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7E Learning Cycle Based Interactive Learning Media as Alternative Teaching Material in Vocational High Schools

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Abstract:

A high-quality learning process is crucial for enhancing the competitiveness of graduates in the professional world. Teaching materials such as Interactive Learning Media have an important role in enabling students to gain knowledge and be actively involved in learning activities. The objective of this study is to develop, evaluate the feasibility, and determine the impact of implementing 7E Learning Cycle Based Interactive Learning Media. This research followed the R&D approach using the ADDIE model. The research subjects included 2 material experts, 2 media experts, 2 language experts, 36 XI TITL students, and 2 subject teachers determined by purposive sampling. The research instrument uses interview guidelines, questionnaire sheets and test questions. Data collection was conducted through interviews, questionnaires and tests. The research findings indicate that 7E Learning Cycle Based Interactive Learning Media is very valid, with a validity level of 85% according to media experts, 79% according to subject matter experts, and 79% according to language experts. The practicality test yielded results of 82% for students and 87% for teachers, falling under the category of "very practical." The evaluation results demonstrated an average score increase of 6.29. It is recommended that students utilize the 7E Learning Cycle Based Interactive Learning Media to facilitate meaningful learning experiences, foster critical thinking skills, promote independence, and enhance conceptual understanding of the subject matter. Furthermore, subject teachers are encouraged to utilize the outcomes of this Interactive Learning Media Development as a framework for developing teaching materials on other topics.

Keywords: *ADDIE, Electric Motor Installation, Interactive Learning Media, Learning Cycle 7E, Vocational School*

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Introduction

Vocational High School is a formal education pathway that equips the young generation with competent and competent vocational skills (Suharno et al., 2020). Vocational High Schools form every graduate ready to enter the world of work, be employed, or become an entrepreneur (Hassan et al., 2021). However, in reality in the field, Vocational High Schools still have many problems and challenges (Kailani & Rafidiyah, 2020; Usman & Hamid, 2022). The open unemployment rate for Vocational High School graduates remains a cause for concern as it continues to surpass the rates of other educational levels (Soelistiyono & Feijuan, 2021). Previous research stated that vocational school graduates in Indonesia have the highest unemployment rate among all levels of education, namely 9.6% (Suliyanah et al., 2021). Therefore, it is very important for Vocational High Schools to improve their standards so that their graduates can have superior competitiveness in the employment sector. This can be achieved by improving the quality of education or perfecting graduates' skills (Krismadinata et al., 2020).

Providing a quality learning process is one way to increase the competitiveness of graduates in the workforce (Mahmudah & Putra, 2021). In the realm of vocational education, the paramount objective is to cultivate a wide range of skills that can be readily employed to address a myriad of practical problems encountered in everyday life (Yuliyanto & Adam Rahmanto, 2023; Hariri et al., 2021). For this reason, learning needs to be directed so that it can help students master various knowledge and skills, such as science process skills, scientific skills, critical thinking skills and creative thinking skills (Ahmad et al., 2020). This is in line with the educational paradigm in the 21st century which demands that educational institutions guarantee that students have high-level thinking abilities which have implications for reasoning, systematic, critical and creative abilities in solving problems (Peña-Ayala, 2021). This aims to ensure that students are able to answer educational challenges in the future. In the 21st century, the essential skills can be categorized into the 4C framework, which includes critical thinking, creativity, collaboration, and communication skills (Umam & Jiddiyyah, 2020). This information highlights the importance of students acquiring critical thinking ability as a necessary skill. Students who have critical thinking skills will help them in solving problems, namely by paying attention to other people's opinions based on data, truth, knowledge, so that students do not hesitate in making decisions (Polat & Aydın, 2020). Despite this, students' critical thinking proficiency is still relatively insufficient. The inadequacy in students' critical thinking skills can be attributed to their lack of interest in learning and the absence of learning models in the classroom that familiarize students with addressing problems within the cognitive domains C4-C6 (Putri et al., 2022). This results in students not being used to developing their critical thinking skills. One effort to increase students' understanding of theoretical concepts is through interactive learning by applying critical thinking skills (Jumhur et al., 2021; Abdulah et al., 2021).

