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THE EFFECT OF USING E-MODULES IN PROJECT-BASED LEARNING EVALUATION COURSES ON IMPROVING THE CRITICAL THINKING SKILLS OF STUDENTS IN EDUCATIONAL TECHNOLOGY AT THE FACULTY OF EDUCATION, UNIVERSITY OF MAKASSAR

Andi Tenri Sugi.M[1*], Arnidah[2], Farida[3]
[1,2,3]Teknologi Pendidikan, Universitas Negeri Makassar, Indonesia
*anditenrisugim@gmail.com

Abstrak

Abstrak berisi: Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan *E-Modul* berbasis proyek terhadap peningkatan kemampuan berpikir kritis mahasiswa pada mata kuliah Evaluasi Pembelajaran. Latar belakang penelitian ini didasarkan pada keterbatasan media pembelajaran yang digunakan, yang masih kurang interaktif dan belum mendorong kemampuan berpikir kritis mahasiswa secara optimal. Penelitian menggunakan pendekatan kuantitatif dengan metode quasi experiment model one group pretest-posttest. Subjek penelitian ini adalah mahasiswa Teknologi Pendidikan, Fakultas Ilmu Pendidikan, Universitas Negeri Makassar yang menempuh mata kuliah Evaluasi Pembelajaran. Validator terdiri dari ahli materi, *E-Modul* yang digunakan juga dinilai sangat layak oleh validator ahli dengan tingkat validitas sangat valid. Teknik pengumpulan data yang digunakan meliputi observasi, kuesioner, serta pre-test dan post-test. Hasil penelitian menunjukkan bahwa penggunaan *E-Modul* berdampak signifikan terhadap peningkatan kemampuan berpikir kritis mahasiswa, nilai rata-rata pre-test dan dan post-test meningkat. Dengan demikian, *E-Modul* berbasis proyek terbukti menjadi alternatif bahan ajar yang efektif, inovatif, dan adaptif dalam meningkatkan kualitas pembelajaran dan kemampuan berpikir kritis mahasiswa.

Kata kunci : *E-Modul*, Evaluasi Pembelajaran, Berpikir Kritis, Mahasiswa

Abstract

This study aims to examine the effect of using a project-based E-Module on improving students' critical thinking skills in the Evaluation of Learning course. The background of this research is based on the limitations of the currently used learning media, which remain less interactive and have not optimally fostered students' critical thinking abilities. The study employs a quantitative approach with a quasi-experimental method using a one-group pretest-posttest design. The research subjects were students of the

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Educational Technology Study Program, Faculty of Education, Universitas Negeri Makassar, who were enrolled in the Evaluation of Learning course. The validators consisted of subject matter experts, and the E-Module used was assessed as highly feasible by expert validators, with a validity level categorized as very valid. Data collection techniques included observation, questionnaires, as well as pre-test and post-test instruments. The results revealed that the use of the E-Module had a significant impact on enhancing students' critical thinking skills, as indicated by the increase in average scores from pre-test to post-test. Therefore, the project-based E-Module has been proven to be an effective, innovative, and adaptive teaching material alternative in improving learning quality and students' critical thinking skills.

***Keywords**: E-Modul, Learning Evaluation, Critical Thinking, Students*

INTRODUCTION

The implementation of the learning process must create an enjoyable, inclusive, collaborative, creative, effective, and flexible environment. This aligns with Article 14, Paragraph 3, Letter a of the Ministry of Education, Culture, Research, and Technology Regulation No. 53 of 2023, which states that learning can be conducted remotely, online, or through a combination of face-to-face sessions. According to Hakiki and Fadli in Fricticarani et al. (2023), the 5.0 technology era emphasizes the comprehensive integration of technology, including in education. In this context, learning needs to develop 21st-century skills, including critical thinking, creativity, collaboration, problem-solving, and systems thinking. Mariana (2025) notes that critical thinking is a vital skill in navigating the challenges of an increasingly complex world.

Interactive e-modules are the result of the transformation of printed learning media into digital form enriched with interactive features (Aeni & Widodo, 2022). These e-modules are a solution to the limitations of traditional learning approaches and address the needs of modern learning. By presenting dynamic, personalized learning that suits various learning styles and modalities, interactive e-modules promote a better learning experience (Amalia & Susiyawati, 2023).

