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Development of E-Modules Based on Google Workspace For Education in Improving Teachers' Digital Literacy Competencies

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ABSTRACT

Digital literacy competence of teachers refers to their ability to understand, use, and leverage digital technology for teaching and daily work activities. It includes the skills to locate, evaluate, create, and communicate information using various digital tools. This study aims to develop a training e-module on using Google Workspace for Education to strengthen teachers' digital literacy competence. The research employed a Research and Development (R&D) approach and was conducted at SD PGRI Serui. The product development followed the ADDIE framework: Analysis, Design, Development, Implementation, and Evaluation. The research subjects were the teachers at SD PGRI Serui. The outcome of the study is a training e-module titled "Google Workspace for Education Application." Expert reviews showed the module was rated very good, with average scores of 98.64%, 84.20%, and 80.00%. The module was declared valid and suitable for field testing. In individual and small group trials, the module received high practicality ratings of 85.00% and 89.00%. A large group trial revealed positive participant responses to 31 statements covering five key module criteria. Eighteen statements were rated "strongly agree" and thirteen "agree." Thus, the module is considered good, engaging, and suitable for use in face-to-face or independent learning.

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1. INTRODUCTION

Technology-based learning is not something new. In addition, there are changes in the learning process. The work system has changed from manual (conventional) to modern (IT or digital) (Loderer, Pekrun, & Lester, 2020; Marquardt & Kearsley, 2024). Technology and science continue to develop, which gives the world of education the opportunity to continue to innovate and improve the teaching and learning process (Reding & Eaton, 2020; Rohaini & Fathoni, 2025). The use of media in learning activities is one way technology influences education. Electronic learning (e-learning) is a new learning and teaching concept combined with rapidly developing information and communication technology (Abed, 2019; Ilhami & Fathoni, 2025). This learning concept makes it easier for students and teachers to

obtain learning resources with easy and light access. In order to teach students, especially in critical thinking skills, creativity, collaboration and communication in learning, a teaching material media in the form of electronic modules is needed (Octaberlina & Muslimin, 2020).

Teachers must have the competence to utilize technology and information in their learning because when learning takes place, teachers are also forming the competence of their students in utilizing technology as well (Abkarin, 2021; Spiteri & Chang Rundgren, 2020). Using technology during learning aims to facilitate and make learning activities more effective so that students can learn through computer networks or the internet. In addition, teachers must also strengthen various aspects of the curriculum system, management, models, strategies, and learning approaches needed with skills in this century, one of which is 21st century literacy skills. One type of literacy in utilizing digital technology is digital literacy (Prabowo, Nisaa'k, Khoiruddin, & Fathoni, 2025).

Google Workspace for Education is software developed by the world's giant technology company Google in the form of a set of productivity and collaboration tools using the Google Cloud system for schools and educational institutions (Cikusin & Mistar, 2024). Google's goal in creating this tool is none other than to facilitate the work of education actors. Starting from teachers, staff, and also students, in order to create a better teaching and learning system (LEE & KIM, 2020). Google Workspace for Education as a solution offered to answer the needs in the world of education. offers various attractive services to support academic activities. Google Workspace for Education digital platform has a Learning Management System (LMS) feature to support e-learning such as creating assignments, creating surveys and giving grades. In addition, it can function even more according to the needs required.

Training modules are one way to bridge the gap between the progress of the era that is all automatic and the quality of teachers. In responding to the era of increasingly developing technology, teachers are expected to be able to catch up on technological progress caused by low ICT competency among teachers (Dilnoza, Maftuna, Guzalkhon, Makhliyo, & Maftuna, 2019). E-Modules are the latest innovation of printed modules, where these electronic modules can be accessed with the help of computers that have been integrated with software that supports e-module access (Ly, Bani, Hariana, & Meok, 2024). E-modules are also digital learning media that are systematically arranged so that students can learn independently and solve existing problems. It is concluded that E-modules are digital teaching materials that are systematically arranged and presented in electronic form.