According to the findings from interviews with students at SMK Negeri 3 Tondano, it can be seen that the productive learning method used by the teacher is that the teacher provides material in the form of files in the form of YouTube videos/pdf/Word, then the teacher gives assignments related to the material that has been studied in the form of questions or summaries. Learning tends to be conventional so that there is no interaction between students, or students and teachers. This is in line with the opinion of previous research that this makes students feel that by using this method without any direction or evaluation from the teacher, they do not understand the material well, especially in lesson materials that use the application of formulas to carry out calculations (Wahdah et al., 2024; Iskandar et al., 2020). Lack of understanding of learning material will have an impact on students' critical thinking skills which will later influence the readiness of vocational school graduates to enter the world of work (Fajari, 2021; Prianto et al., 2021). (Setyani et al., 2024) emphasized the need to design vocational school education to help students improve their various skills such as scientific process skills, scientific literacy, critical thinking, and creative thinking. The use of inappropriate learning methods or models and teaching materials will cause students to be less actively involved, which can affect the development of their critical thinking skills (R. Wulandari, 2021). In vocational school learning, a learning model is needed that is able to provide opportunities for students to be more involved in learning in order to improve their critical thinking skills. Besides that, learning also needs to be integrated with capable and interactive teaching materials (Abdulrahaman et al., 2020). Teaching materials are one of the important elements to support maximum delivery of material (Sukma et al., 2020). The teaching materials used still use printed books, which do not meet the needs of students, namely they are less interesting, monotonous, less innovative, and the questions available are still in the C1-C3 cognitive realm. This can make students easily bored, unable to absorb learning information well, so that students' critical thinking skills are not honed optimally (Pamungkas et al., 2018).

The importance of implementing an interactive learning model can make students active in investigating and being scientific in solving a problem (Valverde-Berrocoso et al., 2020). The Learning Cycle 7E is a pedagogical framework based on constructivist principles, enabling students to build their understanding through engaging actively in the learning journey (Amanah, 2022). The incorporation of the Learning Cycle 7E framework in educational tasks has the potential to improve students' abilities in critical thinking. This is achieved by initially guiding students to explore their knowledge of previously learned concepts and connecting them to the upcoming material (Sari et al., 2021). The 7E Learning Cycle model allows students to be actively involved in various stages, thus allowing them to play an important role in the learning process, which includes Elicit (generating previous understanding), Engage (stimulating thinking abilities), Explore (investigating), Explain (explaining), Elaborate (applying), Evaluate (evaluating) and Extend (expanding) (Adnyani et al., 2018).

The learning process at vocational schools is expected to increase students' self-confidence for independent learning. In this way, the use of teaching materials is also an important element in the successful transfer of knowledge to students (Diwangkoro & Soenarto, 2020). There are many kinds of teaching materials that help teachers in the process of teaching activities, one of which is Interactive Learning Media. Interactive Learning Media are teaching materials that help students build knowledge and encourage them to actively participate in learning activities (Sudarmo et al., 2021). The implementation of Interactive Learning Media in The Learning Cycle 7E enhances the learning experience by integrating technology and encouraging active student participation. This approach empowers students to take a more proactive role in their learning journey, resulting in a more effective and efficient learning process.

Interactive Learning Media makes it easier for students to access learning anywhere and anytime (Manurung, 2021). Furthermore, this Interactive Learning Media is equipped with image and video visualization to stimulate students' excitement and curiosity towards learning (Wati & Nugraha, 2020). The structure of this Interactive Learning Media follows the learning stages of the Learning Cycle 7E model. This approach aims to empower students to enhance their learning independently, develop a solid understanding of the concepts by actively participating in the learning process, and cultivate their reasoning skills to effectively master the required competencies in their education.

Therefore, appropriate learning models and teaching materials are needed to support the delivery of the material well so that there are no errors in understanding the concepts. Interactive Learning Media is designed following the syntax of the Learning Cycle 7E model. Interactive Learning Media is then integrated with animation and video to visualize examples of learning material in vocational schools, especially Electric Motor Installation material, so that students can easily understand it because they are directly involved in learning activities. It is also hoped that this will enable students to be active and independent in studying the concept of Electric Motor Installation, and can improve learning outcomes or students' critical thinking abilities. Based on this7E Learning Cycle Based Interactive Learning Media was developed for electric motor installation subjects in vocational schools. This research aims to develop, test the feasibility, and test the impact of implementing 7E Learning Cycle Based Interactive Learning Media that has been created.

Research Method

Development research (R&D) utilizing the ADDIE model is the type of research employed to address problems. The ADDIE model, a development research design, comprises five key stages: analysis, design, development, implementation, and evaluation (Tu et al., 2021). Interactive learning media, which are designed based on the Learning Cycle 7E, follow a structured approach that incorporates various procedures in line with the steps of the ADDIE model. The analysis stage serves as the first step in the research and development (R&D) process of the ADDIE model (Anggraini & Putra, 2021). At the analysis stage, analyze the needs for 7E Learning Cycle Based Interactive Learning Media for electric motor installation subjects. Further analysis consists of analyzing the curriculum used, namely the Independent Learning Curriculum, the Characteristics of class XI TITL students who already have gadgets or computers so that they can be given 7E Learning Cycle Based Interactive Learning Media in learning activities.

