



Digital Literacy Questionnaire Instrument: Based on the Integration of Elementary School Students' Characteristics

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ABSTRAK

Pada era kemajuan teknologi, diperlukan kemampuan literasi digital yang mumpuni untuk siswa Sekolah Dasar (SD). Permasalahan muncul adalah kurangnya alat ukur untuk memotret kemampuan literasi digital khusus siswa SD. Dimana alat ukur ini dapat digunakan sebagai alat untuk memprofilisasi kemampuan literasi digital siswa SD. Hasil potret profil kemampuan literasi digital dapat digunakan oleh guru untuk melakukan strategi-strategi intervensi kedepannya. Berdasarkan hal tersebut, penelitian ini bertujuan untuk mengembangkan sebuah instrumen angket yang dapat mengukur kemampuan literasi digital pada siswa SD. Penelitian ini menggunakan tujuh area literasi digital yang telah ditetapkan oleh UNESCO (2018). Aspek karakteristik siswa SD meliputi kognitif, bahasa, motorik, social-emosi juga menjadi pertimbangan. Penelitian ini menerapkan model 4D. Data dikumpulkan menggunakan instrument angket validitas. Subjek coba adalah dosen Pendidikan Guru Sekolah Dasar yang memiliki rekam jejak penelitian terkait teknologi Pendidikan. Data dianalisis menggunakan teknik analisis deskriptif untuk mendeskripsikan validitas produk yang telah dikembangkan. Hasil validasi menunjukkan bahwa indikator-indikator pengembangan instrumen ini telah disusun berdasarkan teori literasi digital yang diusung oleh UNESCO pada tahun 2018, dan juga telah diperinci dengan karakteristik siswa SD. Menurut para ahli, instrumen ini masuk pada kategori yang sangat baik dan siap digunakan dalam mengukur kemampuan literasi digital siswa Sekolah Dasar.

ABSTRACT

In this era of technological progress, adequate digital literacy skills are needed for elementary school students. The problem that arises is the lack of measuring tools to capture digital literacy skills specifically for elementary school students. Where this measuring instrument can be used as a tool to profile elementary school students' digital literacy abilities. The results of the digital literacy skill profile portrait can be used by teachers to carry out future intervention strategies. Based on this, this research aims to create a questionnaire instrument that can measure digital literacy skills in elementary school students. This research uses seven areas of digital literacy that have been determined by UNESCO (2018). Aspects of the characteristics of elementary school students including cognitive, language, motoric, social-emotional are also taken into consideration. This research applies a 4D model. Data was collected using a validity questionnaire instrument. The test subjects were elementary school teacher education lecturers who had a track record of research related to educational technology. Data were analysis using descriptive analysis techniques to describe the validity of the products that had been developed. The validation results show that the indicators for developing this instrument have been prepared based on the digital literacy theory promoted by UNESCO in 2018, and have also been detailed with the characteristics of elementary school students. According to experts, this instrument can be considered an excellent category and is ready to be used in measuring the digital literacy skills of elementary school students.

1. INTRODUCTION

The importance of digital literacy in classroom learning cannot be denied in this digital era. In the digital era, digital literacy is a fundamental skill that students must have to be able to learn and participate effectively in society (Ahmad, 2020; Shopova, 2014). Digital literacy helps students to understand, analysis and critically evaluate digital information, and create and share digital content in a responsible way (Kong, 2014; Oakley et al., 2020). Classroom learning that integrates digital literacy can increase student motivation and help them achieve better learning outcomes. The definition of digital literacy in classroom learning includes an understanding of how digital technology can be used to support learning, including skills in searching for information online, evaluating the validity of information sources, and

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producing creative and informative content using various digital media (Kurniadi et al., 2023; Setyaningsih et al., 2019; Wahab et al., 2022). The function of digital literacy in classroom learning is very important because it helps students to develop skills that are relevant to the demands of the times, such as the ability to think critically, analysis information, collaborate online, and maintain security and ethics in the use of technology. However, the condition of digital literacy in classroom learning is also faced with various challenges, risks and the need for competency development (Ince, 2022; Mustofa & Budiwati, 2019). These challenges include online content that is not always accurate or useful, security and privacy risks in interacting online, and the need to develop digital competencies in dealing with a complex technological world. These include a lack of teacher professional development, uneven digital infrastructure across school districts, or unequal access to digital media among students (Lindfors et al., 2021; Weninger, 2022). In facing this challenge, effective preventive efforts require an in-depth understanding of students' digital literacy profiles.