Modules have several specific characteristics/criteria, for example in the form of the smallest and most complete teaching unit, containing a series of learning activities that are designed systematically, containing learning objectives that are formulated clearly and specifically, allowing students to learn independently, and are a realization of individual differences. To produce a good and interesting module, its arrangement must be in accordance with the criteria set by the Ministry of National Education (2008) as follows: 1) Self Instructional; namely being able to teach students independently; 2) Self Contained; namely all learning materials from one competency unit or sub-competency studied are contained in one module as a whole; 3) Stand Alone (stand alone); namely the module developed does not depend on other media or does not have to be used together with other learning media; 4) Adaptive; namely the module should have high adaptive power to the development of science and technology; and 5) User Friendly; the module should be friendly to its users.

Although various studies have discussed the importance of digital literacy for teachers and the influence of educational technology on the quality of learning, there are still limitations in the development of specific, practical training media that are directly integrated with the Google Workspace for Education application. In addition, there have not been many studies that comprehensively examine the use of Google Workspace-based e-modules as a medium for improving teachers' digital literacy competencies, especially at the elementary education level. This study presents a novelty in the form of developing a training e-module that is specifically designed to equip teachers with practical competencies in operating the Google Workspace for Education application through the ADDIE model approach, which is rarely applied in the context of teacher training in elementary schools in Indonesia, especially in areas that have not been touched by intensive digital training.

This research is relevant to the needs of the world of education in facing the digital era, where teachers are required to be able to master information technology to support learning. Its significance lies in the real contribution to improving teachers' digital literacy through the provision of valid, practical learning media that can be used independently or in face-to-face training, thus supporting the sustainable digital transformation of education. This research aims to develop and test the feasibility of an e-module based on Google Workspace for Education to improve teachers' digital literacy competencies.

2. METHODS

The research method should be included in the Introduction. The method contains an explanation of the research approach, subjects of the study, the conduct of the research procedure, the use of materials and instruments, data collection, and analysis techniques. This research is a research and development (Research and Development) using the Analysis, Design, Develop, Implementation and Evaluation model framework. The scope of this development model systematically examines the procedures in analyzing, designing, developing, implementing and evaluating each stage and learning product that will be tested for validity and feasibility.

The most appropriate steps for researchers by considering the conditions faced in the development process. The development model used in this study is the research and development model (Research & Development) proposed by Lee and Owens (2004). The reason for choosing this model is because this model is a model that is specifically designed to develop multimedia (Lee and Owens, 2004:2). This development model is said to be a procedural model because the sequence of steps in the process is arranged systematically and each development step has a clearly arranged sequence of development steps. The research and development procedure in the Lee and Owens (2004) model consists of five stages, namely assessment/analysis which includes needs assessment and front-end analysis, design, development, implementation, and evaluation.

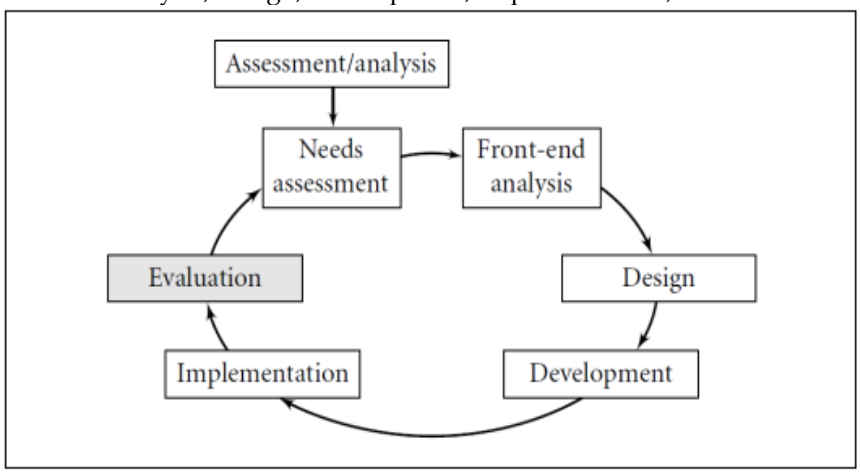

Figure 1. Development Steps Lee & Owens (2004:3)

