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Development of online learning modules to improve lecturers' digital literacy skills and teaching creativity

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Abstract. This research is motivated by low levels of digital literacy and limited creativity in teaching among lecturers, as well as the significant obstacles encountered in online learning at the Faculty of Teacher Training and Education, Universitas Primagraha. The purpose of this study is to analyze the needs, develop, and test the feasibility and effectiveness of a Digital Literacy E-Module for lecturers. Using the Research and Development (R&D) method within the ADDIE model, this study involved the entire population of FKIP lecturers, with 36 respondents selected through purposive sampling. Data collection techniques included observation, questionnaires, and tests, using instruments such as expert validation sheets, user response questionnaires, and learning outcome test questions. The results indicated that the E-Module is categorized as "Highly Feasible," with an average validation score exceeding 84%, and demonstrated moderate effectiveness, as indicated by an N−Gain score of 0.62. It is concluded that this E-Module is effective in enhancing lecturers' digital literacy and teaching creativity to support the quality of online learning within Universitas Primagraha. It is recommended that the institution integrate this module into continuous professional development programs for lecturers to ensure the quality of adaptive online learning.

Introduction

The era of technological disruption has compelled higher education institutions to undergo a fundamental transformation across the entire learning process. As conceptualized through theoretical reviews, digital literacy is a spectrum of competencies that enables individuals to participate fully in the information society (Ilomäki et al., 2016; Martínez-Bravo et al., 2022). The acceleration of digitalization positions lecturers at the forefront of maintaining academic quality through the utilization of online platforms (Nazyrova et al., 2025; Samsudi et al., 2025). Ideally, the quality of online learning is determined by three primary indicators: the effectiveness of instructional design, meaningful interaction between educators and students, and the objectivity of remote evaluation (Cruz et al., 2025; Pratama & Saregar, 2021; Vlachopoulos & Makri, 2021). Achieving this success necessitates a synergy between proficient digital literacy and adaptive teaching creativity (Oktaviani et al., 2022; Raymundo, 2020; Rosar & Weidlich, 2022). Lecturer creativity within the digital ecosystem is characterized by indicators of fluency in generating media

ideas, flexibility in selecting relevant platforms, and originality in packaging content to ensure it remains interactive and meaningful (Rhodes dalam Lucifora et al., 2025).

However, the reality at the Faculty of Teacher Training and Education, Universitas Primagraha, reveals a significant gap. Based on an analysis of 36 lecturers from the Elementary School Teacher Education, Physical Education, Health and Recreation, Mathematics Education, and Civic Education programs, it was found that lecturers' digital literacy level was only 41%. This low competency is directly proportional to the level of teaching creativity, which stands at only 33%. As a result, lecturers tend to simply transfer conventional materials into virtual spaces in their raw form without creative modification, leading to online learning obstacles reaching a critical rate of 83%. These obstacles range from technical barriers to difficulties in conducting authentic evaluations of learning outcomes (Agustina & Murcahyanto, 2023; Fitri, 2025). This phenomenon serves as an alarm for the institution that the current online learning model has not yet reached an optimal point (Bereczki & Kárpáti, 2021; Surani & Hamidah, 2020; Wang & Li, 2022; Wastiana et al., 2024; Zaeni Achmad Syam et al., 2025).

In response to these issues, there is a 91% urgency to implement strategic intervention through the development of systematic learning support media. This study proposes the development of a Digital Literacy E-Module utilizing the ADDIE (Analysis, Design, Develop, Implementation, and Evaluation) framework (Rahmawati et al., 2021; Rustandi, 2021; Sulastri, 2024). The selection of this model is based on its systematic characteristics, which are essential for producing empirically tested products. This e-module adopts the Technological Pedagogical Content Knowledge (TPACK) principles, which bridge technical skills with the art of teaching (pedagogy), ensuring that the delivered materials possess both aesthetic value and high absorption rates for students.

The primary novelty of this research lies in its hybrid approach, which integrates technical digital literacy dimensions with pedagogical creativity stimulation within a single, unified product. Unlike previous studies that tend to be tool-oriented or limited to basic application tutorials (Lubis et al., 2023; Putri & Ahmadi, 2023; Sari et al., 2022), this e-module is specifically contextualized to address the real-world challenges faced by lecturers at the Faculty of Teacher Training and Education, Universitas Primagraha. This product does not merely teach "how" to use digital platforms but also explores "why" and "how" to package materials to achieve precise engagement levels through a modified TPACK perspective.

Based on the background above, this research is formulated to answer the following questions: (1) What are the digital literacy e-module needs of Faculty of Teacher Training and Education Universitas Primagraha lecturers? (2) What is the design and feasibility level of the Digital Literacy E-Module based on expert validation? (3) To what extent is the effectiveness of the e-module in enhancing lecturers' digital literacy and teaching creativity?. The primary objective of this study is to analyze needs, describe the development process, and test the feasibility and effectiveness of the Digital Literacy E-Module to improve the quality of online learning within the Faculty of Teacher Training and Education at Universitas Primagraha.

Method

Research Method and Design

This study employs the Research and Development (R&D) method, utilizing the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model (Rahmawati et al., 2021; Rustandi, 2021; Untoroseto & Triayudi, 2023). The selection of this model is predicated on its systematic workflow, which enables researchers to produce instructional products that are valid, practical, and effective in accordance with specific field requirements.

Participants and Sampling Technique

The population of this study consists of all permanent lecturers at the Faculty of Teacher Training and Education (FKIP), Universitas Primagraha. The sampling technique employed is Total Sampling (saturated sampling), given the relatively small and accessible population size. The research subjects comprise 36 respondents with the following distribution: 17 lecturers from Elementary School Teacher Education, 8 from Physical Education, Health and Recreation, 8 from Mathematics Education, and 3 from Civic Education.