The development of teaching materials is an important strategy in responding to the dynamics of learning by taking into account the characteristics of students. Teaching materials that are interesting, specific, and easy to understand encourage students to actively engage and be motivated to understand the material in depth. Hazijah (2025) states that E-Modules support independent learning without direct assistance from others. E-Modules provide comprehensive materials and features such as quizzes and automatic feedback. This interactive learning approach has proven to encourage active participation and enhance students' learning motivation. With effective design, the material becomes more dynamic and easier to understand (Febriati, 2025).

Researchers conclude that E-Modules enhance students' learning autonomy as they can adjust their own learning pace and style. However, this effectiveness heavily depends on the quality of the E-Module design, which must anticipate students' difficulties and provide adequate support. Interactive E-Modules can combine various elements such as text, images, videos, animations, quizzes, simulations, and evaluations. This allows for more engaging audiovisual presentation of material and encourages active student involvement (Amelya, 2024). Textbooks remain the primary reference in learning, but they have shortcomings such as being less interactive and unable to explain phenomena dynamically. Therefore, E-Modules are a better alternative. The aim is to increase interest and motivation to learn, as well as strengthen critical and creative thinking skills. These skills are important so that students can manage and utilize information in an ever-changing world (Silaban, 2021).

The learning process in the Learning Evaluation course is carried out in a structured manner, starting from competency planning to implementation using online platforms such as LMS. This platform is used to deliver material, facilitate discussions, and enable interaction between lecturers and students. The learning process can be carried out online through forums or study groups. The use of teaching materials greatly influences students' critical thinking skills. Good teaching materials provide access to broader information and encourage independent learning. Students are required to develop their own understanding of the material, thereby taking responsibility for their learning process, which fosters critical thinking skills.

Preliminary data collection results for the second semester of 2023/2024 indicate that the implementation of the Learning Evaluation course using blended learning with the SYAM-OK LMS still lacks interactive digital teaching materials. Some sub-CPMKs still use e-books and presentation slides that do not support interactivity. Although easily accessible, these e-books and slides tend to be passive, as they are merely digitized versions of printed materials without additional interactive features. The slides also merely transfer text and images without encouraging active student participation. In contrast, interactive E-Modules are designed to convey information and encourage active student participation through the integration of various learning elements.

The lecturers in charge of the course, Mr. Fajrin Baids, M.Pd, and Mrs. Nuraini Yusuf, S.Pd, M.Ed., stated that although digital teaching materials are available, there is still a need to develop more interactive teaching materials, both in terms of material presentation and student assignments. To reinforce these findings, the researchers conducted further observations on February 22, 2025, by distributing a questionnaire to 28 students enrolled in the course.

The questionnaire aimed to analyze the impact of E-Modules on students' critical thinking skills. Data collected via Google Forms showed that most students require E-Modules as a learning support tool. Of the total respondents, 10 students (35.7%) strongly agreed, 11 students (39.3%) agreed, 6 students (21.4%) were neutral, and only 1 student (3.6%) disagreed. From this data, approximately 70% of students felt

that the use of E-Modules made them more interested in participating in learning. This finding indicates that the use of E-Modules has a positive impact on increasing students' interest in learning and has the potential to enhance the effectiveness of the learning process.

RESEARCH METHOD

This study uses a quantitative descriptive method, which is a research method used to test theories by measuring research variables objectively and systematically using numbers or numerical data.

In this study, the instrument used is a questionnaire that must be validated by an instrument validator to ensure that the items are appropriate and reflect the indicators to be measured based on the research objectives and theoretical framework, ensuring that the wording used is clear and easy to understand, as well as to increase the reliability and accuracy of the instrument data to be more credible and the data obtained to be more accurate and accountable in research analysis.

This study uses a quasi-experimental design with a one-group pretest-posttest model. This approach is used to determine the changes that occur after treatment, namely the use of project-based E-Modules in the Learning Evaluation course, which aims to analyze the effect of using project-based E-Modules in the learning evaluation course on improving the critical thinking skills of students in the Educational Technology Department, Faculty of Education, Makassar State University.

The study on the effect of using project-based E-Modules on the development of critical thinking skills among students in the Educational Technology program at the Faculty of Education, University of Makassar, involves the following variables:

1. Independent variable:

a. The frequency of E-Module usage, referring to how often students use E-Modules during a certain period, is divided into daily, weekly, or semester-long categories. The more frequently E-Modules are used, the higher the level of understanding and critical thinking skills that are expected to be gained.

b. The quality of E-Module usage includes an assessment of the design, content, and readability of the material in the E-Module. A well-designed E-Module that uses clear material relevant to the learning objectives will stimulate students' critical thinking.

c. The more the E-Module fits with the curriculum, the more likely it is to improve students' understanding and critical thinking skills.