The data analysis technique in this research aims to process non-test data collected through questionnaires given to expert validators and respondents during product trials. Qualitative analysis involved describing data from expert reviews, trial participants, and initial interviews. It also included written responses collected alongside the questionnaires, serving as a basis for product refinement in addition to quantitative scores. Quantitative analysis was used to assess the data from validation questionnaires completed by subject matter experts, media and design experts, facilitators, and training participants. This analysis aimed to evaluate the quality of both the instrument and the developed e-module.

Validity analysis was conducted by reviewing expert evaluations, comments, and suggestions to guide product revisions. The e-module was considered valid if the expert ratings reached a minimum qualitative classification of “good” (85.01%–100.00%). Practicality analysis was based on individual

and group trial sheets. Scores from individual trials were converted into qualitative data using a five-point scale (Widoyoko, 2012), and the module was considered practical if average scores met the minimum threshold of 81.00%–100.00%. The same standard applied to group trial assessments. Lastly, usability analysis was carried out using participant response questionnaires to evaluate the module's usefulness.

3. FINDINGS AND DISCUSSION

The development procedure for the Google Workspace for Education e-module training program at SD PGRI Serui follows the instructional design framework proposed by Lee & Owens (2004), which consists of five main stages. The process begins with a Performance Gap Analysis, identifying the instructional needs as a solution to bridge the gap in post-training performance. The low comprehension of Google Workspace for Education among training participants is often due to limited learning time and the volume of content to be mastered. Thus, the e-module serves as an intervention to address learning challenges and improve performance. In the Front-End Analysis, participants are viewed as adult learners who are generally independent and psychologically mature. Therefore, the e-module is designed to support self-directed learning, complementing conventional training and aiding knowledge transfer. The Learner Analysis focuses on the participants' characteristics, including age-related cognitive capacities, which influence the learning process and content delivery.

Resource Analysis identifies the lack of structured teaching materials. Participants previously relied on unsystematic references and lacked a reusable learning tool, hindering knowledge retention and application. This e-module addresses that gap by providing consistent, accessible content. The Concept Analysis ensures the e-module supports two core training subjects Google Workspace for Education and its basic tools both selected based on their relevance to institutional performance goals. Content is organized logically from general to specific. Finally, the Task Analysis describes the module structure, including learning objectives, assignments, formative assessments, and feedback mechanisms, ensuring comprehensive and engaging learning experiences for participants.

The design or planning stage of product development resulted in the formulation of several essential components that laid the foundation for the creation of the e-module. The primary purpose of this e-module is rooted in the learning objectives detailed in the introductory chapter. These objectives are further elaborated into basic competencies and success indicators for each training subject, particularly focusing on Google Workspace for Education. These goals were established based on a comprehensive curriculum analysis conducted during the initial analysis phase.

The intended users of this e-module are training participants, specifically elementary school teachers at SD PGRI Serui, who are responsible for delivering education in their respective institutions. Additionally, the e-module may also serve as a practical resource for training facilitators, broadening its utility beyond just the direct participants. The module is constructed as a complete learning tool comprising several key components: usage guidelines, learning objectives (basic competencies and indicators), instructional content with illustrative examples, summaries, enrichment sections, answer keys, formative assessments, feedback mechanisms, and follow-up guidance. These components are designed to offer a comprehensive and engaging learning experience.