The next stage is the design stage. At the design stage, 7E Learning Cycle Based Interactive Learning Media E is designed by compiling a design display, selecting Graduate Learning Achievements and Subject Learning Achievements as well as compiling materials that will be included in 7E Learning Cycle Based Interactive Learning Media. Then it continues with the development stage, where this development stage goes through various steps such as testing the validity of the instrument. At the implementation stage, the effectiveness of 7E Learning Cycle Based Interactive Learning Media was tested by XI TITL students in learning about electric motor installation. The final stage is the evaluation stage. At the evaluation stage, an assessment is carried out on the 7E Learning Cycle Based Interactive Learning Media that has been developed and evaluation of the results before using the product and after using the 7E Learning Cycle Based Interactive Learning Media. The research design carried out can be seen in Figure 1.

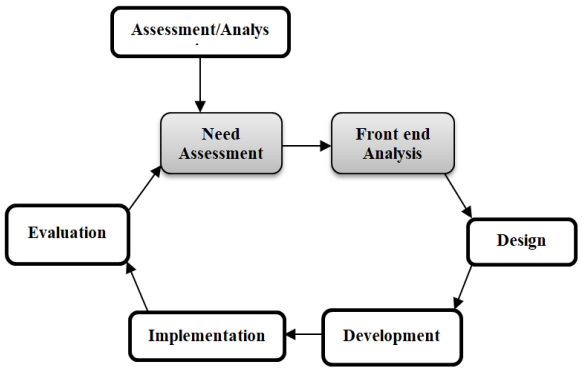

Figure 1. The ADDIE instructional design cycle (Yuniarti et al., 2023)

The subjects of this research on the development of 7E Learning Cycle Based Interactive Learning Media consisted of 2 learning media experts, 2 material experts in the field of Electric Motor Installation, 2 language experts, 36 class XI TITL students and 2 teachers at SMK Negeri 3 Tondano. The object of this research is 7E Learning Cycle Based

Interactive Learning Media which has been developed. The sampling technique used was purposive sampling. Purposive sampling is a data collection technique with consideration of certain criteria to achieve research objectives (Campbell et al., 2020). 2 media experts were determined based on purposive sampling based on the consideration that the subjects had expertise in the field of interactive learning media. 2 material experts were determined based on purposive sampling based on the consideration that the subjects had expertise in the field of electric motor installation which includes the working mechanism of electric motors, electric motor control, and electric motor protection systems. 2 linguists were determined based on purposive sampling based on the consideration that the subjects had expertise in the use of language in learning media including writing, use of phrases, and language style. 2 Teachers in the Electrical Power Installation Engineering skills program were selected using purposive sampling based on subject considerations and are teachers of the Electrical Motor Installation subject. 36 class XI TITL students were determined based on purposive sampling. This is aimed at measuring the effectiveness of using 7E Learning Cycle Based Interactive Learning Media in improving students' critical thinking skills of class XI TITL students at SMK Negeri 3 Tondano.

The data collection technique carried out in this research was using questionnaires and learning outcomes tests. The instruments used consisted of a validation questionnaire sheet for 7E Learning Cycle Based Interactive Learning Media for media experts, material experts, and language experts, a practicality test sheet for use by students and teachers, as well as an electric motor installation learning outcomes test to measure students' critical thinking skills. The subject learning outcomes test includes 30 questions with a cognitive dimension (C4) with the Higher Order Thinking Skill (HOTS) question type. Before being employed in data collection, the questionnaire sheet underwent thorough testing to verify its validity and reliability. The validity of the instrument was assessed using content validity. Instrument validity is carried out using expert judgment. The results of the instrument trial were then measured for the suitability index using the Aiken-V formula. The agreement index V is then matched to the instrument validity criteria in Table 1.

Table 1. Aiken-V Validity Categories

	Index	Category
Validity Aiken-V	0 – 0,4	Low
	0,41 - 0,8	Medium
	0,81 - 1	High

The results of the instrument validity test by experts stated that the instrument was valid with several improvements according to suggestions. Validity test using the Aiken-V formula is seen in Table 2.

Table 2. Summary of the Results of the Validity of the Research Instrument With Aiken-V

Instrument	Number of appraisers	Index Aiken-V	Category
Media expert	2	0.83-0.84	High
Material expert	2	0.78-0.84	Medium - High
Linguist	2	0.80-0.85	Medium - High
User practicality	8	0.84-0.92	High

The reliability used in developing 7E Learning Cycle Based Interactive Learning Media is carried out by taking instrument data from students when learning about electric motor installation. The data obtained was processed and analyzed to determine the level of reliability of the instrument using the Cronbach's Alpha formula.