Efforts to capture student profiles regarding digital literacy skills can be done using an instrument. Therefore, a valid instrument is needed to measure students' digital literacy. This instrument is needed to determine the appropriate profile of students' digital literacy abilities, so that educators can design learning strategies that suit students' digital literacy needs and levels (Bojko, 2013; Hutagalung & Purbani, 2021). Thus, digital literacy instruments are not only an evaluation tool, but also a basic preventive step to identify students' needs and risks before they are exposed to threats or unsafe content online. Previously, there had been research on the development of digital literacy instruments (Febliza & Okatariyani, 2020; Lestari et al., 2022), previously research focus more on developing digital literacy instruments for high school students and equivalent. Another research of these tools are not specifically targets or is tailored to the unique needs and developmental characteristics of children at the elementary school level. Existing tools are more general and often do not take into account how young children understand and interact with digital technology, which differs significantly from older students or adults (De León et al., 2023; Lukitasari et al., 2022; et al., 2023; Waliyuddin & Sulisworo, 2022). The characteristics of elementary school students include various aspects that are interrelated and influence their digital literacy. Apart from developing cognitive abilities, such as the ability to analysis and evaluate information, it is also necessary to pay attention to students' language skills in understanding digital instructions as well as fine and gross motor skills in using technological devices (Al Shammari, 2021; Dudu & Vhurumuku, 2012). Apart from that, social and emotional aspects such as the ability to work in a team, resolve conflict, and understand the social impact of using technology also need to be taken into account in designing a comprehensive digital literacy instrument (Jeong, 2017; Wilkinson & Kao, 2019).

In the context of digital literacy, this cognitive development must be considered to understand how students can assimilate and use technology. Furthermore, in language development, elementary school students also experience significant progress, starting from basic vocabulary to a deeper understanding of meaning, metaphor and implied meaning (Berk, 2018; Santrock, 2018). Likewise, gross and fine motoric development, as well as socio-emotional, play an important role in forming elementary school students holistically. By paying attention to these aspects, digital literacy approaches can be better structured, according to the needs and development potential of elementary school students in their education and development. Through the integration of a deep understanding of the characteristics of elementary school students from these multiple perspectives, digital literacy instruments can be better designed to meet students' individual needs, promote effective learning, and develop the skills necessary for success in the digital era (Aulia & Aulia, 2020; Cookson & Stirk, 2019).

Although there has been previous research on digital literacy, the difference between this research and previous research lies in the development of a digital literacy instrument that is focused specifically on elementary school students. The novelty of this study enrich our understanding of digital literacy at the Elementary education level and provide deeper insight into the readiness of elementary school students to face the challenges and opportunities in the digital era. Therefore, the main aim of this research is to develop and measure the validity of a digital literacy instrument for elementary school children, so that it can make a meaningful contribution to developing more adaptive and effective curriculum and learning strategies in this digital era.

2. METHOD

The research and development method used in this research is the 4D Model, which was chosen because of its simplicity in developing and validating digital literacy instruments for elementary school students. The 4D model consists of four main phases: Define, Design, Develop, and Disseminate (Thiagarajan, S., Semmel, D. S., dan Semmel, 1974). This digital literacy instrument is a questionnaire guide type used by teachers and uses a Likert scale as justification for its measurement.

The first phase in the 4D Model is Define, where the research objectives, test subjects, and formulation of theoretical parameters are clearly defined. Next, in the Design phase, the design of a digital literacy instrument that suits the needs of elementary school students is developed based on an understanding of student characteristics and the purpose of measuring digital literacy in the form of a grid. Then, in the Develop phase, the instrument is created, questionnaire items are formulated and tested for validity. This phase also includes expert validation and revision of the instrument to ensure its accuracy and reliability. Finally, dissemination is carried out.