The development team is composed of the author who acts as both the researcher and the content analyst two academic supervisors, one graphic designer, and two expert validators specializing in media, content, and design. These validators were responsible for reviewing and assessing both the product and the instruments used. In the testing stages, three teachers participated in individual trials, nine respondents in small group testing, and twenty participants were involved in field (large group) testing. Prior to content development, a content analysis was conducted to select relevant materials from various sources. The selected content was then organized according to the established learning objectives. In general, the module focuses on two main subjects: Google

Workspace for Education and its fundamental tools. The structure, scope, and sequence of the content were carefully planned to support these themes effectively.

The specifications of the module cover both pedagogical and non-pedagogical aspects. Pedagogically, the module emphasizes autonomous learning tailored to adult learners, following the andragogical approach, which recognizes the independence of adult learners. The non-pedagogical characteristics include an appealing visual design, clear usage instructions, the inclusion of images and tables to support comprehension, integration of local data, structured feedback and follow-up design, and embedded links for both online and offline access to the e-module. The prototype developed represents a miniature version of the final product and serves as a standard reference for the complete version of the e-module. It embodies all the intended features and functions and forms the basis for further validation and refinement in the subsequent development phases.

After completing the module prototype, the researcher entered the development phase, a crucial stage focused on refining and validating both the data collection instruments and the instructional product. This phase was essential to ensure that the resulting e-module would meet high standards of quality and effectiveness for its intended use in training settings. The development phase began with the construction of various data collection instruments. The researcher designed several validation questionnaires tailored to the needs of different experts and stages of testing. These included questionnaires for product validation by content experts, media experts, and design experts. Additionally, an instrument validation sheet was created, along with questionnaires for individual trials, small group trials, and large group field testing, all of which were directed toward participants involved in the training.

Once developed, these research instruments underwent a validation process to ensure their credibility and relevance. Expert validation played a central role in this process. A design expert was assigned the task of reviewing the instruments to confirm their accuracy and appropriateness for evaluating the module. This validation covered a range of questionnaires, including those for content, media, and design experts, as well as instruments intended for the individual and small group trials. The results of this validation process were documented in the appendices of the research report for transparency and accountability. In addition to expert validation, a statistical approach was employed to validate the instrument used in the field testing or large group trial. This involved assessing the significance of the correlation coefficient using the Pearson Product Moment Correlation method, with the aid of SPSS software. A critical value (r) was applied at a 5% significance level to test the strength of each questionnaire item. Out of 40 items tested, 9 were deemed invalid and were therefore excluded from the final instrument. As a result, the field trial questionnaire used with the 20 training participants included only the 31 items that met the required validity criteria.

Parallel to instrument validation, the instructional module itself underwent a series of validation steps to enhance both its conceptual integrity and practical application. These improvements were guided by feedback from a panel of expert validators, comprising content or subject-matter experts, media experts, and design experts. Specifically, the validation process by content experts was based on a comprehensive evaluation questionnaire that addressed five core components. These included the feasibility of the content, assessed through five indicators; the feasibility of the module's presentation, with three indicators; the appropriateness of language use, with four indicators; the evaluation aspect, evaluated through one key indicator; and an adult learning component, which consisted of two indicators to assess the module's alignment with principles of adult education. Altogether, these components were translated into 56 specific statements, enabling a detailed and systematic review of the module's instructional design and pedagogical value.