Research Setting and Timeline

The research was conducted within the Universitas Primagraha environment in Serang, Banten. The study spanned a four-month period, from August 2025 to December 2025, encompassing all stages from the initial needs analysis to the final evaluation of product effectiveness.

Research Procedures

The development procedure followed the five main stages of the ADDIE model (Untoroseto & Triayudi, 2023): (1) *Analysis Phase:* Analyzing the gap in digital literacy and teaching creativity through observation and the distribution of needs assessment questionnaires to 36 lecturers; (2) *Design Phase*: Compiling the e-module storyboard, developing a TPACK-based material map, and designing assessment instruments; (3) *Development Phase:* Producing the e-module and conducting validation by experts (material, media, and instructional design), followed by user trials to determine feasibility; (4) *Implementation Phase:* Testing the product on a limited scale within the lecturers' instructional processes to measure its practicality; (5) *Evaluation Phase:* Conducting a summative evaluation by comparing pre-test and post-test scores to measure the product's effectiveness.

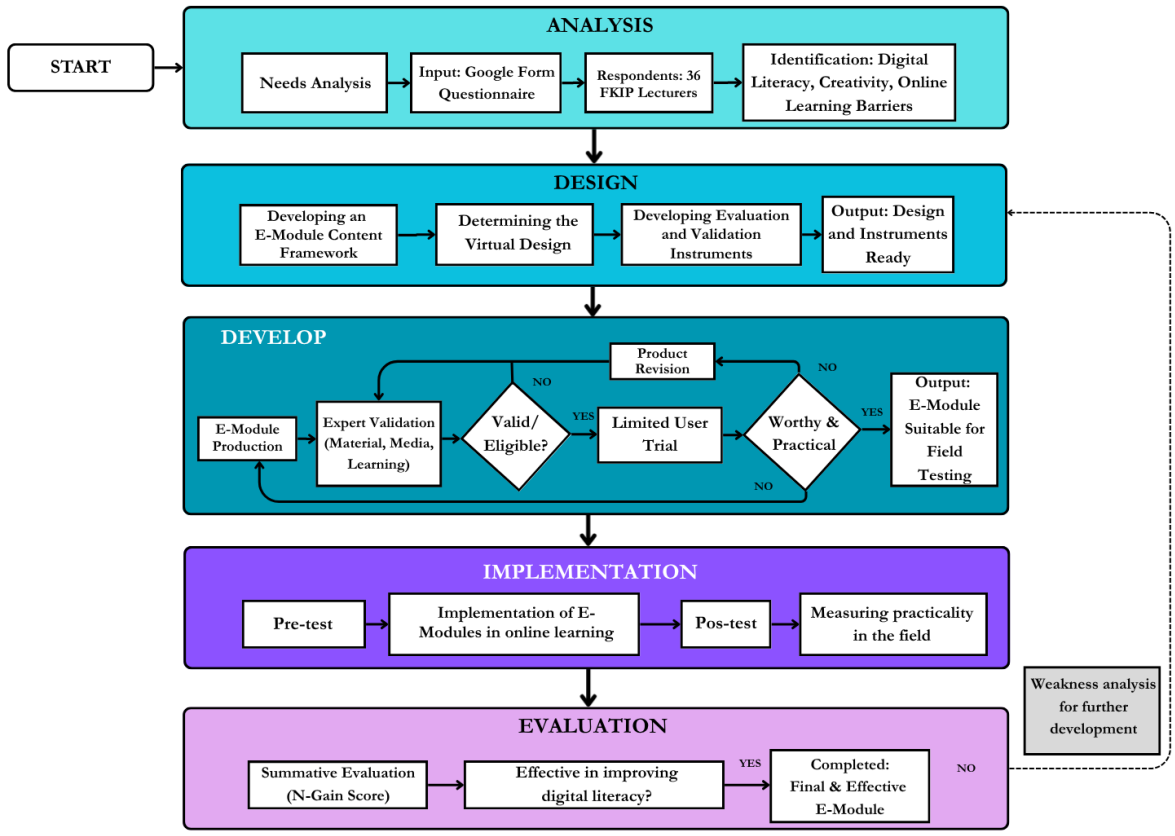


Image 1. Flowchart of the ADDIE Model Development Process

Data Collection Techniques and Research Instruments

Data collection techniques in this study include observation, questionnaires, and learning outcome tests. The feasibility of the instruments was first assessed through expert judgment (expert validation), with results indicating that the instruments fell into the "Highly Feasible" category, as demonstrated by an average feasibility percentage of 88.89%. Furthermore, the test instruments were analyzed for item validity and reliability using the KR-20 formula. The validity test results showed that 15 out of 20 items were declared valid, while the reliability test yielded a coefficient of 0.9612, indicating that the instrument possesses a very high level of reliability.

The following is the research instrument blueprint used in this study:

Table 1. Research Questionnaire Blueprint

No.	Indicator	Item Numbers	Total Items
1	Teaching Creativity	1, 2, 3, 4, 5	5
2	Online Learning Quality	6, 7, 8, 9, 10	5
Total			10

Table 2. Research Test Instrument Blueprint

No.	Variable	Indicator	Item Numbers	Total Items
1	Teaching Creativity	Fluency	1, 2	2
		Flexibility	3, 4, 5	3
		Originality	6, 7	2
2	Online Learning Quality	Effectiveness of Instructional Design	8, 9	2
		Meaningful Interaction between Educators and Students	10, 11, 12	3
		Objectivity of Remote Evaluation	13, 14, 15	3
Total Items				15

Data Analysis Techniques and Criteria

The data collection instruments include validation sheets for material experts, media experts, and instructional design experts, as well as instruments to assess the validity of test items and questionnaires. Additionally, a user response questionnaire was used to assess the product's practicality.