The test subjects in this research were digital literacy and learning experts. The expert is elementary school teacher education lecturers who had a track record of research related to educational technology. Validator are asked to test and provide input on expert validation questionnaire instruments that refer to seven areas of digital literacy according to UNESCO (2018), such as students' understanding or competence in (1) Basics of hardware and software; (2) Information and data literacy; (3) Communication and collaboration; (4) Digital content creation, (5) Security; (6) Problem solving; and (7) Career-related Competencies. Also of concern are the characteristic aspects of elementary school students, especially cognitive, language, motor and socio-emotional aspects so that this instrument can be feasible for elementary school students. The grid of instruments used by validators is show in [Table 1](#).

Table 1. Validity Instruments Grid.

No.	Assessment Aspects
1	Practicality of questionnaire instructions
2	Suitability of the indicators developed with the theoretical aspects studied
3	Operational level of indicator items in each aspect (suitable for elementary school children)
4	The level and suitability of the sequence of indicators in each aspect
5	Representation of the distribution of indicator items

Data analysis in this research will focus on analyzing the validity of the instrument. This includes the use of simple statistics to evaluate the extent to which the instrument can measure what it should measure, namely the digital literacy abilities of elementary school students according to predetermined standards. Thus, the 4D Model becomes a comprehensive methodological basis for developing and validating digital literacy instruments for elementary school children. Become the limitation of this research is that it only involves testing content validity with experts.

3. RESULT AND DISCUSSION

Result

Define-Formulation of Theoretical Aspects Digital Literacy

There are seven areas of digital literacy there are: (1) Basics of hardware and software, namely mastery of the basics of hardware and software is important in digital literacy. This involves an understanding of how computers and mobile devices work, the ability to operate the devices properly, and expertise in installing and managing software to ensure optimal system performance and security; (2) Information and data literacy, namely the ability to seek information from credible sources, evaluate information critically, and manage and use data responsibly to support appropriate decision making and accurate information; (3) Communication and collaboration, namely skills in communicating effectively and collaborating in an online environment, are key to digital literacy. This involves the ability to communicate with others politely and effectively, collaborate on online projects, and use social media responsibly, paying attention to ethics and its impact on online interactions; (4) Digital content creation, namely the ability to create and share creative and informative content digitally, use technology to express oneself, and understand copyright and digital content licenses used to ensure sustainability and fairness in the use of digital works; (5) Security, which includes steps to protect yourself from online threats such as cyberbullying, fraud and malware. Additionally, maintaining the privacy and security of online data is a priority, while using digital technology responsibly to create a safe and ethical online environment; (6) Problem solving. Digital problem-solving skills involve the ability to identify and define problems, use digital technology to find appropriate solutions, and evaluate and select the best solutions. This allows individuals to face technological challenges effectively and efficiently, increasing their ability to adapt and innovate in dealing with digital problems; (7) Career-related competencies, which include the development of digital skills relevant to work and education, the use of digital technology to increase job opportunities, and the ability to adapt to technological changes that occur in the world of work. It

prepares individuals to succeed and thrive in a work environment that is constantly changing and innovating.

Characteristics of Elementary School Students

Cognitive aspect, Elementary school students' cognitive development occurs gradually along with their age. That student in grades 1-2 are still tied to their own perceptions and have difficulty understanding other people's perspectives. However, as students get older, they begin to understand the concept of cause and effect and develop in logical thinking. That student in grades 3-4 are starting to develop classification, seriation, and transduction skills. In the final stage, students can reason abstractly and solve problems in a more complex way, using hypothetical-deductive reasoning, and thinking about possibilities. In relation to digital literacy, aspects of elementary school students' cognitive development must of course pay attention to students' cognitive abilities. Language aspects, Furthermore, in language development, elementary school students experience rapid growth along with increasing vocabulary and understanding of meaning. They begin to master basic vocabulary and use more complex sentences. Students in grades 1-2 began to use words with more specific meanings and more complex sentences. In the next stage, students understand deeper meaning and use more complex sentences and develop an understanding of metaphor and implied meaning. In the final stage, students begin to develop more confident reading, writing, and public speaking skills.

Motor aspects, the development of gross and fine motor skills are also an important focus in the development of elementary school students. They experience improved coordination, balance, and muscle control as they age. Students in grades 1-2 enjoy playing with more active and energetic movements, while students in grades 3-4 are starting to develop more complex fine motor skills, such as writing and drawing. In the final stage, students are able to perform more coordinated and complex movements, such as playing sports and dancing. Socio-emotional aspects, finally, in socio-emotional development, elementary school students begin to build self-identity, learn to interact with peers, and understand the emotions of themselves and others. Students in grades 1-2 begin to develop a sense of friendship and learn to resolve conflicts, students in grades 3-4 begin to develop the ability to empathize and understand other people's perspectives. In the final stage, students begin to develop social skills such as empathy, cooperation and communication. Thus, the development of elementary school students includes various aspects that are important to understand in the context of their education and development.