2. Dependent Variable:

a. Analytical skills measure the extent to which students can analyze information, whether it be data, arguments, or complex situations. This includes students' ability to identify problems.

b. Analytical skills measure the extent to which students can analyze information, whether it be data, arguments, or complex situations. This includes students' ability to identify problems.

FINDING AND DISCUSSION

A. FINDING

This research was conducted at the Educational Technology Study Program, Faculty of Education, Makassar State University. The focus of the study is on the use of E-Modules in the Project-Based Learning Evaluation course and its impact on enhancing students' critical thinking skills. The research location is within the academic environment of the Educational Technology Program, FIP UNM, specifically among students enrolled in the Learning Evaluation course during the even semester of the 2023/2024 academic year.

The number of respondents in this study was 30 students from the Learning Evaluation course class. Sampling was conducted using cluster sampling techniques to ensure diversity in the target population. The details are outlined in the table below:

Table 1 Respondent Characteristics Based on Number of Participants

No	Name	NIM	generation
1	ES	220401502019	2022
2	GA	220401501027	2022
3	MY	220401502006	2022
4	SS	220401502023	2022
5	R	220401502006	2022
6	DP	220401500005	2022
7	NS	220401502016	2022
8	KK	220401502008	2022
9	ICM	220401501010	2022
10	NA	220401502004	2022
11	M	220401502021	2022
12	NW	220401502009	2022
13	SA	220401501013	2022

14	K	220401501028	2022
15	AF	220401501003	2022
16	NWA	220401501016	2022
17	RE	22040150007	2022
18	PT	220401500003	2022
19	D	220401502027	2022
20	FA	220401502013	2022
21	MR	220401502020	2022
22	MF	220401502022	2022
23	YP	220401500020	2022
24	HA	220401501020	2022
25	NI	220401502014	2022
26	H	220401500017	2022
27	M	220401502026	2022
28	RA	220401502029	2022
29	ES	220401502001	2022
30	NH	220401501019	2022

Processed Data Sources, 2025

Based on Table 1, 30 students who took the Learning Evaluation course were respondents in this study. All respondents were from the class of 2022, who were actively involved in the learning process in the even semester of the 2023/2024 academic year. The selection process utilized cluster sampling techniques to ensure proportional representation and diversity within the group. The respondents comprised students with diverse backgrounds in terms of learning interests and involvement in project-based learning.

Data Validation Analysis Results

Variables of E-Module Usage

Table 2 Assessment of E-Module Usage (Pre-Test)

Category	Question	Score	Frequenty	Percentage(%)	Weight
Self-Paced Learning	Question 1	Highly valid (4)	2	7	8
		Valid (3)	6	20	18
		Not Valid (2)	21	70	42
		Highly invalid (1)	1	3	1
		Total	**30**	**100**	**69**
	Question 2	Highly valid (4)	2	7	8
		Valid (3)	8	27	24
		Not Valid (2)	20	66	40
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**72**
Self-Intruction	Question 3	Highly valid (4)	2	7	8
		Valid (3)	7	23	21
		Not Valid (2)	21	70	42
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**71**
	Question 4	Highly valid (4)	4	1	16
		Valid (3)	11	37	33
		Not Valid (2)	14	47	28
		Highly invalid (1)	1	3	1

		Total	**30**	**100**	**78**
Self-Contained	Question 5	Highly valid (4)	3	10	12
		Valid (3)	8	27	24
		Not Valid (2)	18	60	36
		Highly invalid (1)	1	3	1
		Total	**30**	**100**	**73**
	Question 6	Highly valid (4)	2	7	8
		Valid (3)	16	53	48
		Not Valid (2)	12	40	24
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**80**
Chungking / Modular	Question 7	Highly valid (4)	4	13	16
		Valid (3)	11	37	33
		Not Valid (2)	14	47	28
		Highly invalid (1)	1	3	1
		Total	**30**	**100**	**78**
	Question 8	Highly valid (4)	3	10	12
		Valid (3)	6	20	18
		Not Valid (2)	21	70	42
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**72**