Data obtained from validation and questionnaires were analyzed using percentage techniques based on the following feasibility criteria:

Table 3. Eligibility Criteria

Interval (%)	Criteria
$80\% < X \leq 100\%$	Very Eligible
$60\% < X \leq 80\%$	Eligible
$40\% < X \leq 60\%$	Fairly Eligible
$20\% < X \leq 40\%$	Not Eligible
$0\% < X \leq 20\%$	Very not Eligible

Source: Pratama & Saregar (in Rahayu et al., 2021)

The product's effectiveness was measured using the Normalized Gain (N−Gain) analysis to assess improvements in learning quality before and after the treatment. The formula used is as follows:

$$g=\frac{(\%\ S_{post}-\%\ S_{pre})}{100-\%\ S_{pre}}$$

Where:

g = Normalized Gain score
Spost = Average post-test score
Spre = Average pre-test score
Smax = Maximum possible score

The interpretation criteria for the N−Gain score, according to Hake (Hake dalam Ibisono & Achmadi, 2020), are as follows:

Table 4. N-Gain Score Criteria

N−Gain Score	Interpretation
$g < 0.3$	Low
$0.3 \leq g \leq 0,7$	Moderate
$g > 0.7$	High

Product Specifications

The resulting product is a web-based/interactive flipbook Digital Literacy E-Module. The primary specifications of the product include: (1) TPACK-based content framework; (2) Multimedia features, including video tutorials and interactive quizzes; (3) Cross-device accessibility, ensuring responsiveness on both smartphones and laptops; and (4) Practical guidelines for developing creative instructional media.

Results and Discussion

Result

Analysis Phase

The research commenced with the analysis phase to map the specific needs and identify digital competency gaps among lecturers in online learning (Sukendra et at., 2023; Zhafira et al., 2025; Rahadi et al., 2025; Rusmini et al., 2023). The preliminary data collection revealed a crucial portrait of the pedagogical conditions at the Faculty of Teacher Training and Education at Universitas Primagraha. Data indicated that lecturers' digital literacy was low (41%), which in turn affected the limitations in teaching creativity (33%). This reflects a strong correlation in which technical barriers systematically constrain lecturers' capacity for innovation. This condition is further exacerbated by high operational obstacles in online learning (83%); however, conversely, there is a very high urgency for development (91%), indicating strong internal motivation among lecturers to undergo transformation. The detailed percentages of these indicators are presented in the following table:

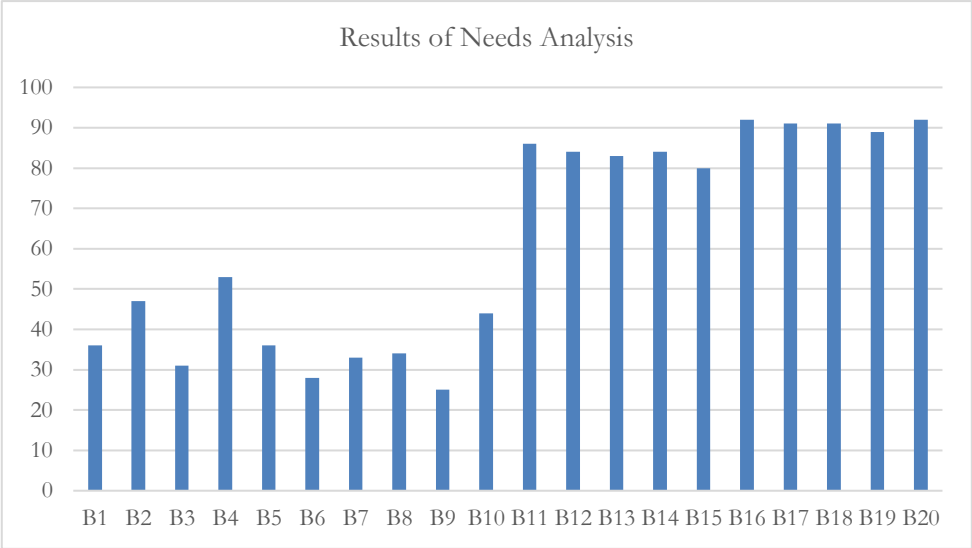


Image 2. Graph of Average Percentage of Needs Analysis Results

Based on the analysis of questionnaires from 36 lecturers across various study programs, more in-depth empirical data on competency weaknesses were identified. The low level of digital literacy is evidenced by significant obstacles in operating the Learning Management System (LMS) and a limited ability to mitigate technical issues, with only 36% able to do so. The subsequent impact is a stagnation of innovation, where the implementation of game-based learning and the creation of interactive multimedia content emerged as the indicators with the lowest scores. Conversely, lecturers face external pressures, including concerns about connection stability and the difficulty of remotely monitoring students' activities. This phenomenon creates a paradox: despite substantial technical barriers, research subjects exhibit very strong self-awareness of the importance of professional development, as evidenced by the high expectation for digital literacy modules (92%).

The results of this analysis provide a foundation for concluding that enhancing digital literacy must not only address basic operational aspects but also target strategic abilities to bridge pedagogical interactions in virtual spaces (Widana & Ratnaya, 2021). Therefore, developing a digital literacy module is a crucial and urgent solution. These findings mandate that the product developed in the subsequent stage must possess highly practical characteristics and be capable of providing efficient technical solutions to avoid increasing the cognitive load of lecturers, which is already elevated due to these systemic constraints.