Table 3. Conversion of Scale 4 Results Validity of 7E Learning Cycle Based Interactive Learning Media

Value Scale Range	Qualification	Description
76% - 100%	Very Valid	The product does not need to be revised and is suitable for use
51% - 75%	Valid	The product has minor revisions as recommended and is still suitable for use
26% - 50%	Less Valid	The product has had major revisions according to recommendations and is not yet suitable for use
0 % - 25%	Invalid	The product must be completely revised and is not suitable for use

Table 4. Conversion of Scale 5 Results Practicality of 7E Learning Cycle Based Interactive Learning Media

Percentage (%)	Category
0-20	Not practical to use
21-40	Less practical to use
41-60	Quite practical to use
61-80	Practical to use
81-100	Very practical to use

The research data that has been collected is analyzed using qualitative descriptive and quantitative descriptive analysis methods. This qualitative descriptive analysis was used to determine the design of 7E Learning Cycle Based Interactive Learning Media. Qualitative descriptive analysis techniques are used to explain and analyze data expressed in sentences and words. Meanwhile, the quantitative descriptive analysis method in 7E Learning Cycle Based Interactive Learning Media consists of validity tests by media experts, material experts, language experts, practicality tests and effectiveness tests. The conversion guide for assessing the validity and practicality of 7E Learning Cycle Based Interactive Learning Media is presented in Table 3 and Table 4.

Analysis of the impact value or effectiveness of using 7E Learning Cycle Based Interactive Learning Media can be seen and determined through the following hypothesis. Null hypothesis (Ho) There is no increase in the average learning outcomes in the electric motor installation subject for class X TITL students by using interactive learning media based on Learning Cycle 7E. Alternative hypothesis (Hα): There is an increase in the average learning outcomes of the electric motor installation subject for class X TITL students by using 7E Learning Cycle Based Interactive Learning Media. μ is the average value of learning outcomes for the electric motor installation subject for class X TITL students who were given 7E Learning Cycle Based Interactive Learning Media during class.

Meanwhile μ0 is the hypothesized average value of 70 in accordance with the minimum completeness standard for learning electric motor installation. Before carrying out the hypothesis test, the learning outcomes data from the electric motor installation subject were tested first through a normality test. The normality test uses the Shapiro-Wilk approach because the number of sample data is smaller than 50 (Ahadi & Zain, 2023).

Result and Discussion

Result

Analysis

The development of 7E Learning Cycle Based Interactive Learning Media is structured with several procedural stages according to the ADDIE development model which consists of 5 activity stages. At the analysis stage, an analysis of the needs for 7E Learning Cycle Based Interactive Learning Media was carried out for learning about electric motor installation in the TITL skills program at SMK Negeri 3 Tondano. The next analysis carried out was an analysis of the curriculum used, namely the Independent Learning Curriculum, the characteristics of class XI TITL students who already have gadgets or computers so that they can be given 7E Learning Cycle Based Interactive Learning Media in learning activities. At SMK Negeri 3 Tondano, especially in learning the subject of electric motor installation, it is known that the teachers who teach the subject still use conventional media which is still one-way. The teacher provides material in the form of files in the form of YouTube videos/pdf/Word, then the teacher gives assignments related to the material that has been studied in the form of questions or summaries. So there is no interaction between students, or students with the teacher. This causes learning to be less involving for students. Therefore, teachers need interactive teaching media to support learning about innovative electric motor installations. Apart from that, students need technology-based teaching materials because they tend to prefer learning with ICT-based media.

Design

The second stage of ADDIE is the design stage. At this design stage, 7E Learning Cycle Based Interactive Learning Media are carried out by preparing media display designs. Activities carried out at this stage include choosing a form of delivery of 7E Learning Cycle Based Interactive Learning Media, creating instructional learning strategies, designing assessments and evaluation instruments, mapping elements of 7E Learning Cycle Based Interactive Learning Media starting from color layout and appropriate illustration images. At the design stage, activities are also carried out to organize the systematics of 7E Learning Cycle Based Interactive Learning Media, such as designing flowcharts, media navigation structures, and 7E Learning Cycle Based Interactive Learning Media storyboard, and activities for selecting Graduate Learning Achievements and Subject Learning Achievements, determining sub-subs. Subject

Learning Achievements, as well as compiling materials that will be included in 7E Learning Cycle Based Interactive Learning Media. Examples of storyboard and flowchart design results can be seen in the following figure 2.