Design-Student Digital Literacy Ability Questionnaire Instrument Grid

After formulating the theoretical aspects above, the next step is to develop an instrument grid. This is explained in the instrument grid in [Table 2](#).

Table 2. Student Digital Literacy Ability Questionnaire Instrument Grid.

No	Aspect	No	Indicator
1	Hardware and Software Basics	1	The student's ability to properly turn on and turn off a computer or mobile device.
		2	Students' understanding of the functions and operating simple features of the application, such as shifting pages (scroll), clicking navigation buttons (home, next), and adjusting the volume or screen brightness.
		3	Demonstration of students' ability to install and uninstall simple applications or software.
		4	Understand the function of antivirus applications as a device security tool.
2	Information and Data Literacy	5	Students' ability to choose search keywords and access simple information with the help of teachers from reliable sources such as official websites or digital reference books.
		6	Students' ability to explore simple information and optimize the information features provided in digital sources, such as QR codes, direct links, embedded sources, etc.
		7	Students' ability to use the information obtained to support the completion of assignments given on digital applications, such as quizzes, games, practice questions, etc.
3	Communication and Collaboration	8	Participate in class discussions using technology (e.g., sending answers via learning applications).
		9	Students' ability to convey messages clearly and effectively through

No	Aspect	No	Indicator
			learning applications.
		10	Student activity and participation in assignments through learning applications.
4	Digital Content Creation	11	The quality of students' digital work, such as making simple drawings or photo collages.
		12	Students' understanding in selecting or using images, videos or other copyrighted content (reference source).
		13	Students are able to create and share simple digital content.
5	Security	14	Students are able to sort information when inputting personal data on digital application requests (including application permissions).
		15	Students' understanding of the risks of cyberbullying and the steps they take to protect themselves.
		16	Student compliance with school security policies or the digital learning environment (e.g. accessing digital information according to specified study hours, not accessing prohibited websites, etc.).
6	Problem solving	17	Students' ability to identify the technology problems they face. (Error, hang, not responding, application permissions).
		18	Strategies students use to find solutions to digital problems. (Error, hang, not responding, application permissions).
7	Career Related Competencies	19	Demonstration of students' ability to use digital devices such as computers, tablets, smartphones, or interactive whiteboards.
		20	Students' abilities as they use applications or software relevant to a particular job, such as word processing or spreadsheet applications.
		21	Students' abilities as they create projects or presentations about the jobs they envision in the future.

After the grid was prepared, a questionnaire for assessing students' digital literacy skills was developed by adding a Likert scale column of 1 to 5 and a column for behavior emergence as show in [Table 3](#).

Table 3. Student Digital Literacy Ability Questionnaire Instrument.

No	Indikator	Scoring					Description (Behaviour)
		1	2	3	4	5	
1	The student's ability to properly turn on and turn off a computer or mobile device.						
2	Students' understanding of the functions and operating simple features of the application, such as shifting pages (scroll), clicking navigation buttons (home, next), and adjusting the volume or screen brightness.						
3	Demonstration of students' ability to install and uninstall simple applications or software.						
4	Understand the function of antivirus applications as a device security tool.						
5	Students' ability to choose search keywords and access simple information with the help of teachers from reliable sources such as official websites or digital reference books.						
6	Students' ability to explore simple information and optimize the information features provided in digital sources, such as QR codes, direct links, embedded sources, etc.						
7	Students' ability to use the information obtained to support the completion of assignments given on digital applications, such as quizzes, games, practice questions, etc.						
8	Participate in class discussions using technology (e.g., sending answers via learning applications).						
9	Students' ability to convey messages clearly and effectively through learning applications.						
10	Student activity and participation in assignments through						

