF7	0.496	0.058	8.584	< .001	0.382	0.609
	DC1	0.477	0.073	6.529	< .001	0.334	0.62

After conducting a second CFA test, the researcher found that some items could interfere with the structure of the factors that caused the results to be unfit. So the researcher deleted nine items, namely DS4, DS2, DS1, DS9, DC7, DSF5, DSF6, DC4, and DC2, so that out of the 28 items tested, there were 19 items whose factor structure was fit. The distribution in each dimension is: (1) Digital skills and ethics dimensions with nine items; (2) Digital security dimension with six items; and (3) The dimension of digital culture with four items. The results of the measurement of this new factor structure are as follows:

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Table 6. Confirmatory Factor Analysis final

Index	Value
Comparative Fit Index (CFI)	0.901
Tucker-Lewis Index (TLI)	0.887
Root mean square error of approximation (RMSEA)	0.064
Standardized root mean square residual (SRMR)	0.054

The table above shows that the CFI and TLI values of the factor structure formed are 0.901 and 0.887 simultaneously. These results show that the CFI value has met the criteria, but TLI does not. Meanwhile, the RMSEA value and SRMR value are 0.064 and 0.054, where both meet the criteria. Although the TLI score was not met, the other three criteria have been met. So, it can be concluded that the factor structure for 19 items is a fit.

6. Discussion

After going through the initial, Explanatory, and final Confirmatory Factor Analysis stages, 19 items of the elementary school digital literacy framework were produced, as described in Table 7: Digital Skills (5 items), Digital Ethics (4 items), Digital Safety (6 items), and Digital Culture (4 items).

Table 7. Final pillars and indicators of digital literacy of elementary school students

Pilar	Indicator	Kode	Item
Digital Skill (DS)	I can upload files	DS3	3
	I can store data, information, and content in digital media	DS5	5
	I am used to discovering if the information I find on a website is true or wrong	DS6	6
	I used to compare different sources of information to decide if the information was correct	DS7	7
	I can interact through various digital technology communication devices.	DS8	8
Digital Ethics (DE)	I don't upload photos with other people's children	DE1	10
	I don't tag a friend when I upload content without needing to tell my friend	DE2	11
	I will not comment rudely if anyone makes negative comments on my posts.	DE3	12
	I didn't create a group and add people without permission	DE4	13
Digital Safety (DSF)	On social media accounts, I can control who can see my timeline	DSF1	14
	I know how to report abuse on social networks	DSF2	15
	I can turn off the option to show geographic position	DSF3	16
	I don't upload personal data on social media.	DSF4	17
	I'm used to creating secure passwords with a combination of numbers, letters, and punctuation	DSF7	20
	I backed up data in several places.	DSF8	21
Digital Culture (DC)	I adjust my communication so the second party is not offended.	DC1	22
	I included the author's name when reposting	DC3	24
	I share traditional and contemporary Indonesian cultural arts digitally	DC5	26
	I consider the feelings of readers who have different political views	DC6	28
	Total		**19**

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Based on the final Confirmatory Factor Analysis (CFA) results, a final model of the digital literacy framework of elementary school students with nineteen indicators was found. Furthermore, nineteen indicators of the digital literacy framework were analyzed using two references for elementary school digital literacy, namely *the Student Outcomes Framework* and the ISTE (International Society for Technology in Education) standards. Digital literacy indicators contained in the *Evaluating Global Digital Education: Student Outcomes Framework reference* (Tiven et al., 2018) are divided into four categories: indicators of knowledge, skills, attitudes, and behaviors. Each indicator consists of several more detailed digital literacy sub-indicators. Of the four indicators, three indicators by the digital literacy framework of this research are knowledge indicators, skills indicators, and attitude indicators.