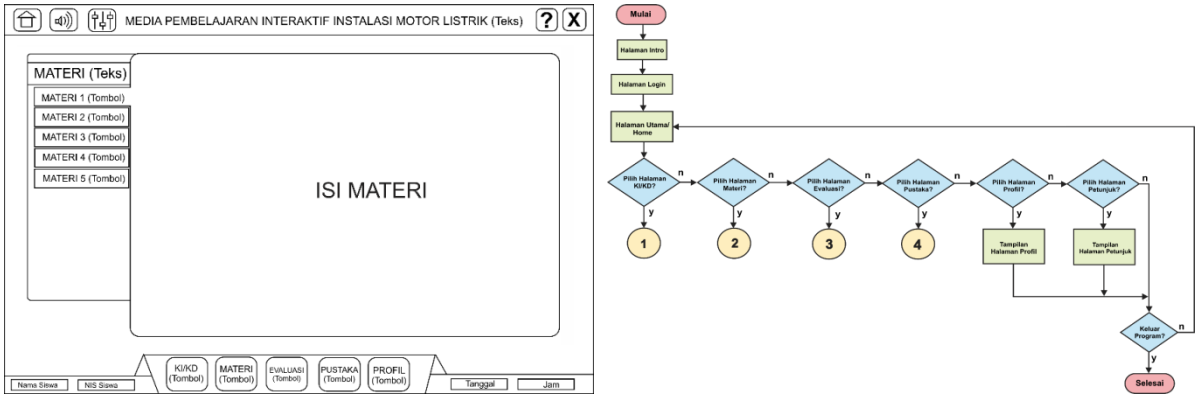

Figure 2. Examples of storyboard and flowchart design results

Development

Then proceed to the third stage of ADDIE, namely the development stage through various steps including collecting activities of 7E Learning Cycle Based Interactive Learning Media that have been previously designed, media creation activities, and testing the validity of 7E Learning Cycle Based Interactive Learning Media with media experts, material expert, and language expert. This 7E Learning Cycle Based Interactive Learning Media was developed using Adobe Flash CS6 software to produce an interactive learning media product based on Learning Cycle 7E which can be accessed electronically/digitally in the form of a SWF application. The products that have been developed can then be used via various electronic devices, including computers and laptops. This 7E Learning Cycle Based Interactive Learning Media is structured with 5 material chapters on the Electric Motor Installation Subject, namely Electric Motor Installation Components, Motor Protection, Alternating Current Electric Motors, 3 Phase Electric Motor Connections, and Motor Operation Systems. This 7E Learning Cycle Based Interactive Learning Media consists of several menus including the Subject Learning Achievements Menu, material menu, evaluation menu, library menu, and profile menu. The results of developing 7E Learning Cycle Based Interactive Learning Media can be presented in Figure 3 and Figure 4.

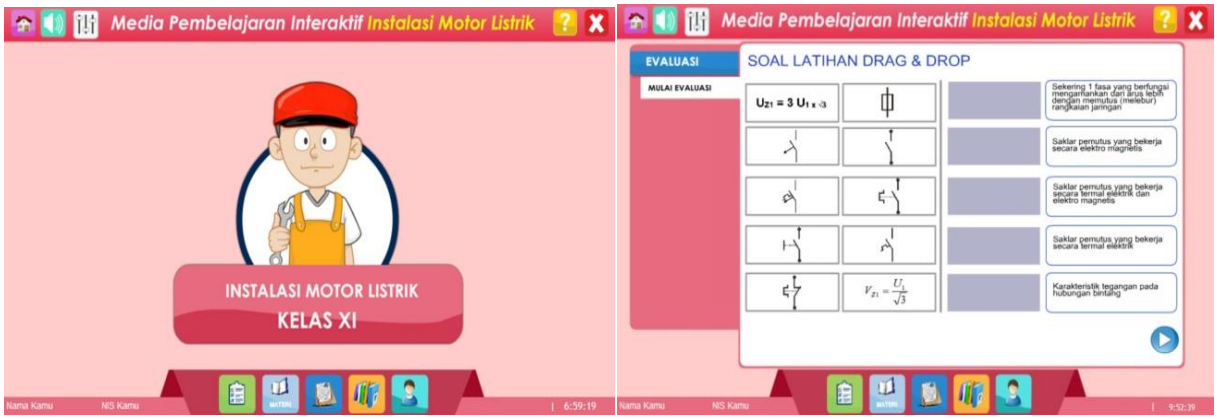

Figure 3. Main Menu Display and Sample Evaluation menu display

Figure 3 above shows the main page and an example of the evaluation menu display. In the main menu display there are several navigation buttons which have various functions in the form of navigation buttons to access menu material, evaluation menu, glossary menu, profile menu, bibliography menu, instructions menu, navigation buttons to adjust the volume, and a button to exit the learning media. The menu display sample is an example of the third screen display accessing the evaluation menu. In the evaluation menu there are 3 types of evaluation, namely drag and drop, multiple choice, and true or false.