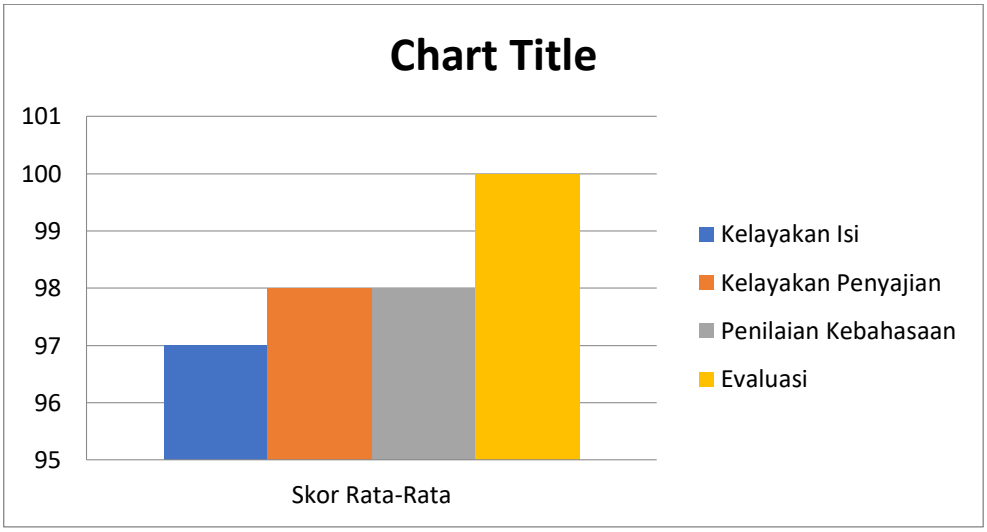

Figure 2. Results of Material Expert Validation

A learning module is considered valid if the assessment by the content expert meets at least a "Good" classification on a qualitative scale, specifically falling within the range of 70.01% to 85.00%. In this study, the validation results presented in Figure 1 show that the average overall score across the five evaluation aspects reached 98.6%. This score falls within the "Excellent" category, indicating that the module received a very high rating from the content expert. Based on this result, the module is deemed valid, comprehensive, and suitable for field testing without the need for any revisions. (Please provide the results or description of the media expert validation so I can continue writing this section in a consistent narrative style. If you don't have it yet, I can help create a sample based on common validation structures.)

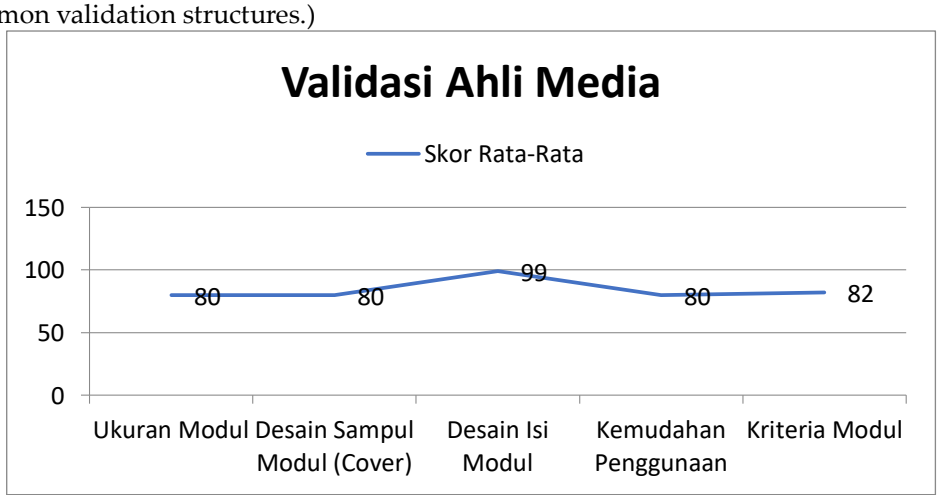

Figure 3. Media Expert Validation Results

The validation questionnaire by media experts contains assessment components from the graphic feasibility aspect with 4 (four) assessment indicators and the module criteria aspect with 5 (five) assessment indicators. All aspects are detailed into 55 (fifty-five) statement items. Figure 2 shows that the overall average score from the graphic feasibility aspect and the module criteria above gets a value of 84.20%. This means that the assessment criteria given by media experts are Very Good. Because the average score interval is 70.01% - 85.00%, the module is said to be valid and worthy of being tested in the field.