Meanwhile, the ISTE Standards present a framework for innovation and excellence in teaching, learning, and leadership (Theodoridis & Kraemer, 2019). The ISTE Standards consist of four parts: Students, Educators, Educational Leaders, and Trainers. There are seven ISTE standards for students: empowered learners, digital citizens, knowledge constructors, innovative designers, computational thinkers, creative communicators, and global collaborators. Each standard is reduced to several indicators. Two of the seven standards are indicators in the digital literacy framework produced in this study, namely the standards for empowered learners and digital citizens. Table 8 compares the pillars and indicators of the digital literacy framework proposed in this study with the digital literacy indicators contained in the *Student Outcomes Framework* reference and ISTE standards.

Table 8. Comparison of digital literacy framework with students outcomes framework and ISTE

Indicator	Students Outcomes Framework	ISTE Standards and Indicators
Digital Skills	Skill Indicators	Empowered Learner (1.1.)
1. I can upload files. 2. I can store data, information, and content in digital media. 3. I am used to discovering if the information I find on a website is true or wrong. 4. I used to compare different sources of information to decide if the information was correct. 5. I can interact through various digital technology communication devices.	Ability to use digital tools to research and learn information. Ability to use digital tools to create original content. Ability to use digital tools to present information. Ability to select appropriate digital tools for different purposes and audiences.	Use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways (1.1.c.).
Digital Ethics	Knowledge Indicators	Digital Citizen (1.2.)
6. I don't upload photos with other people's children.	Understanding of online communication etiquette	Cultivate and manage their digital identity and reputation and realize the

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Indicator	Students Outcomes Framework	ISTE Standards and Indicators
7. I don't tag a friend when I upload content without needing to tell my friend. 8. I will not comment rudely if someone makes a negative comment on my post. 9. I didn't create a group and add people without permission.		permanence of their actions in the digital world (1.2.a.). Demonstrate understanding and respect for the rights and obligations of using and sharing intellectual property (1.2.c.)
Digital Safety	Knowledge Indicators	Digital Citizen (1.2.)
10. On social media accounts, I can control who can see my timeline. 11. I know how to report abuse on social networks. 12. I can disable the option to show geographic position. 13. I don't post personal data on social media. 14. I'm used to creating secure passwords with a combination of numbers, letters, and punctuation. 15. I backed up data in several places.	Understanding of internet security and safety	Engage in positive, safe, legal, and ethical behavior while using technology, including social interactions online or while using networked devices (1.2.b.). Manage their personal data to maintain digital privacy and security and know the data collection technologies used to track their navigation online (1.2.d.)
Digital Culture	Attitudinal Indicators	Digital Citizen (1.2.)
16. I adjust how I communicate so the second party doesn't feel offended. 17. I included the author's name when reposting. 18. I share traditional and contemporary Indonesian cultural arts digitally. 19. I consider the feelings of readers who have different political views.	Appreciation for digital tools as a means of communicating with varying audiences and encountering different perspectives.	1.2.c. demonstrate understanding and respect for the rights and obligations of using and sharing intellectual property.

The first pillar in the digital literacy framework produced in this study is *digital skills.* The definition of digital skills has shifted from a technical orientation to a broader perspective that considers content-related or high-

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level skills. A recent systematic academic literature review proposes seven core skills with a digital component. 21st-century digital skills are technical, informational, communication, collaboration, creativity, critical thinking, and problem-solving (van Laar et al., 2020). However, at the elementary school level, the application of digital skills in subject practice includes children's regular practical work based on information and communication technology in the form of interdisciplinary educational projects using digital tools and devices (Tsvetkova et al., 2022). The five digital skills indicators proposed in this study align with the *skills indicators* in the *Student Outcome Framework* and the ISTE standard for students: Empowered Learners. The five indicators include (1) the ability of students to upload files, (2) the ability to store data, information, and content in digital media, (3) the ability to find out whether the information found on the website is true or false, (4) the ability to compare various sources of information to decide whether the information is accurate, and (5) the ability to interact through various digital technology communication devices.