Figure 4. Sample Material and Simulation Menu Display

Figure 4 above shows a sample of the Material and Simulation Menu Display. The material menu consists of a collection of material on electric motor installation subjects which include Electric Motor Installation Components, Motor Protection, Alternating Current Electric Motors, 3 Phase Electric Motor Connections, and Motor Operation Systems. In the simulation menu, learning media users are able to test electric motor circuits or carry out simulations related to electric motor installations. The simulation menu is also equipped with text and video explanations related to the series of simulated electric motor installations.

The development of 7E Learning Cycle Based Interactive Learning Media was completed through the development stage, where the resulting product was then tested for its suitability in terms of media, material and language through expert validity testing. The percentage results of the validity test scores from each media expert, material expert and language expert can be seen in Figure 5 below.

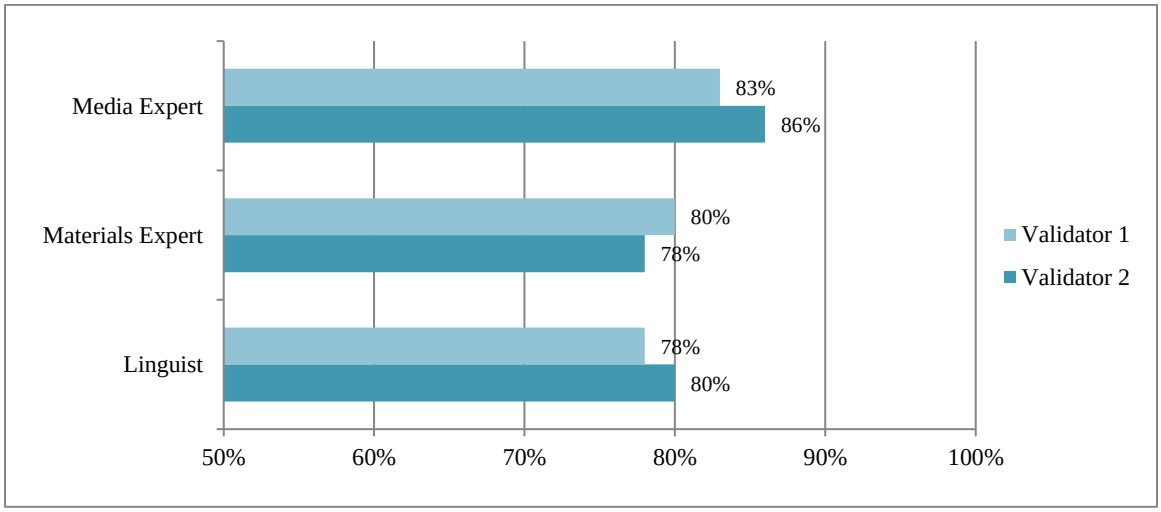

Figure 5. Percentage Results of Validity Test Scores from Each Expert

Based on Figure 5, it can be seen the percentage score results of the validity test for each media expert, material expert and language expert. The percentage score results of the media validity test show a percentage score of 83% from validator 1 and a percentage score of 86% from validator 2. The percentage score results of the material validity test show a percentage score of 80% from validator 1 and a percentage score of 78% from validator 2. Meanwhile, the percentage score results of the language validity test show a percentage score of 78% from validator 1 and a percentage score of 80% from validator 2. Furthermore, the level of validity of 7E Learning Cycle Based Interactive Learning Media from each media expert, material expert and language expert can be seen in Table 5.

Based on Table 5, it states that the validity value for media experts is 85%, the validity value for material experts is 79% and the validity value for language experts is 79%. Based on the percentage conversion of validity, it can be stated that the validity of this 7E Learning Cycle Based Interactive Learning Media when viewed from the validity of material experts, media experts and language experts is in the "Very Valid" category so this means that this 7E Learning Cycle

Based Interactive Learning Media product suitable for use in learning electric motor installation in the Tondano State Vocational School's Electrical Power Installation Engineering study program.

Tabel 5. Validity test results of 7E Learning Cycle Based Interactive Learning Media

Aspect	Percentage of Feasibility/Validity	Description
Media Expert	85%	Very Valid
Materials Expert	79%	Very Valid
Linguist	79%	Very Valid

Implementation

Interactive learning media products based on Learning Cycle 7E which have been validated by material experts, media experts and language experts are then carried out in the product implementation stage. At the implementation stage, the learning environment was organized and the practicality of using 7E Learning Cycle Based Interactive Learning Media was tested on the subject of electric motor installation. The organization of this learning environment was carried out with the aim of ensuring that the required classrooms and facilities were available before testing the practicality of using 7E Learning Cycle Based Interactive Learning Media. Furthermore, the 7E Learning Cycle Based Interactive Learning Media that was developed was assessed for its practicality by involving teachers who taught the electric motor installation subject in the Tondano State Vocational School's Electrical Power Installation Engineering study program, namely 2 teachers who taught the subject and 36 class XI TITL students. The results of the practical analysis of students and subject teachers can be seen in Table 6 below.

