Development of Learning Modul on the Work Based Learning Learning Model the Teaching Factory Concept (WBL-TEFA) in Automotive Vocational Learning

Pengembangan Modul Pembelajaran pada Model Pembelajaran *Work Based Learning* dengan Konsep *Teaching Factory* (WBL-TEFA) pada Pendidikan Vokasi Otomotif

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Abstract

This research is based on the results of a preliminary study that identified the issue of suboptimal learning quality. The research objective is to develop the WBL-TEFA Learning Module as an effort to enhance the learning and academic achievement of Automotive students in a manner that is valid, practical, and effective. The research method employed is research and development utilizing the 4D development procedure, which includes defining, designing, developing, and disseminating. Expert validation is conducted through a focus group discussion to determine the validity of the WBL-TEFA Learning Module. The effectiveness test is carried out using the Nonequivalent Control Group Design. The level of effectiveness is measured by the improvement in students' academic achievement. The results of this study, in general, resulted in a learning module design consisting of a cover, introduction, table of contents, the position map of the learning module, glossary, introductory learning material, learning activities, evaluation, and conclusion. The utilization of the WBL-TEFA Learning Module is statistically declared to be both valid and practical. The average Aiken's V value obtained is 0.941, thus categorizing the learning module as valid. The WBL-TEFA Learning Module is assessed as "Highly practical," with an average response rate from lecturers of 91.29% and a student response rate of 89.60%. The use of the WBL-TEFA Learning Module is significantly effective in enhancing students' academic achievement (Sig. 2-tailed value is less than 0.05).

Keywords: *WBL-TEFA model learning module, validity, practicality, effectivity*

Abstrak

Penelitian ini didasarkan kepada hasil studi pendahuluan yang menemukan masalah bahwa kualitas pembelajaran belum optimal. Tujuan penelitian adalah mengembangkan Modul Pembelajaran Model WBL-TEFA sebagai usaha untuk meningkatkan prestasi akademik mahasiswa Otomotif yang valid, praktis, dan efektif. Metode penelitian ini adalah *Research & Development* menggunakan prosedur pengembangan 4D yaitu *define, design, develop* dan *disseminate*. Untuk menentukan validitas Modul Pembelajaran Model WBL-TEFA menggunankan uji pakar melalui *Focus Group Discussion*. Uji efektivitas dilakukan melalui *Nonequivalent Control Group Design.* Tingkat efektivitas diukur dari peningkatan prestasi akademik mahasiswa. Hasil penelitian ini secara umum menghasilkan disain modul pembelajaran yang terdiri dari sampul, kata pengantar, daftar isi, peta posisi modul pembelajaran, glosarium, pendahuluan pembelajaran, kegiatan pembelajaran, evaluasi, dan penutup. Penggunaan Modul Pembelajaran Model WBL-TEFA dinyatakan valid dan praktis secara statistik. Bahwa nilai Aiken's V rata-rata yang diperoleh sebesar 0,941, sehingga modul pembelajaran dinyatakan dalam kategori valid. Modul Pembelajaran Model WBL-TEFA dinyatakan "Sangat praktis", yaitu penilaian praktikalitas respon dosen rata-rata sebesar 91,29% dan respon mahasiswa sebesar 89,60%. Penggunaan Modul Pembelajaran WBL-TEFA dinyatakan efektif secara signifikan dalam meningkatkan prestasi akademik mahasiswa (Nilai Sig. 2-tailed kurang dari 0,05).

Kata Kunci: modul pembelajaran WBL-TEFA, validitas, praktikalitas, efektivitas

1. Introduction

The ongoing industrial revolution 4.0 will bring changes in all aspects of life, changing the way of life, how humans relate to humans, and humans to machines (Himmetoglu et al., 2021) starting from the transformation of information technology, mobile communication, and e-commerce, automotive technology, social media, internet in communication, Collaboration System, Cloud Computing, Intelligent robots (Moraes & Lepikson, 2017). Higher education must be able to anticipate these rapidly developing technological developments. The curriculum and learning model must meet the demands of a highly competitive industry and follow the rapid development of information and technology because every industrial revolution has changed the work process (McGrath & Yamada, 2023). In particular, vocational education is considered to be able to answer human resources that can survive in the digitalization era. The challenges and responsibilities of TVET are significant because they can produce technicians with skills relevant to industry demands (Akimov et al., 2023).