The second pillar is *digital ethics.* Ethics in digital literacy are necessary for elementary school students to avoid bullying, game addiction, social media victims, and victims of negligence in time management (Kemendikbudristek, 2021). *Digital ethics* is defined as the ability of individuals to embody, model, adapt, rationalize, consider, and develop digital ethical governance (netiquette) (Deloitte, 2021). In the 2020-2024 Digital Literacy Roadmap of the Ministry of Communication and Informatics, the Basic Curriculum Module of Digital Ethics was prepared by emphasizing individual knowledge of digital ethical governance. Digital ethics indicators in this study include (1) not uploading photos with people's children, (2) not tagging friends without permission when uploading content, (3) not making rude comments if someone comments negatively, and (4) not creating groups and adding people without permission. This study's four indicators of digital ethics are the *Knowledge Indicators* in the *Student Outcome Framework* and the ISTE Digital Citizen standard.

The third pillar is *digital security*. Nowadays, digital security is critical because it is related to preventing offline threats (Tomczyk, 2020). Digital security has become a global challenge, along with the popularity of digital technology and the rapid development of the Internet (Tomczyk & Potyrała, 2021). Digital Security can be defined as the ability of users to identify, patterning, apply, analyze, weigh, and raise awareness of personal data protection and digital security in daily life (Ameliah et al., 2021). The digital security pillars of this study consist of six indicators: (1) the ability to manage social media timelines, (2) knowledge of how to report abuse on social networks, (3) the ability to disable geographical positions, (4) not uploading personal data on social media, (5) being used to creating secure passwords with a combination of numbers, letters, and punctuation, and (6) the ability to back up data in several places.

The fourth pillar is *digital culture*. The lack of digital culture is one of the challenges faced by Industry 4.0 (Hariharasudan &; Kot, 2018). Digital culture considers the relationship between interdisciplinary computing and other fields of knowledge. Digital culture involves technology and society, digital citizenship, and digital understanding (Nogueira et al., 2022). Digital culture is creating an open and positive attitude toward future technology challenges (Brunetti et al., 2020). The pillars of digital culture in this study consist of four indicators: (1) the ability of students to adjust the way they communicate so that the second party does not feel offended, (2) the author's name is included when reposting, (3) the digital sharing of traditional and contemporary Indonesian cultural arts, and (4) the consideration of the feelings of readers who have different political views. Four indicators of digital culture in this study are included in the scope of the *Knowledge Indicators of the Student Outcome Framework* and the ISTE Digital Citizen standard.

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7. Conclusion

This study aims to propose a digital literacy framework for elementary schools by adopting 28 indicators from Indonesia's national digital literacy framework, which refers to the Digital Literacy Roadmap 2020-2024. Based on the initial Confirmatory Factor Analysis (CFA) results, the factor structure formed from the Instrument analysis fits. However, researchers removed 18 out of 28 items to get the structure, leaving only ten items. The large number of items that must be removed raises the assumption from researchers that there is confusion in the structure of the formed factors. Therefore, the researcher conducted an Explanatory Factor Analysis (EFA) test to obtain a new factor structure.

The new factor structure formed from the results of EFA has three dimensions: (1) Digital Skills and Ethics Dimension with 13 items; (2) Digital Security Dimension with seven items; and (3) Digital Culture Dimension with eight items. The CFA test is again carried out on the new factor structure. After the second CFA test, the researchers found that some items could interfere with the structure of the factors that caused the results to be unfit. So, the researcher deleted nine items from the 28 items tested. In the final CFA results, 19 items were found whose factor structure was fit and became the framework for elementary school digital literacy with four pillars, namely Digital Skill (5 items), Digital Ethics (4 items), Digital Safety (6 items), and Digital Culture (4 items).

The digital literacy framework generated from the CFA test was then analyzed using two references to the framework with context considerations for elementary school students. The elementary school digital literacy indicators, produced in this study are appropriate and included in the scope of indicators used as benchmarks, namely *the Student Outcome Framework* and ISTE Standards.

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