Tabel 6. Practicality Test Results for Using 7E Learning Cycle Based Interactive Learning Media

Aspect	Practicality Percentage	Description
Student practicality	82%	Very practical to use
Teacher practicality	87%	Very practical to use

Based on Table 6 above, it shows that the results of the practicality analysis of 7E Learning Cycle Based Interactive Learning Media in terms of the student aspect are included in the category "Interactive Learning Media is very practical to use" with a percentage of 82%. Meanwhile, the results of the practicality analysis in terms of the teacher's aspect of the 7E Learning Cycle Based Interactive Learning Media developed are included in the "Interactive Learning Media is very practical to use" category, with a percentage of 87%. In accordance with the practicality percentage conversion guidelines, it can be stated that 7E Learning Cycle Based Interactive Learning Media is in the "Interactive Learning Media is very practical to use" category. This proves that the 7E Learning Cycle Based Interactive Learning Media that has been developed is very practical to use for learning the installation of electric motors, electrical circuits in the Tondano State Vocational School's Electrical Power Installation Engineering study program.

Evaluation

At the evaluation stage, an assessment was carried out on the 7E Learning Cycle Based Interactive Learning Media that had been developed. The research results obtained explain the results of the development of Interactive Learning Media which were assessed in terms of validity, practicality and impact or effectiveness of its use on learning about electric motor installation. The data obtained through the evaluation test was then analyzed descriptively to obtain the average value of the learning outcomes for electric motor installation. The average analysis results are listed in Table 7.

Tabel 7. Results of Descriptive Analysis of Evaluation Tests

N		
	Valid	36
	Missing	0
Mean		76.2956
Median		76.6700
Minimum		53.33
Maximum		93.33

Based on Table 7, it shows that the average value obtained when compared with the hypothesized minimum standard value for learning about electric motor installation is $\mu = 76.29 \geq \mu 0 = 70$, meaning that Hα is accepted, namely "There is an increase in the average learning outcomes for electric motor installation for class XI TITL students using 7E Learning Cycle Based Interactive Learning Media" with a total increase of 6.29. Before carrying out a one-sample t-test, an analysis prerequisite test is first carried out, namely the normality test. Data can be stated to be normally distributed if the Shapiro-Wilk significance value is ≥ 0.05 then H0 is accepted (data is normally distributed), conversely if a significance value ≤ 0.05 is obtained then H0 is not accepted (data is not normally distributed). Normality test using Shapiro-Wilk is 0.423. This means that the data has a normal distribution and can be classified as having met the prerequisite tests in the T-test. The results of the test analysis using the One Sample T Test can be presented in Table 8.

Tabel 8. Results of T One Sample Test Analysis

	Test Value = 70					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Hasil Test Evaluasi	4.177	35	.000	6.29556	3.2361	9.3550

Based on the results of the t-test analysis for one sample, the t-count value was 4.177 > t-table 1.69, which means that t-count is greater than t-table so that it is in accordance with the hypothesis testing criteria, Ha is acceptable and based on the sig value. 2-tailed 0.00 < significance level 0.05. Therefore, it can be stated that the development of 7E Learning Cycle Based Interactive Learning Media has had a positive or effective impact on improving the learning outcomes of the electric motor installation course in the Tondano State Vocational School's Electrical Power Installation Engineering study program.

Discussion

Interactive learning media is a learning approach that combines technology with active student interaction in the learning process (Puspitarini et al., 2019). Previous research explains the importance of implementing interactive learning media in the learning process which is able to enable students to actively investigate and provide scientific understanding in solving a problem (Septian, 2019). Another study indicates that the use of interactive learning media can enhance the quality of learning as well as the flexibility in education (Kartini & Putra, 2020). It is in line with other studies that state the use of interactive learning media is highly suitable for implementation in classroom learning because it can facilitate students in absorbing lesson materials and tends to be more interested in the content being delivered (Rahmi et al., 2019).

Previous research has indicated that the utilization of inadequate teaching materials and inappropriate learning models can result in students' limited engagement in the development of critical thinking skills (R. Wulandari, 2021). Another study indicates that the low critical thinking skills of students are due to their lack of interest in learning and the inadequate implementation of teaching models in the classroom that fail to prepare students to face problems within the cognitive domains of C4-C6 (Jumhur et al., 2021). Insufficient comprehension of the learning materials will result in a lack of critical thinking skills among students, which will ultimately affect the readiness of vocational high school graduates to enter the workforce (Soelistiyono & Feijuan, 2021). So, in vocational school learning, a combination of the use of appropriate teaching materials and appropriate learning models is required.