To become an automotive expert who can compete in the 21st-century labour market, an expert must have multi-skills or the ability to find opportunities that open up for future careers (Helper et al., 2019). An expert must be excellent in communication skills, problem-solving skills, innovation, creativity, and critical thinking skills (Osborne et al., 2020) to have the potential to manage the system. However, there is currently a gap between expectations and reality. There has been a decrease in several competencies in automotive engineering students. Automotive engineering graduates still do not optimally have communication, problem-solving, creative, and critical thinking skills. Therefore, educational programmes must include more opportunities for students to develop the above soft skills (Erol et al., 2016).

Therefore, it is necessary to innovate a new educational approach to changing the learning process that continuously adjusts for the better to improve students' skills and achievements. The WBL-TEFA learning model is one of the student-based learning models that can make students active by successfully providing student feedback (Karre et al., 2019). The main objective of WBL learning is to improve the implementation of knowledge, problem-solving, thinking, and intellectual skills.

Although the WBL model is not a new learning approach, WBL learning with the TEFA concept can be considered innovative for automotive vocational learning because it successfully combines and integrates concepts from several educational theories and operates them in a coherent series of activities. Furthermore, WBL-TEFA can help students learn actively because it places WBL-TEFA based on learning and working in the real world that occurs in motor vehicles and makes students responsible for learning together to solve these problems (Maksum & Purwanto, 2019). Developing the WBL-TEFA model Learning Module is needed to optimize the advantages of the WBL model with the advantages of the TEFA model in the implementation of learning. By optimizing the advantages between the two learning models, it is hoped that it can overcome the problem of learning quality that is not yet optimal. After the development of the WBL-TEFA model is completed, it is necessary to develop a "Learning Module" to support the implementation of the model in the field so that the WBL-TEFA model can be implemented effectively and efficiently in the Automotive Engineering Department.

2. Literature review

2.1. WBL-TEFA Model Learning Module

Learning Module is one teaching material widely used in learning process activities (Enke et al., 2015). The concept of learning modules is now widely used by individuals and educational institutions to produce various materials, tools, resources, and guides that have been and will be published to achieve specific learning competencies. Kuhlmann et al., (2023) state that the learning module is a complete and accessible package of learning process activities, with the primary objective being to achieve some stated competencies and objectives which must be achieved by students. Furthermore (Nugroho, 2023) states that the learning module is a package of teaching materials for a particular course.

Learning modules help students understand and apply learning materials more easily to be more effective and efficient (Salirawati, 2016). In addition, learning modules can also help students overcome learning problems and improve their academic performance (Syahmaidi, 2017). The learning module is one of the supporting systems resulting from developing the WBL-TEFA Model in automotive vocational learning. Students are important subjects in determining the successful implementation of the WBL-TEFA model to improve student learning outcomes in the classroom. Therefore, the existence of this innovative model-based learning module is vital for students to read and understand the implementation of the WBL-TEFA model (Maksum & Purwanto, 2022).

A suitable module will help lecturers teach a subject matter through various planned learning activities to achieve a predetermined Learning Outcome (LO) (Sudarman & Ardian, 2021). Suitable learning modules can increase student motivation, interest and activity in participating in the learning process and encourage students to be more confident, dare to display their talents, and improve collaborative skills, thus helping to improve student academic achievement (Elliott, 2015).

Before developing a learning module, it is necessary to analyze the differences in individual abilities in students (Rossi, 2023). This is very important so that learning objectives can be easily achieved. According to Nawawi (2017), because each student's potential is not the same, the ability of students to do questions and exercises is also not the same. Smart students must be given appropriate assignments and exercises, require high intelligence and imagination to complete, and can increase student intelligence and talent. Conversely, weak students must be given tasks and exercises that they can do based on the intelligence, abilities, and talents that exist in students (Yulando et al., 2019).