No	Indikator	Scoring					Description (Behaviour)
		1	2	3	4	5	
	learning applications.						
11	The quality of students' digital work, such as making simple drawings or photo collages.						
12	Students' understanding in selecting or using images, videos or other copyrighted content (reference source).						
13	Students are able to create and share simple digital content.						
14	Students are able to sort information when inputting personal data on digital application requests (including application permissions).						
15	Students' understanding of the risks of cyberbullying and the steps they take to protect themselves.						
16	Student compliance with school security policies or the digital learning environment (e.g. accessing digital information according to specified study hours, not accessing prohibited websites, etc.).						
17	Students' ability to identify the technology problems they face. (Error, hang, not responding, application permissions).						
18	Strategies students use to find solutions to digital problems. (Error, hang, not responding, application permissions).						
19	Demonstration of students' ability to use digital devices such as computers, tablets, smartphones, or interactive whiteboards.						
20	Students' abilities as they use applications or software relevant to a particular job, such as word processing or spreadsheet applications.						
21	Students' abilities as they create projects or presentations about the jobs they envision in the future.						

1 : not appropriate; 5: Verry appropriate

After the question items are arranged, an expert validation or assessment needs to be carried out. To facilitate experts in assessing and providing input on this instrument, an instrument assessment guide is needed. The guidelines together with the results obtained from assessment or validation can be observed as show in [Table 4](#).

Table 4. Assessment Feedback.

No.	Assessment Aspects	Evaluation				Feedback/Suggestions
		1	2	3	4	
1	Practicality of questionnaire instructions				√	The assessment instructions are easy to understand and can be used well
2	Suitability of the indicators developed with the theoretical aspects studied				√	The indicators developed are in accordance with the seven theoretical aspects that are used as the basis. The indicators are very clear to understand. The cognitive aspect is suitable, as in indicator No. 1,5,6, & 7. likewise Language aspect No. 8 & 9. Motor aspect No. 3 & 19. Socio-emotional aspects No. 8 etc.
3	Operational level of indicator items in each aspect (suitable for elementary school children)				√	The indicator items and activity demands are in accordance with the activities or learning stages of elementary school students. Not too high, but enough to represent the ability of elementary school students in digital literacy. Examples of activities that are appropriate for elementary school students can be considered to be added to make it easier to justify students' abilities.
4	The level and suitability of the sequence of indicators in each aspect				√	The indicators developed are coherent and have good cohesion
5	Representation of the				√	The indicators developed have an even load and the

No.	Assessment Aspects	Evaluation				Feedback/Suggestions
		1	2	3	4	
	distribution of indicator items					numbers are quite representative of the seven aspects developed, there is no one aspect that has a dominant distribution of indicator items or vice versa.
	Conclusion					The instrument is in the very good category and can be used.

1= Poor, 2=fair, 3=good, 4=very good

Base on [Table 4](#), in general, the results of validation by experts can be said to be very good and this questionnaire instrument can be used. several aspects of the suitability of elementary school students' characteristics are highlighted, such as the cognitive aspect in indicator No. 1,5,6, & 7. Language aspect No. 8 & 9. Motor aspect No. 3 & 19. Socio-emotional aspects No. 8 etc. Even though experts have stated that this instrument is good and can be used, examples of activities suitable for elementary school students could be considered added to make it easier to justify students' abilities. At the dissemination stage, the product results are disseminated to a wide audience. This dissemination process is carried out through the publication of research articles in scientific journals.

Discussion

This study reports on the development and validation of a digital literacy instrument specifically designed for elementary school students, aimed at enhancing their digital competencies. The instrument, meticulously crafted based on UNESCO's comprehensive digital literacy framework and an analysis of elementary school student characteristics, provides educators with a practical, age-appropriate tool for assessing and fostering structured digital literacy skills ([Berk, 2018](#); [Santrock, 2018](#)). Validators have confirmed the instrument's validity. The instructions included in the questionnaire were evaluated to be clear and easily understandable, which is essential in the context of elementary school children. The practicality of the instructions ensures effective participation from young respondents, reducing the risk of errors in comprehension and responses. This indicates that the questionnaire design has successfully targeted the appropriate audience effectively.