Design Phase

In the Design phase, the primary focus was to transform the identified problems into a systematic product blueprint. The design of this E-Module was not generic; rather, it was specifically directed at addressing the previously mapped competency gaps. Activities during this stage included structuring the learning materials, determining visual aesthetics that support self-directed navigation, and developing evaluation instruments to accurately measure competency attainment.

The module design adopts modified Technological Pedagogical Content Knowledge (TPACK) principles to trigger lecturers' creative power in producing online learning content. The e-module structure is designed to be practical and accessible, addressing the real-world problems of lecturers at the Faculty of Teacher Training and Education, Universitas Primagraha, without causing excessive cognitive load. In addition to product design, this phase also involves preparing research instruments, including validation sheets for material, media, and instructional experts, as well as draft test instruments and user response questionnaires, which will be tested for feasibility in the

subsequent stage. The result of this phase is a prototype of the Digital Literacy E-Module, ready for production and validation

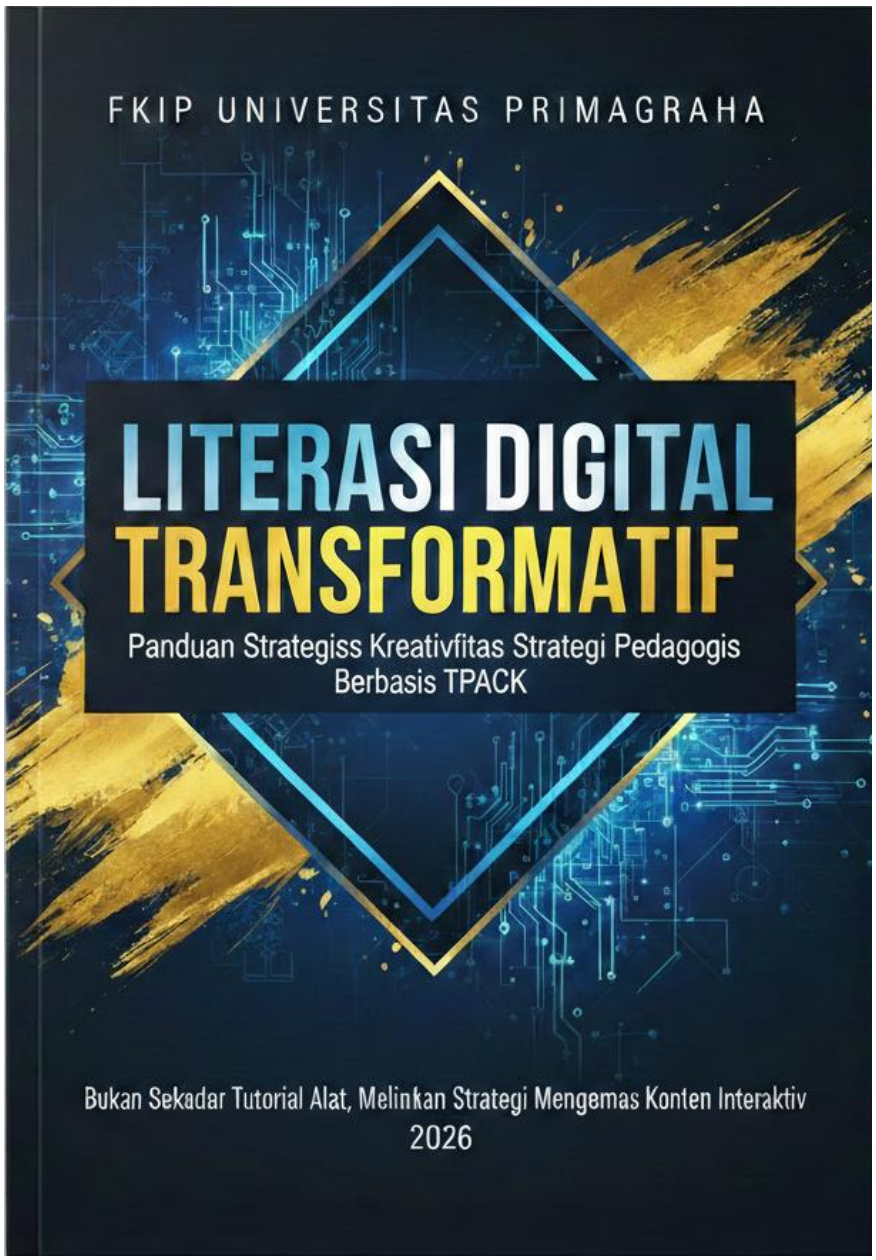


Image 3. The Visual Appearance of the Lecturer Digital Literacy E-Module

Development Phase

In the Development phase, the previously designed product drafts were produced into a complete E-Module, which then underwent a series of rigorous validation processes. This stage aimed to assess the product's feasibility from an expert perspective and to evaluate initial user responses before the product was implemented at a broader scale. The validation process encompassed aspects of media, material, and instructional design, as well as testing the quality of the research instruments themselves.