The learning module developed must refer to and be guided by various rules, standards and procedures that must be followed so that the resulting module is genuinely suitable for use and provides maximum benefits for improving the quality of the learning process (Rossi, 2023). Furthermore, Shofiyati et al., (2020) stated that a suitable learning module must be practical to make it easy for students to learn, understand and understand. Learning modules usually focus more on individual learning, where students are given opportunities and encouraged to learn independently and teaching staff or instructors do not always need to accompany students.

2.2 WLB-TEFA Learning Model

This learning model is named WBL-TEFA, which is a learning model developed from the integration between Work Based Learning (WBL) and Teaching Factory (TEFA), based on the principle of using link and match and product quality as a starting point to gain new knowledge (Treviño-Elizondo & García-Reyes, 2022; Moldovan, 2019). The development of the WBL-TEFA model is needed to synergize the advantages of the WBL model with the TEFA model in automotive vocational learning. The basis for developing the WBL Model is adapted from the study (Osborne et al., 2020), and the basis for developing the TEFA Model refers to the study (Karre et al., 2019).

The WBL-TEFA model that has been developed produces seven learning syntaxes, namely: (1) initiation, (2) receive orders, (3) necessity of information, (4) generate and short the possible solution, (5) execute orders, (6) quality control, and (7) assessment. The results of applying the WBL-TEFA model can improve students' academic achievement and soft skills, which make them more confident, responsible, able to solve problems, and able to work together in teams. The syntax of the WBL-TEFA Learning Model that has been developed meets the criteria of valid, practical and effective, so it is very feasible to implement. Furthermore, the WBL-TEFA Model that has been produced needs to be supported by other model components, namely Learning Modules, which are also valid, practical, and effective.

3. Research Methods

3.1. Research Procedure

The type of research conducted was a mixed method, a mixture of "Research and Development" with a quantitative approach (Crewell et al., 2007). This research uses the development procedure (Gall et al., 2007). The WBL-TEFA model development procedure uses the 4D development procedure, namely defining, designing, developing, and disseminating (Figure 1). To determine the validity of the learning module using expert tests through Focus Group Discussion (FGD). The effectiveness test was conducted through Quasi-Experimental Design. The increase in student learning outcomes measures the level of effectiveness. The control class research trial subjects totalled 17 people, and the experimental class totalled 17 people. Data analysis used Aiken's V test to measure congruence and consistency between the measured variables and the test to see whether the difference between the two data groups was statistically significant.