	Question 9	Highly valid (4)	4	13	16
		Valid (3)	14	47	42
		Not Valid (2)	11	37	22
		Highly invalid (1)	1	3	1
		Total	**30**	**100**	**81**
	Question 10	Highly valid (4)	3	10	12
		Valid (3)	14	47	42
		Not Valid (2)	13	43	26
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**80**
Learning Aktivity	Question 11	Highly valid (4)	4	13	16
		Valid (3)	12	40	36
		Not Valid (2)	14	47	28
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**80**
	Question 12	Highly valid (4)	5	16	20
		Valid (3)	17	57	51
		Not Valid (2)	8	27	16
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**87**
		Total	**360**		**921**

Processed Data Sources, 2025

Based on Table 2, it is known that before the use of E-Modules, the majority of students responded in the “valid” to “invalid” categories, with a total weight of 921. This indicates that students' initial perceptions of the use of E-Modules were still relatively low. Especially in the aspects of Self-Paced Learning and Self-Instruction, many students gave ratings in the middle and lower categories. This suggests that students have not yet fully adapted to the self-directed learning model offered by E-Modul.

Self-directed learning is one of the key aspects influencing students' critical thinking skills. Students who have not developed the habit of independent learning tend to face difficulties in optimizing the use of digital learning media such as E-Modules, especially during the initial implementation phase. Additionally, there are still some instructional materials that do not meet the standards of learning effectiveness, as they have not been able to accommodate the characteristics of independent and flexible learning as required by 21st-century education..

Table 3 E-Module Usage Assessment (Post-Test)

Category	Question	Score	Frequency	Presentase (%)	Weight
Self-Paced Learning	Question 1	Highly valid (4)	9	30	36
		Valid (3)	19	63	57
		Not Valid (2)	2	7	4
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**97**
	Question 2	Highly valid (4)	7	23	28
		Valid (3)	23	77	69
		Not Valid (2)	0	0	0
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**97**
	Question 3	Highly valid (4)	5	17	20

		Valid (3)	25	83	75
		Not Valid (2)	0	0	0
		Highly invalid (1)	0	0	0
Self-Intruction		**Total**	**30**	**100**	**95**
	Question 4	Highly valid (4)	10	33	40
		Valid (3)	19	64	57
		Not Valid (2)	1	3	2
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**99**
Self-Contained	Question 5	Highly valid (4)	5	17	20
		Valid (3)	20	66	60
		Not Valid (2)	5	17	10
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**90**
	Question 6	Highly valid (4)	5	17	20
		Valid (3)	24	80	72
		Not Valid (2)	1	3	2
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**94**
Chungking/ Modular	Question 7	Highly valid (4)	5	17	20
		Valid (3)	24	80	72
		Not Valid (2)	1	3	2
		Highly invalid (1)	0	0	0

		Total	**30**	**100**	**94**
	Question 8	Highly valid (4)	6	20	24
		Valid (3)	24	80	72
		Not Valid (2)	0	0	0
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**96**
Learning Aktivity	Question 9	Highly valid (4)	5	17	20
		Valid (3)	25	83	75
		Not Valid (2)	0	0	0
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**95**
	Question 10	Highly valid (4)	4	13	16
		Valid (3)	26	87	78
		Not Valid (2)	0	0	0
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**94**
	Question 11	Highly valid (4)	7	23	28
		Valid (3)	22	74	66
		Not Valid (2)	1	3	2
		Highly invalid (1)	0	0	0
		Total	**30**	**100**	**96**
	Question 12	Highly valid (4)	8	27	32
		Valid (3)	20	66	60

	Not Valid (2)	2	7	4
	Highly invalid (1)	0	0	0
	Total	**30**	**100**	**96**
	Total	**360**		**1143**

Processed Data Sources, 2025

Based on Table 3, after the implementation of E-Modules in the learning process, students' perceptions improved significantly. This is demonstrated by an increase in the total assessment score from 921 in the pre-test to 1143 in the post-test. Most students rated the categories “very valid” and “valid” for all aspects measured, namely Self-Paced Learning, Self-Contained, Chunking-Modular, and Learning Activity. These results indicate that the implementation of the E-Module in lectures effectively enhances students' understanding of the material and strengthens active interaction in the learning process.