The assessment data from experts and users at this stage are summarized in the following table:

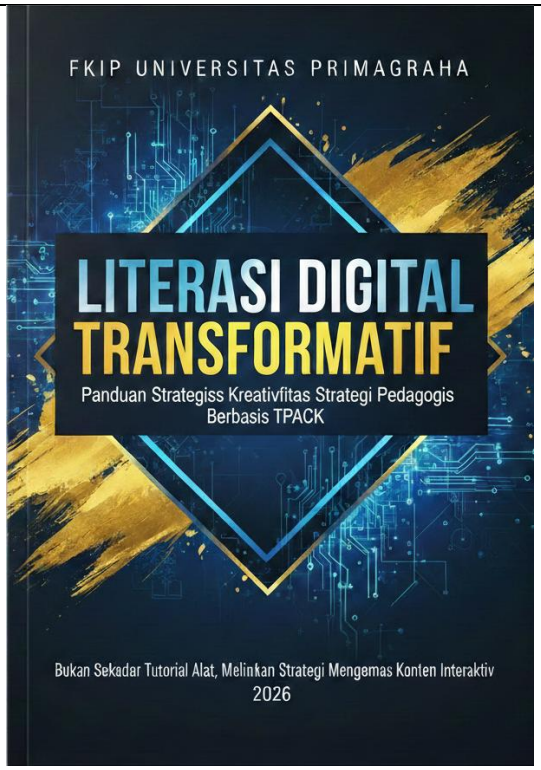
Table 5. Recapitulation of Expert and User Assessments

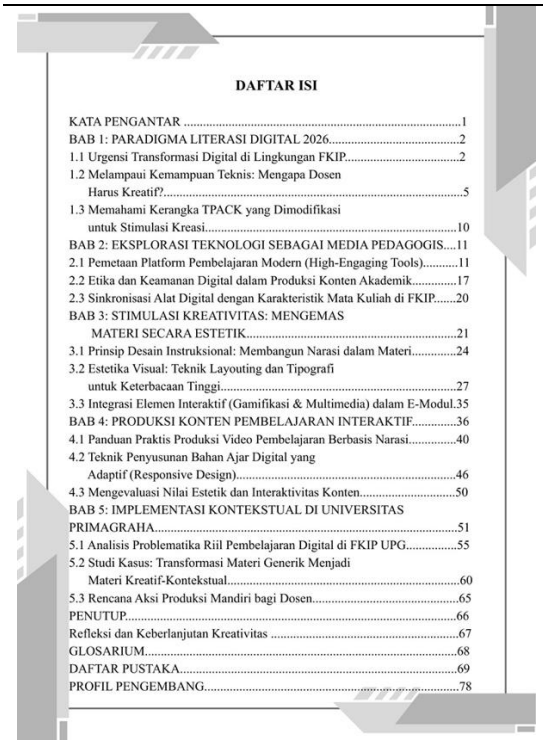
No	Validity Testing	Experts (%)	Category	Users (%)	Category
1	Media Validity	88.33	Very Feasible	90.67	Very Feasible
2	Material Validity	84.38	Very Feasible	87.73	Very Feasible
3	Instructional Validity	90.97	Very Feasible	91.07	Very Feasible
4	Test Instrument Validity	88.89	Very Feasible	-	-
5	Questionnaire Instrument Validity	91.67	Very Feasible	-	-

In-depth analysis reveals that the high instructional validation score (90.97%) indicates that the material delivery flow within the E-Module is highly logical and facilitates self-directed learning. Correspondingly, media and material validations confirm that the presented content is highly accurate and features an ergonomic interface.

Although the product was quantitatively declared very feasible, the researcher nonetheless refined its quality through product revisions based on the validators' suggestions. This revision process aimed to ensure that the final product was precise and aligned with the needs of lecturers at the Faculty of Teacher Training and Education, Universitas Primagraha. The modifications made are presented in the following comparison table:

Table 6. Revision Results Based on Validator Suggestions

E-Module Before	E-Module After
	
Absence of subheadings	Subheadings added



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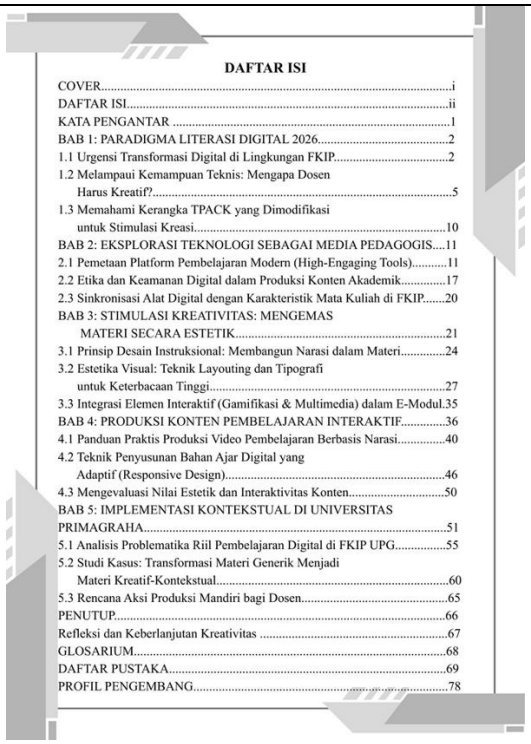

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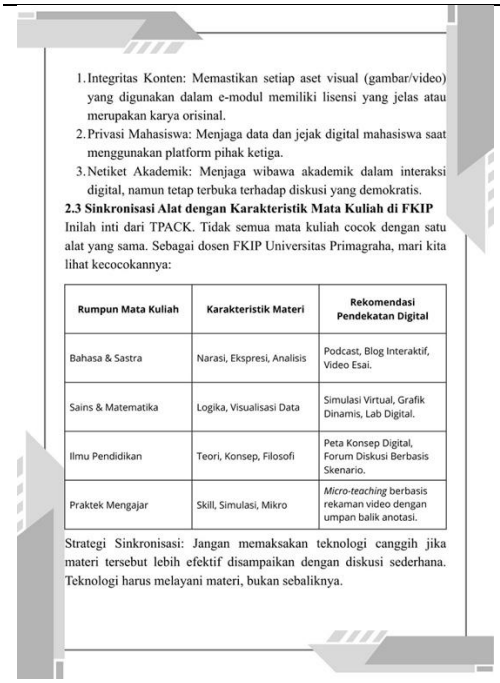

1. Integritas Konten: Memastikan setiap aset visual (gambar/video) yang digunakan dalam e-modul memiliki lisensi yang jelas atau merupakan karya orisinal.
2. Privasi Mahasiswa: Menjaga data dan jejak digital mahasiswa saat menggunakan platform pihak ketiga.
3. Netiket Akademik: Menjaga wibawa akademik dalam interaksi digital, namun tetap terbuka terhadap diskusi yang demokratis.