The importance of practicality in educational product development cannot be overstated. Implementing educational products without practical testing can hinder learners' understanding of the material and their achievement of educational goals. Practicality and validity are crucial aspects in developmental research, especially when such educational product ([Almubarak et al., 2021](#); [Tunnisa et al., 2022](#)). Collaborative efforts between researchers, experts, and end-users are essential for designing products that meet field requirements. Additionally, the validity of educational products is measured through expert validation and reliability coefficients to test instrument reliability ([Sylvia et al., 2019](#); [Yansyah et al., 2021](#)). The quality of an educational product should be rigorously assessed for validity, practicality, and effectiveness ([Agus, 2016](#); [Ananta Dewi et al., 2022](#); [Pratama & Effendi, 2021](#); [Utami et al., 2022](#)).

In the context of cognitive development aspect, activities like turning computers on and off (Indicator 1) aid young students in understanding the cause and effect concept. Previous study posits that this process teaches them the direct relationship between actions and their consequences, which is essential for the development of logical thinking ([Berk, 2018](#)). This alignment is also evident in indicators 5, 6, and 7, which pertain to Information and Data Literacy, aligning with the concrete operational stage and simplicity suitable for young learners. In terms of language development, older students tend to use complex sentence structures and comprehend deeper meanings ([Berk, 2018](#); [Santrock, 2018](#)). Digital activities like writing emails or using social media serve as practical training for elementary students, enhancing effective language skills and fostering overall language development in subsequent ages. This suitability is observed in indicators 8 and 9. Motor skills are referenced in indicators like 3 and 19, where physical interaction with technological devices, as explained by studies stated that plays a crucial role in developing hand-eye coordination and fine motor skills ([Esmaelzadehazad et al., 2021](#); [Hudson et al., 2021](#)). These activities are highly relevant for students at all elementary levels, who continue to refine their motor control through precision-demanding activities. The socio-emotional aspect is particularly notable in activities like participating in class discussions using technology. Such activities support social development and empathy ([Berk, 2018](#); [Santrock, 2018](#)). These interactions facilitate listening skills, sharing, and appreciating different perspectives, which are essential for building social character and managing emotions in diverse social situations.

Aligning the assessment instrument with the underlying theoretical framework is critical in learning product development, ensuring effectiveness. The selection of the instrument must consider alignment with learning objectives, material content, learner characteristics, applied theories, student learning styles, and available environmental conditions and facilities (Darmayanti & Abadi, 2021; Octavyanti & Wulandari, 2021; Sylvia et al., 2019). Ensuring the alignment between learning content and objectives is essential for maximizing learning quality.

According to the validators, the formulated indicators are appropriately suited for elementary school students—neither too advanced nor too simplistic—accurately representing their capabilities in digital literacy. This evaluation confirms that the difficulty levels of the indicators have been well-adjusted to match the cognitive abilities of students at the primary education level. Recommendations to include suitable activity examples will further clarify and justify students' capabilities, a critical step to ensure that the indicators truly reflect what students at that age can and should achieve. The sequential arrangement of the indicators demonstrates good coherence and adherence among indicators within the same aspect. Understandable survey instruments also enhance the validity and reliability of the collected data (Asrial et al., 2019; Lestiyawati & Adi, 2021).

This study provides important insights for the development of a more targeted curriculum to enhance digital literacy among elementary school students. The developed instrument can be used by educators to identify areas that need strengthening in digital learning. The findings of this research can serve as a basis for policymakers to develop more comprehensive educational programs in digital literacy. By understanding the characteristics of students, the policies created can be more aligned with the needs and conditions of students in the field. However, this study has limitations; the highly variable characteristics of elementary school students can influence the research results. The instrument may need to be adjusted to accommodate more specific individual differences.

4. CONCLUSION

This research has successfully developed and validated a digital literacy assessment tool specifically designed for elementary school students. The instrument, grounded in the UNESCO framework (2018) and tailored to the unique developmental characteristics of elementary school student, effectively integrates cognitive, linguistic, motoric, and socio-emotional aspects into its design. The validation process demonstrated that the instrument's indicators are not only theoretically sound but also practically applicable, confirming their relevance and appropriateness for the intended age group. The developed instrument provides educators with a robust tool to assess and enhance students' digital literacy, thereby supporting more informed and targeted educational strategies. This tool will enable educators to identify specific areas of need and tailor interventions to improve digital literacy among young learners effectively. Furthermore, the research highlights the necessity of involving educational technology experts in the development process to ensure that the assessment tools are not only valid but also aligned with current pedagogical standards and technological advancements.

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