3.2. Design of Model Effectiveness Test

The effectiveness test began with a quasi-experimental pretest step between the control and experimental classes. Data collection and experimental implementation of the study were completed in 10 working weeks. In the first week, pretest activities were conducted for the control and experimental classes. Furthermore, for the next eight weeks, the experimental procedure will be carried out, namely for the experimental class, the implementation of the WBL-TEFA learning module model is carried out, while the control class is carried out learning with the Teacher Based Instruction model. After the experimental procedure was completed, a posttest was conducted, measuring the Learning Achievement students achieved after ten weeks of learning.
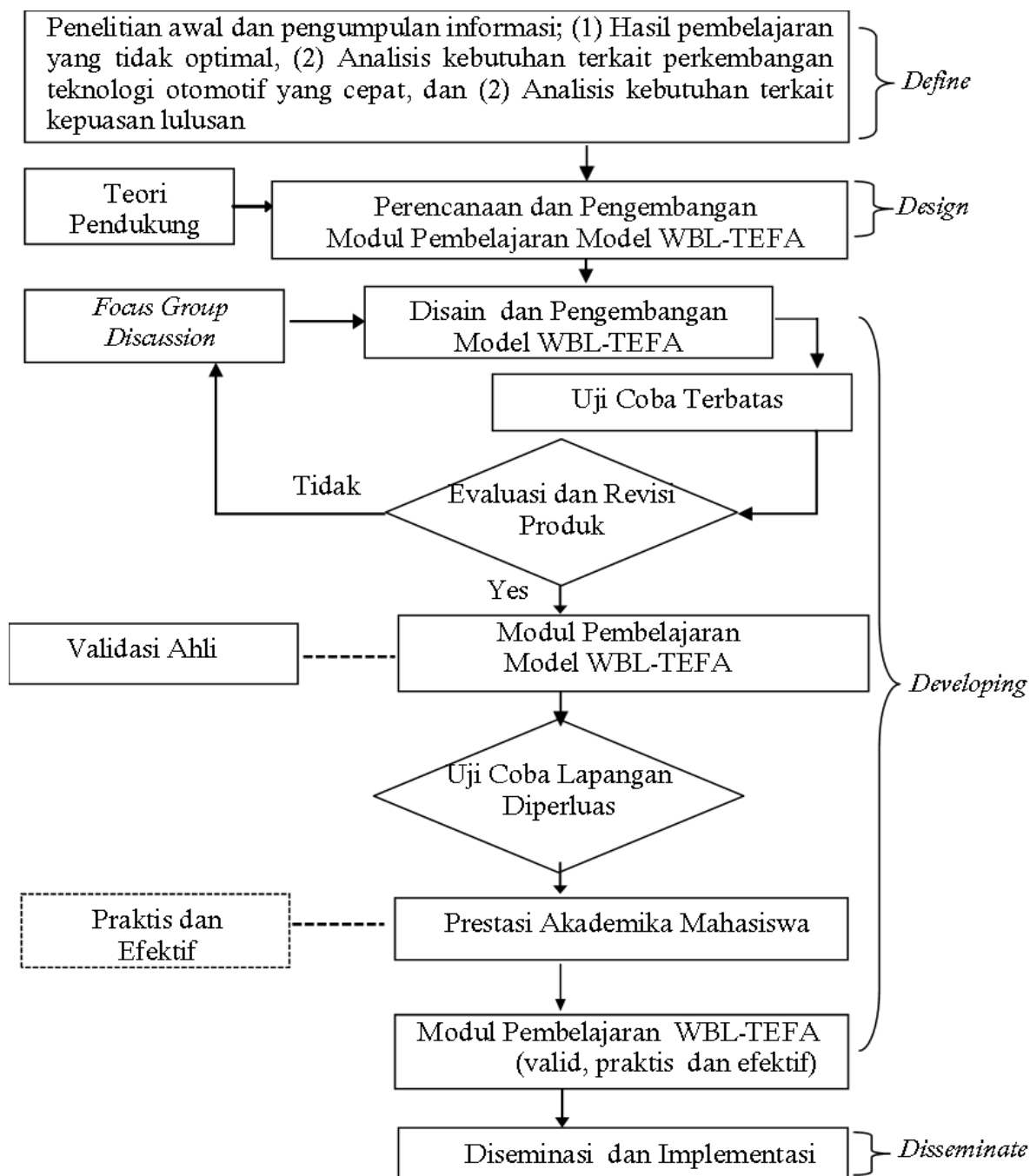
Figure. 1. Stages of Module Development

4. Results and Discussion

4.1 Research Results

4.1.1 Validity of the Learning Module

The validity test carried out on the WBL-TEFA Model Learning Module includes six aspects of validation: the front page component of the learning module, learning objectives, language and writing aspects, indications of instructions, learning syntax structure, and learning material. Table 1 shows the results of the expert's assessment of the WBL-TEFA Learning Module that has been developed.

Table 1. Validator Team Assessment of the Learning Module

No	Validation Component	V1	V2	V3	V4	V5	Aikens'V	Criteria
1	Learning Module Home Page Components	5,0	5,0	5,0	5,0	4,0	0,95	Very good
2	Learning Objectives	5,0	4,0	5,0	5,0	4,0	0,90	Very good
3	Language and Writing Aspects	5,0	5,0	5,0	5,0	5,0	1,00	Very good
4	Indicator Instructions	5,0	4,0	5,0	5,0	4,0	0,90	Very good
5	Structure of Learning Syntax	4,0	5,0	5,0	5,0	5,0	0,95	Very good
6	Learning Materials	5,0	5,0	4,0	5,0	5,0	0,95	Very good
	Rata-Rata						0,941	

The validity test of the WBL-TEFA Model Learning Module has been carried out to prove whether the learning module developed is very feasible and appropriate for use in the learning process in the Automotive Engineering Department. The validity assessment was carried out by five expert teams (expert review) in the appropriate field to validate the learning module using valid and reliable assessment instruments. The results of data analysis show the average Aiken's V value obtained is 0.941, with Aiken's V assessment range ranging from 0 to 1. According to (Ross, 2006), the criteria for the level of validity of Aiken's V is interpreted as relatively high (valid) if the score obtained is more significant than 0.60. Because the validation results by experts on the validity of the learning module obtained the lowest value of V = 0.941, which means ≥ 0.600, it can be stated that all components of the learning module validation are valid. Based on the input of suggestions for improvement provided by the expert team, the learning module was improved to obtain a better WBL-TEFA module and become feasible.