2.3 Sinkronisasi Alat dengan Karakteristik Mata Kuliah di FKIP

Inilah inti dari TPACK. Tidak semua mata kuliah cocok dengan satu alat yang sama. Sebagai dosen FKIP Universitas Primagraha, mari kita lihat kecocokannya:

Rumpun Mata Kuliah	Karakteristik Materi	Rekomendasi Pendekatan Digital
Bahasa & Sastra	Narasi, Ekspresi, Analisis	Podcast, Blog Interaktif, Video Esai.
Sains & Matematika	Logika, Visualisasi Data	Simulasi Virtual, Grafik Dinamis, Lab Digital.
Ilmu Pendidikan	Teori, Konsep, Filosofi	Peta Konsep Digital, Forum Diskusi Berbasis Skenario.
Praktek Mengajar	Skill, Simulasi, Mikro	*Micro-teaching* berbasis rekaman video dengan umpan balik anotasi.

Strategi Sinkronisasi: Jangan memaksakan teknologi canggih jika materi tersebut lebih efektif disampaikan dengan diskusi sederhana. Teknologi harus melayani materi, bukan sebaliknya.

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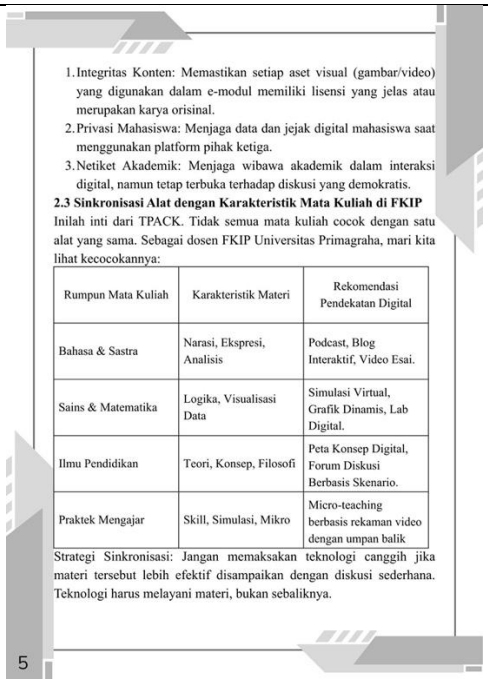

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Implementation Phase

In the Implementation phase, the Digital Literacy E-Module, which had been deemed feasible and subsequently revised, was formally deployed to the Faculty of Teacher Training and Education lecturers at Universitas Primagraha. The primary objective of this stage was to assess the practicality of the product when used in online learning activities and to observe its impact on creativity and

instructional quality. Practicality was measured using user response questionnaires that assessed lecturers' perceptions of the module's ease of use, usefulness, and efficiency.

The data from the practicality testing during the implementation phase are presented in the following table:

Table 7. Practicality Testing Results

Assessment Aspect	Total Score	Average Score	Percentage (%)
Teaching Creativity	176	17.60	44.00
Online Learning Quality	177	17.70	44.25
Total	353	35.3	88.25

The practicality test result of 88.25% confirms that the product falls into the "Highly Practical" category. Further analysis indicates that the e-module's accessible design successfully minimized user resistance to new technology. Lecturers perceived that the module did not constitute an additional workload; instead, it functioned as a digital assistant providing instant solutions to their pedagogical problems. The success of this stage proves that the contextualization of materials within the module design is a key factor in the acceptance of an innovation within a higher education environment.

Evaluation Phase

The Evaluation phase is the final stage of the ADDIE model, aimed at measuring the effectiveness of the Digital Literacy E-Module in enhancing lecturer competence. At this stage, the researcher analyzed the lecturers' learning outcomes by comparing pre-test scores (prior to module usage) and post-test scores (after module usage) using the Normalized Gain (N-Gain) formula. This analysis was conducted to determine the extent to which the developed product significantly contributes to improving digital literacy skills and fostering creativity.