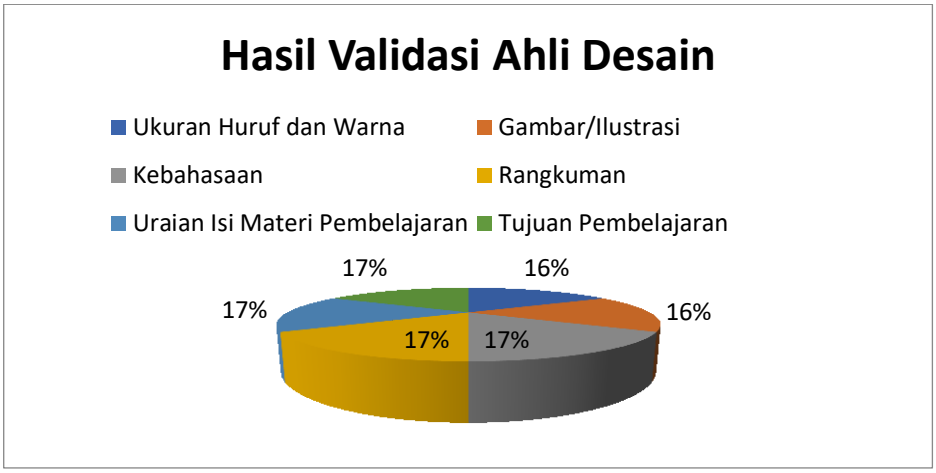

Figure 4. Design Expert Validation Results

The third validator who validated this module was a design expert, where this expert provided a review and criticism as well as suggestions from the aspects of accuracy, components, quality, and systematics of the module design with 8 (eight) assessment indicators. The assessment indicators are detailed into 36 (thirty-six) statement items. Based on the image above, it can be seen that the average overall score from the display design aspect above gets a value of 80%. This means that the assessment criteria given by the design expert are Very Good. Because the average score interval is 80, the module is said to be valid and worthy of being tested in the field.

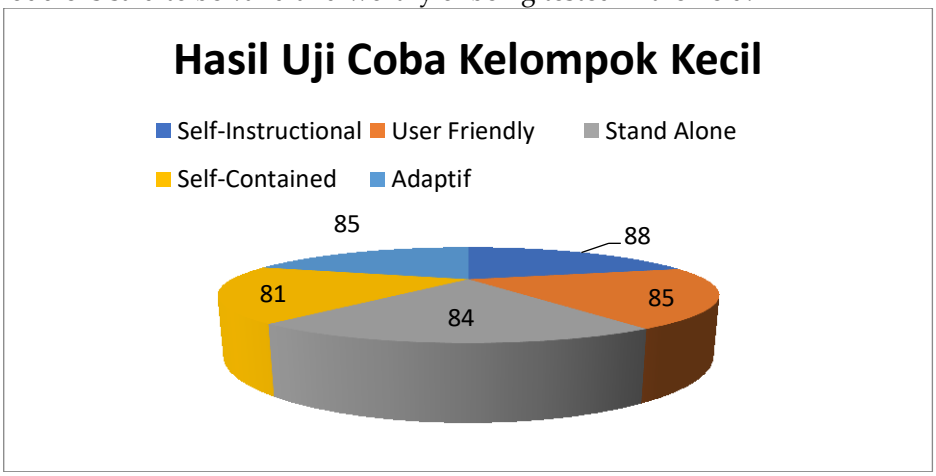

Figure 6. Small Group Trial Results

Implementation Phase

The small group trial was conducted with nine training participants, all of whom were Family Planning Counselors (PKB). This phase aimed to gather learners' initial feedback as end users to assess the feasibility and practicality of the module. The small group trial questionnaire consisted of five key aspects: adaptability (6 statement items), self-contained structure (4 items), stand-alone usability (5 items), user-friendliness (4 items), and self-instructional design (6 items), totaling 25 statement items. As illustrated in Figure 6, the average overall score across these five aspects reached 85%. According to the Practicality Classification Criteria for Small Group Trials, a score within the range of 81.00%–100.00% qualifies as "Very Practical." Thus, based on the responses from eight participants, the module was deemed highly practical. This result confirms that the module meets the required standard of practicality and is suitable for continued implementation and evaluation.