Variables Affecting the Improvement of Students' Critical Thinking Skills

Table 4 Results of Variables Affecting Students' Critical Thinking Skills (Pre-Test and Post-Test)

No	Name	Nim	Value	
			Pre-Test	Post-Test
1	ES	220401502019	0	30
2	GA	220401501027	30	70
3	MY	220401502006	40	50
4	SS	220401502023	50	100
5	R	220401502006	40	100
6	DP	220401500005	40	60
7	NS	220401502016	90	100
8	KK	220401502008	50	70
9	ICM	220401501010	40	100
10	NA	220401502004	40	100

11	M	220401502021	20	90
12	NW	220401502009	80	70
13	SA	220401501013	60	90
14	K	220401501028	60	100
15	AF	220401501003	50	100
16	NWA	220401501016	20	70
17	RE	22040150007	0	100
18	PT	220401500003	90	80
19	D	220401502027	0	100
20	FA	220401502013	0	90
21	MR	220401502020	70	0
22	MF	220401502022	50	70
23	YP	220401500020	0	90
24	HA	220401501020	50	80
25	NI	220401502014	10	100
26	H	220401500017	20	50
27	M	220401502026	30	90
28	RA	220401502029	70	80
29	ES	220401502001	90	60
30	NH	220401501019	40	70

Processed Data Sources, 2025

Based on Table 4, there is a significant increase in scores between the pre-test and post-test. Some students who initially scored 0 (zero) on the pre-test, such as ES and RE, were able to achieve scores of 90 to 100 on the post-test after participating in learning using the E-Module. This improvement is also reflected in the average pre-test score of 47.00, which increased to 78.67 on the post-test, as shown in Table 10. This indicates that the use of the E-Module has a positive impact on students' mastery of the material and critical thinking skills.Tabel 5 Hasil Uji Paired Samples Statistics

Test Variabel Peningkatan Kemampuan Berpikir Kritis Mahasiswa (Pre-Test dan Post-Test)

Pair 1	Mean	N (Number of Samples)	Standar Deviation	Standar Eror mean	Correlation	Sig.
Pretest	47,00	30	30,64254	5,59454	-,109	,565
Posttest	78,67	30	23,88671	4,36110		

Processed Data Source, SPSS, 2025

Based on Table 5, it is known that the average pre-test score before using the E-Module was 47.00, while the average post-test score after using the E-Module increased to 78.67. This increase in scores indicates a significant difference in students' critical thinking skills after being given treatment in the form of using the E-Module. These results confirm that the E-Module can serve as an effective learning tool in promoting the improvement of critical thinking skills.

Table 6 Results of Paired Differences Test on Variables of Improvement in Students' Critical Thinking Skills (Pre-Test and Post-Test)

Pair I	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Standar Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest - Posttest	-31,66667	40,86001	7,45998	-46,92404	-16,40929	-4,245	29	,000

Processed Data Source, SPSS, 2025

Based on Table 6, it shows that the t-value is -4.245 with a significance level (2-tailed) = 0.000 < 0.05, indicating that the use of E-Modules significantly influences the improvement of students' critical thinking skills. This improvement occurs across various indicators of critical thinking skills, namely analysis, synthesis, evaluation, and decision-making. This means that students who previously had critical thinking skills at a moderate to low level experienced a significant improvement after receiving treatment in the form of project-based E-Modules in their learning process.

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B. Discussion

E-Module Usage Variables

Field findings show that the use of project-based E-Modules significantly improves student learning activities. This is evidenced by an increase in critical thinking scores, as seen in the comparison of pre-test and post-test results, which reflects the effectiveness of the learning media used in a real-world context. Students acknowledge that the E-Modules used are more interactive and flexible compared to the conventional teaching materials they have been using. E-Modules provide a more enjoyable learning experience as they allow students to access materials anytime and anywhere without directly relying on the presence of instructors. E-Module Usage Assessment (Post-Test)

In addition to presenting material in a systematic and structured manner, this E-Module also includes challenging project-based assignments that encourage students to think analytically and reflectively. These project assignments require students to integrate theoretical knowledge with practical fieldwork, thereby strengthening the process of applying knowledge in real-world contexts. Students are encouraged not only to memorize the material but also to apply it in real-world contexts through the resolution of problems relevant to their field of study. Furthermore, the E-Module fosters independent learning as students can manage their own study schedules and strategies according to their individual needs and learning styles. As a result, they become more active in managing their learning process, ultimately increasing their sense of responsibility toward their own education.

This active involvement not only improves understanding of the lecture material but also contributes to the development of a more responsible, reflective, and critical learning attitude. The independence formed through the use of E-Modules encourages students to become lifelong learners, individuals who not only study to fulfill academic obligations but also have an intrinsic drive to continue developing themselves. Theoretically, this finding is supported by the opinion of Sidiq & Najuah (2020), who state that E-Modules can be tailored to students' learning needs and effectively enhance conceptual understanding through an adaptive approach. Compared to conventional textbooks, which tend to be one-sided, E-Modules are considered more effective because they support independent and collaborative learning styles and can be used without direct dependence on instructors as the sole source of learning.