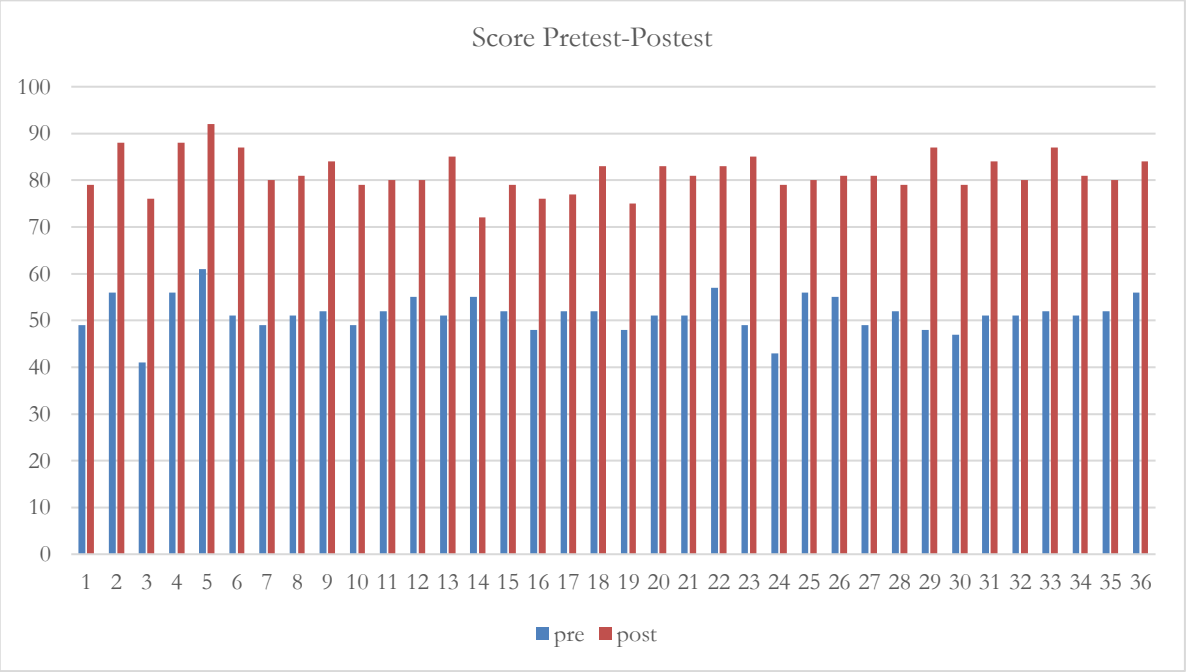

Image 4. Comparison of Pre-test and Post-test Results

Based on the data presented in Image 4, there is a stark and significant difference between the scores achieved before (pretest) and after (posttest) the implementation of the Digital Literacy E-Module among the 36 lecturer respondents. Visually, all research subjects demonstrate a consistent upward trend in scores, with the orange bars (posttest) consistently remaining well above the blue bars (pretest). Most of the lecturers' pretest scores fall within the 40 to 60 range, indicating that their initial understanding of digital literacy and online teaching creativity was in the low-to-fair category. However, following the ADDIE-based E-Module intervention, scores increased substantially during the posttest phase, with most values ranging from 75 to 92.

The effectiveness test results using N-Gain analysis are presented in the following table:

Table 8. N-Gain Test Results

Ngain Score	N-Gain Persen	Interpretation
0.62	62%	Moderate

Based on the N-Gain analysis, a score of 0.62 was obtained, placing it in the "Moderate" category. Despite being at a moderate level, this finding is highly significant given the subjects' initial conditions, which were characterized by severe limitations in digital literacy. The 62% improvement reflects that the Digital Literacy E-Module successfully provided a tangible contribution to restoring lecturers' professional capacity and confidence. The final evaluation confirms that the product is not only theoretically feasible but also empirically proven to be a transformative instrument for overcoming online learning obstacles, which previously stood at 83%.

Discussion

The results of this developmental research demonstrate that the Digital Literacy E-Module, developed using the ADDIE model, is highly effective in addressing low levels of digital literacy and fostering creativity among lecturers at the Faculty of Teacher Training and Education Universitas Primagraha. The initial findings, which indicated a digital literacy rate of 41% and a teaching creativity rate of 33%, confirm a tangible competency gap in meeting the complex demands of online learning. Through the development phase, this product was declared "very feasible" by both experts and users, with average scores exceeding 84%. This proves that integrating systematic material and interactive media design can meet the quality standards for digital learning resources that lecturers require (Evi Yupani & Widana, 2023).

The impact of this research is evident both theoretically and practically. Theoretically, this study reinforces the relevance of employing the ADDIE development model to produce measurable, systematic learning media at the higher-education level. In practice, the use of this e-module provides lecturers with easy access to more creative and innovative teaching strategies without being hindered by spatial or temporal constraints. This is further supported by the practicality test data, which reached 88.25%, indicating that the product is not only conceptually sound but also functional in supporting the daily quality of online instruction.

The findings of this study align with previous research stating that digital literacy is a primary determinant of educators' self-efficacy in virtual environments. The N-Gain score increase of 0.62, or 62% (moderate category), indicates progress consistent with trends in other digital media development studies that incrementally elevate subject competence from low to intermediate levels.

The findings of this study are consistent with previous research stating that digital literacy is a primary determinant of teaching self-efficacy in virtual environments. The score improvement, as

measured by an N-Gain test of 0.62 (moderate category), indicates a progression similar to trends in other digital media development research, which show a gradual increase in subject competence from low to intermediate levels. This increase is also reflected in lecturers' enhanced critical thinking skills; they have begun to demonstrate the ability to analyze the relevance of digital content and synthesize it into more logical, systematic instructional materials before presenting them to students. Greater mastery of digital literacy enables lecturers to move beyond the passive reception of information, allowing them to objectively evaluate the credibility of digital sources.

This is aligned with the dimensions of 21st-century digital literacy, which demand the ability to critically evaluate information to avoid academic misinformation (Martínez-Bravo et al., 2022). In addition to critical thinking indicators, improvements were observed in the area of technical problem-solving independence; lecturers demonstrated agility in seeking independent solutions when encountering operational obstacles on online platforms, which had previously served as a major barrier to the teaching process. This capability is crucial, considering that digital literacy is not merely a set of technical operational skills but rather a cognitive process of searching for and evaluating solutions within a data-rich educational ecosystem (Audrin & Audrin, 2022). Furthermore, the stimulation provided by this e-module encourages lecturers to adopt a proactive stance toward exploring new features in the Learning Management System (LMS), thereby reducing reliance on external technical support and enhancing instructor autonomy in virtual classrooms.