The large group trial involved 20 training participants and aimed to measure the learners' overall responses to the instructional module. A learner response questionnaire was used, containing 31 statement items across five aspects: adaptability (6 items), self-contained content (5 items), stand-alone usability (6 items), user-friendliness (6 items), and self-instructional design (8 items). A Likert

scale was employed in this questionnaire to gauge the extent of agreement or disagreement with each item, thereby assessing the participants' acceptance or rejection of the module's features. The analysis was conducted by calculating the percentage of agreement levels for each item, using standard mathematical formulas to determine the percentage of responses for each indicator.

The results showed that out of the 31 total statements, 18 (or 58.1%) received the highest level of agreement ("Strongly Agree"), while 13 statements (or 41.9%) were marked as "Agree." This indicates that all items in the response questionnaire were positively received by the training participants. Thus, it can be concluded that the participants' overall response was highly favorable. The module is therefore considered to be of good quality, meets feasibility criteria, and is suitable for use in both face-to-face and independent learning settings.

Evaluation Phase

Evaluation was an ongoing process integrated into each phase of the development cycle. From the initial analysis phase through to implementation, continuous evaluation was conducted before advancing to the next stage. This iterative approach ensured that the outcomes of each phase were systematically reviewed and used as feedback to inform and enhance subsequent stages of the module's development.

The findings of this study have several important implications for educational practice, instructional design, and future research in the field of teacher professional development particularly in the integration of digital tools such as Google Workspace for Education. First, the successful development and validation of the e-module highlight the significance of adopting systematic instructional design models like Lee & Owens (2004) in creating effective and practical learning resources. The structured process starting from performance gap analysis to iterative evaluation ensures that the final product is aligned with learners' needs and institutional goals. This serves as a model for educators, curriculum developers, and training institutions aiming to produce high-quality digital learning materials tailored to adult learners. Second, the study emphasizes the importance of incorporating andragogical principles in training modules, especially for adult learners such as in-service teachers. The module's emphasis on self-instructional features, user-friendliness, and flexible accessibility (online/offline) suggests that future educational resources should prioritize learner autonomy and practical applicability to real-world teaching contexts. Third, the positive validation results and practical trial responses indicate that digital modules can effectively supplement conventional face-to-face training programs. This implies that schools and training institutions could leverage similar e-modules as scalable solutions for continuous professional development, especially in remote or resource-limited environments. Finally, this research provides a foundation for future studies on the long-term impact of digital modules on teacher competence, instructional performance, and student outcomes. Subsequent research may explore how such modules influence pedagogical practices over time, or how integration with learning management systems (LMS) can enhance module interactivity and engagement.

4. CONCLUSION

Based on the research findings and development stages undertaken, several conclusions can be drawn. First, the preliminary research provided crucial input for the needs analysis, identifying the development of a training module as an effective intervention to address learning gaps. The module was developed using the Lee & Owens framework, which consists of five phases: Analysis, Design, Development, Implementation, and Evaluation. The final product was an e-module on Google Workspace for Education designed to improve digital literacy among elementary school teachers at SD PGRI Serui. The module includes a cover, user guide for both learners and facilitators, structured content, examples with solutions, images, summaries, enrichment exercises with answer keys, formative tests, feedback, glossary, and references. Second, the module underwent expert validation and field testing to determine its feasibility. Reviews from content, media, and design experts rated the module as very good and valid. Individual, small group, and large group trials further confirmed

the module's practicality, with participants finding it useful, engaging, and suitable for both face-to-face and independent learning. Lastly, the module supports flexible learning modes and enhances teacher competence. An interaction design was developed to guide its effective use, ensuring improved understanding and engagement among both educators and training participants.

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