4.2.1 Practicality of Learning Modules

Table 2 shows the tabulation of practicality measurement of student responses and lecturer responses to the WBL-TEFA Model Learning Module. This practicality measurement instrument consists of several practicality indicators, including aspects of instructions, learning objectives, learning indicators, learning steps (syntax), learning phases, learning materials, learning methods, language, physical form of learning time allocation, and aspects of benefits.

Table. 2. Practicality Assessment Results of Learning Modules

Type of Response	Average Score	Achievement (%)	Category
Lecturer Response	4,56	91,29	Very Practical
Student Response	4,48	89,60	Very Practical

The results of the practicality test are in Table 2 on the WBL-TEFA Model Learning Module based on student assessment with an average score of 89.60. Of the seventeen students who assessed the WBL-TEFA Learning Model, only one rated it in the practical category. In comparison, 16 other students rated it very practical. Furthermore, the results of the practicality test of the WBL-TEFA Model Learning Module are based on the lecturer's assessment of the practicality aspect, with an average value of 91.29, which means it is convenient. Starting from the average value of practicality, it proves that students and lecturers assess very positively and are feasible for the WBL-TEFA Model Learning Module in Automotive Vocational Education.

4.3.1 Effectiveness of the WBL-TEFA Model Learning Module

The effectiveness test was conducted to see the feasibility of using the WBL-TEFA Learning Module and the suitability of the developed module. The effectiveness test was conducted on 17 students as respondents. The effectiveness test stage of the WBL-TEFA Learning Module was carried out to assess the effectiveness of using the learning module, as well as the weaknesses and limitations of the products developed to improve the learning module. The length of time for implementing the effectiveness test was carried out for ten meetings of the learning process. The level of effectiveness of the developed learning module is seen from the difference in significance through the t-test of increasing student academic achievement between the control and experimental classes after using the developed WBL-TEFA Learning Module.

Table. 3. Pretest and Posttest

Variables N	Control Class		Experiment Class	
	Skor Pretest	Skor Posttest	Skor Pretest	Skor Posttest
Average	17	17	17	17
Std. Error Mean	35,270	66,042	36,055	87,880
Median	0,712	0,993	0,602	0,712
Mode	36,00	65,910	38,270	87,52
Standard	36,00	65,500	39,510	87,520
Variance	2,690	4,095	2.481	2,690
Range	7,510	16,771	6.154	7,510
Minimum	9,790	13,640	8.650	9,420
Maximum	31,210	59,090	33.330	85,120
Total	41,420	72.730	41.980	92,720
Variables	629,880	1122,72	646.930	1607,120

Table 3 shows that the average value of student academic achievement pretest in the control class is 35.270, while the average value of academic achievement posttest of students who are not given treatment (control class) is 66.042. In the experimental class pretest, the average value obtained by students was 36.055, while in the experimental class posttest, the average value obtained by students was 87.880. The analysis shows that the WBL-TEFA Learning Module can improve student academic achievement after being used in learning by 72.25%. The difference in the average gain score between the control and experimental classes is 21.053. The WBL-TEFA Learning Module Model developed was declared effective in improving student academic achievement. This is shown from the t-test comparison of learning outcomes between experimental and control class students, namely the value of t-count = 9.465> t-table = 1.70 at a significant level $\alpha = 0.000$. The results of this study imply that the application of the WBL-TEFA Learning Module can significantly improve student academic achievement.