The alignment between the underlying theory and field findings is evident in this study. The E-Module used not only represents the principles of self-instruction, which is independent learning that allows students to control their own learning pace and strategies, but also adopts a chunking-modular approach, where material is presented in small, concise, focused units that are easy to understand and access. Each learning unit in the E-Module is designed to build mastery gradually, so as not to overwhelm students with too much information at once. This approach is highly suited to the

characteristics of digital learning, which demands conciseness, efficiency, and flexibility in absorbing information..

This advantage is reinforced by the existence of varied learning activities, such as project-based assignments, independent reflection, interactive exercises, and case studies that encourage active student participation. These activities create opportunities for students to apply the knowledge they have acquired in contexts that are relevant to the real world. In these activities, students are not only tasked with solving problems but also with exploring, discussing, and presenting their learning outcomes, all of which contribute to the development of higher-order thinking skills. As a result, students demonstrate improvements in terms of learning engagement, intrinsic motivation, and the ability to understand and connect material more deeply. The learning process becomes more dynamic and meaningful, as students are not merely passive recipients of information but actively engage in building their understanding through contextual and reflective activities.

Statistically, the results of this study show a significant increase in students' critical thinking skills after the implementation of project-based E-Modules. This can be seen from the increase in the validity score, from 921 in the pre-test to 1143 in the post-test. This increase in scores reflects a positive change in students' perceptions and abilities after participating in e-Module-assisted learning. This improvement is observed across nearly all assessment indicators, including self-paced learning, self-instruction, self-contained content, and innovative learning activities. This indicates that the E-Module used not only meets content validity standards but is also well-received by students as an effective and efficient learning tool.

Pedagogically, these results indicate that E-Modules are capable of creating a more meaningful and effective learning experience, as they present material in a structured, easily accessible format, accompanied by learning activities that encourage active student engagement. Moreover, E-Modules also open opportunities for students to explore material outside the classroom, thereby fostering a more inclusive, flexible, and self-development-oriented learning environment. This concept aligns with the principles of 21st-century learning, which emphasize the mastery of critical thinking, collaboration, communication, and creativity skills.

The change in scores also reinforces the assumption that the use of E-Modules not only improves understanding of the material but also cultivates higher-order thinking skills, such as analyzing information, evaluating ideas, and reflecting on the learning process. Students become more skilled in identifying problems, constructing logical arguments, and presenting solutions systematically. Thus, it can be concluded that project-based E-Modules make a positive and significant contribution to the quality of the learning process for students, not only from a cognitive perspective but also from an affective and metacognitive perspective. This study shows that the integration of E-Modules into the learning process is a relevant and adaptive strategy for

educational needs in the digital age, while also encouraging the transformation of learning towards a more progressive, inclusive, and student-centered direction.

CONCLUSION

Based on the results of the research and discussions conducted, the researcher concluded that the use of project-based E-Modules in the Learning Evaluation course had a significant effect on improving the critical thinking skills of students in the Educational Technology Study Program, Faculty of Education, Makassar State University. This is evidenced by a comparative analysis of pre-test and post-test scores, which show improvements in various indicators of critical thinking skills after students participated in the learning process using the E-Module. This improvement indicates that the E-Module developed and used in the classroom context can play a tangible role in supporting the development of students' competencies, particularly in the area of higher-order thinking.

The project-based e-module used in this study was designed with consideration of the characteristics of 21st-century learning, which requires students to be active, independent, and capable of critical thinking in solving complex and contextual problems. This e-module presents material in a structured, systematic, and interactive manner, and is equipped with project-based learning activities that integrate theory and practice. This enables students to not only be passive recipients of information but also active participants directly involved in building their understanding of the material. In this process, students are required to analyze, evaluate, and reflect on the information they obtain from various learning sources.

In addition, through the project assignments given in the E-Module, students are trained to work both individually and in groups, so that their collaborative skills also develop. These activities provide students with the opportunity to develop arguments, formulate solutions to real-world problems, and independently evaluate their learning processes and outcomes. These abilities are highly relevant to critical thinking skills, which are one of the primary indicators for assessing the success of learning in today's digital age. Thus, it can be concluded that the use of project-based E-Modules is an effective, adaptive, and modern educational innovation that aligns with the demands of contemporary educational development. These E-Modules can serve as a potential alternative instructional material to support more active, meaningful, and competency-oriented learning processes aligned with 21st-century skills development.

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