Furthermore, the integration of Technological Pedagogical Content Knowledge (TPACK) principles within this e-module provides a solid framework for lecturers to align subject content with appropriate technology. The effectiveness of this transition is supported by findings indicating that the use of appropriate digital tools can simultaneously foster creativity in both students and instructors (Wang & Li, 2022; Widana et al., 2023). The success of lecturers in optimizing interactive media in this study demonstrates that creativity is not static; rather, it can be developed through media interventions designed and implemented measurably via hybrid development models such as ADDIE (Untoroseto & Triayudi, 2023). This reinforces the notion that the success of online learning depends not only on the availability of infrastructure but on how instructors utilize their creativity to create an immersive and engaging learning environment for students (Lucifora et al., 2025).

The digital transformation within the Faculty of Teacher Training and Education (FKIP) at Universitas Primagraha, through this e-module intervention, also anticipates future educational challenges increasingly influenced by Artificial Intelligence (AI). Lecturers with high digital literacy will be better prepared to integrate future technologies into their curricula without losing their pedagogical essence (Nazyrova et al., 2025). With enhanced lecturer competence, the quality of learning outcomes within the faculty is expected to rise, as lecturers are now capable of producing more aesthetically pleasing and meaningful materials. This perspective positions digital literacy as a bridge to broader global literacy, in which the geographical boundaries of education are increasingly blurred (Fitri, 2025). Collectively, the results of this study provide empirical evidence that investing in the development of specific and contextual digital learning media is the most effective step toward improving the quality of higher education in the post-pandemic era.

This confirms the argument that technological mastery, when combined with pedagogical understanding, can enhance lecturers' confidence in managing online instruction (Spante et al., 2018). This relationship reinforces the idea that interventions through customized media are more effective than using generic training materials in overcoming high online learning obstacles. As emphasized by Al-Ansi et al. (2021), integrating information technology into higher education requires contextualized materials to have a tangible impact on learning. Furthermore, teaching creativity through interactive media has been shown to be key to maintaining student engagement

and minimizing burnout during virtual sessions (Surani & Hamidah, 2020). Thus, this developed e-module functions not only as a source of information but also as a tool for pedagogical transformation for lecturers in the digital era.

The primary novelty of this research lies in its hybrid approach, which focuses not only on technical operational literacy but also integrates pedagogical creativity stimulation within a single e-module framework. Unlike conventional modules that tend to be tool-oriented tutorials, this product adopts modified Technological Pedagogical Content Knowledge (TPACK) principles to trigger lecturers' creative power in producing learning content with high aesthetic and interactive value. The contextualization of materials, specifically designed to address real-world problems at the Faculty of Teacher Training and Education at Universitas Primagraha, provides this module with greater precision, relevance, and applicability than similar products in the academic market. Consequently, this e-module successfully transforms lecturers from mere technology users into creative educators who can optimize the digital ecosystem to enhance student learning.

Although this research contributes significantly to the development of lecturer competencies, several limitations must be acknowledged. First, the research subjects were limited to lecturers within the Faculty of Teacher Training and Education Universitas Primagraha, with a sample size of 36 respondents; therefore, generalizing the results to a broader population or institutions with different characteristics should be done with caution. Second, the product effectiveness score within the "Moderate" category (0.62) indicates that using an independent e-module still requires periodic support through mentoring or synchronous training to achieve maximum competency improvement. Third, the implementation duration, conducted within a single development cycle, may not yet fully capture the long-term shifts in lecturers' pedagogical behavior.

Based on these findings, several strategic recommendations are proposed for relevant stakeholders. Institutionally, university leadership should integrate this Digital Literacy E-Module into ongoing professional development programs (such as PEKERTI workshops or internal training) to ensure standardized quality in online learning. In practice, lecturers are encouraged to proactively use the interactive features in the module as a primary reference for designing more creative instructional content. Finally, for future researchers, it is recommended to expand the scope of research subjects across faculties and explore the integration of Artificial Intelligence (AI) into the module to address the increasingly dynamic challenges of digital transformation.

Conclusion

Based on the analysis and discussion, this study concludes three primary points corresponding to the development stages performed. First, the needs analysis results demonstrate that digital literacy skills and teaching creativity among lecturers at the Faculty of Teacher Training and Education, Universitas Primagraha, are suboptimal, highlighting the urgent need for self-directed learning resources. Second, the Digital Literacy E-Module developed using the ADDIE model has been validated and declared "Highly Feasible" by material, media, and education experts to serve as a medium for competency enhancement. Third, the implementation of this e-module proved effective in transforming lecturers into more creative educators who are capable of synchronizing technological and pedagogical aspects through the TPACK framework. This product successfully transformed lecturers from mere technology users into creative educators capable of aligning technological and pedagogical aspects through the TPACK framework. The implementation of this e-module significantly strengthened the lecturers' critical thinking skills in evaluating the credibility of digital information sources before synthesizing them into systematic teaching materials. Furthermore, an improvement was observed in independent technical problem-solving, with lecturers demonstrating greater agility in seeking autonomous solutions to operational

constraints encountered during the online learning process. As a recommendation, institutions should integrate this e-module into continuous training programs for lecturers. Meanwhile, future researchers are encouraged to expand the scope of research subjects to a broader scale to strengthen the generalization of this product's effectiveness in enhancing the quality of the digital ecosystem in higher education.

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