4.2 Discussion

The results of the validity test that has been carried out show that the WBL-TEFA Learning Module has met the criteria for assessing the development of a product with scientific principles, namely the logical consistency between the expected WBL-TEFA Learning Module and the reality module (Ross, 2006). Furthermore, the validity test using product evaluation techniques adapted from (Cho & Kasa, 2015) is carried out by expert review and through Focus Group Discussion

(FGD). Based on the theory (Cho & Kasa, 2015), the learning module validation assessment was carried out by a team of experts on the module that had been developed and through in-depth discussions in FGD activities. Based on the results of the validity test assessment and FGDs that have been carried out, it shows that the learning module products developed meet scientific criteria as products that are suitable for use.

The results of the effectiveness test show that the WBL-TEFA Learning Module is able to improve student academic achievement when used. The effectiveness test showed a significant difference in student academic achievement between those who used the WBL-TEFA Learning Module and those who did not use the learning module (Table 3). For the affective domain, the module influenced students' discipline, commitment, learning responsibility, communication, mutual cooperation, confidence, and interest in learning. In the psychomotor domain, the learning module showed a higher influence on task skills and psychomotor skills than on work process skills. In this case, to improve the lecturer's work process, the learning process should use the WBL-TEFA Learning Module and be supported by the Student Manual that was developed simultaneously. The results of this study are in line with the opinion of (Ross, 2006) that the implementation of learning modules based on interactive and innovative models is effective for improving students' academic achievement and soft skills.

The application of the WBL-TEFA Module in the learning process is able to provide alternatives and positive breakthroughs in learning so that it becomes more interesting. Learning activities using learning modules based on innovative models increase student activities to help students understand the subject matter easily and improve the quality of student process skills. This finding is in line with (Sugiarto et al., 2023) that the correct application of PjBL-based learning modules positively increases cognitive competence psychomotor, and improves student academic achievement. Furthermore, Yolantia et al., (2021) stated that students will gain direct learning experience by applying work-based models such as WBL and TEFA during the learning process, making it easier for students to absorb the knowledge gained. Modules contribute to the quality of student learning outcomes because they contain a complete material structure and the competencies students want to achieve (Nawawi, 2017; Hamid et al., 2017).

The learning process using the WBL-TEFA Learning Module can improve the quality of their process skills, improving students' cognitive, affective and psychomotor abilities. Cognitive Theory and Information Processing support this, that knowledge gained by learning through direct experience assisted by a suitable learning module has several advantages, one of which is that knowledge will last longer in students' memories because, in learning, students are directly involved (Suryana et al., 2022). In addition, learning actual automotive vocations can arouse students' curiosity, making them more active and creative.

During the implementation of the WBL-TEFA Learning Module, students were more independent in carrying out the learning process due to their high curiosity about the learning material in the developed module. This is to the research findings Maksum & Purwanto (2022) that the implementation of electronic-based learning modules encourages students to be more independent and active, so that positive interactions occur during the learning process, including being able to observe and work directly, carry out job shadowing activities, classify, predict, measure, conclude and communicate learning material, and solve problems that occur during learning.

Research conducted by Syahmaidi (2017) states that applying innovative learning modules can overcome the individual problems of students who are less active and make them more active again. This is in line with the opinion (Kuhlmann et al., 2023) that a suitable learning module helps overcome individual learning problems and helps students master one subject matter of the

course faster. According to Enke et al., (2015), the learning module is a complete, structured and accessible package of learning process activities with the main goal being to achieve the planned Learning Outcome (LO). In line with that, (Shofiyati et al., 2020) stated that one of the factors that support the improvement of student skills is improving the quality of learning through the application of innovative learning modules.

5. Conclusion

This research has successfully developed the WBL-TEFA Model Learning Module using the predetermined provisions. This learning module is designed as a learning media that can be used for teaching, mentoring, and learning tools. The module design consists of a cover, introduction, table of contents, module position map on learning, glossary, introduction to learning, learning, evaluation system, and closing. The WBL-TEFA Model Learning Module was declared valid from content and construct validity aspects. The average Aiken's V value obtained is 0.941, so the learning module's content can be stated in the valid category. The WBL-TEFA Learning Module is declared very practical, which is shown from the results of the assessment of the practicality of the average lecturer's response of 91.29% and student responses of 89.60% in the "Very practical" category. The use of the WBL-TEFA Learning Module is declared significantly effective in improving student academic achievement (Sig. 2-tailed value is less than 0.05).

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7. Reference

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