This research produces 7E Learning Cycle Based Interactive Learning Media as an alternative teaching material in vocational schools which aims to improve critical thinking skills and student learning outcomes in the subject of electric motor installation. The novelty of this research is that the resulting product is interactive learning media designed using the Learning Cycle 7E learning model approach which includes bringing up previous understanding, stimulating the ability to think, investigate, explain, apply, broaden and broaden. According to the comprehensive findings, it can be inferred that the developed 7E Learning Cycle Based Interactive Learning Media is valid, practical, and effective in enhancing the learning achievements of class XI TITL students at Tondano State Vocational School in the field of electric motor circuit installation. These conclusions were substantiated through rigorous validity analysis, practicality analysis, and effectiveness analysis. The outcomes of the effectiveness test revealed that the developed product of 7E Learning Cycle Based Interactive Learning Media successfully enhanced the learning outcomes, resulting in a notable increase of 6.29. The results of this research are in line with previous research which states that the learning outcomes of students who use interactive learning media are better than those who do not (Akbarini et al., 2018). Another study indicates that interactive multimedia learning is valid, practical, and effective in enhancing students' critical thinking skills (Djusmaini Djamas Vonny Tinedi, 2018). The research findings also

indicate a similar outcome to previous studies, showing that the integrated Learning Cycle 7E model with technology-based learning media has a positive impact on learning, thus playing a crucial role in achieving learning objectivess (Saputri & Rofiki, 2024).

7E Learning Cycle Based Interactive Learning Media that was developed has had a positive impact on the learning outcomes of the Electric Motor Installation subject. Some of the advantages of the Learning Cycle 7E model are that it can increase student learning motivation, Learning Cycle 7E increases students' ability to learn cooperatively and collaboratively, and Learning Cycle 7E can also improve students' critical thinking abilities (Apriliyani & Masrurotullaily, 2023). The level of suitability (validity) of a teaching material such as Interactive Learning Media can be seen from the sub-aspects/indicators of Subject Learning Achievement, materials, simulations and evaluation (Yunarti et al., 2022). Apart from that, the material in Interactive Learning Media is packaged with various pictures and video illustrations which are useful for making it easier for students to understand the learning material (S. Wulandari, 2020). A good Interactive Learning Media can be seen if it is arranged in a structured format with complete supporting features, examples of material features, video images, evaluation illustrations, reference lists, and others (Dwanda Putra & Try Syukrianto S, 2023). 7E Learning Cycle Based Interactive Learning Media is prepared in efficient language according to EYD spelling and is understood by students based on their characteristics. Because the language used in the material can also influence the level of students' understanding and mastery of the material being studied (Mingvianita, 2023). The regularity of sentence structure, spacing and flow of material also contributes to the practicality of the Interactive Learning Media being developed. A teaching material such as Interactive Learning Media must be equipped with 6 quality elements, namely consistency, format, attractiveness, organization, font shape, and use of white space (Arifin et al., 2021). Apart from that, the use of digital-based media can create a new learning environment for students so that they can increasing their interest in learning and motivation to engage in learning (Jannah et al., 2020).

According to the aforementioned findings and analysis, it can be concluded that the 7E Learning Cycle Based Interactive Learning Media, which has been developed, has successfully generated a highly valid, practical, and effective product. This product has proven to significantly enhance the learning outcomes of class XI TITL students in the Electrical Power Installation Engineering study program at SMKN 3 Tondano. The developed 7E Learning Cycle Based Interactive Learning Media possesses numerous advantages that greatly facilitate the learning process related to electric motor installation. These advantages include training students' critical thinking skills, student independence, discipline, responsibility and communication through learning based on the 7E Learning Cycle which is conceptualized in interactive learning media. 7E Learning Cycle Based Interactive Learning Media also provides high opportunities for students to have the courage to express their participation in learning, contains attractive designs with the support of relevant images and video illustrations, can be used easily for beginners because the product is user friendly so the product is Interactive Learning Media Based Learning Cycle 7E can be disseminated to other schools to be applied to different subjects and grade levels.

Conclusion

The development of 7E Learning Cycle Based Interactive Learning Media has yielded valid, practical, and impactful results for electric motor installation students at XI TITL SMK Negeri 3 Tondano. These interactive learning materials have been proven to enhance learning outcomes, whether used in classroom activities or independently by students. The results of the validity test of interactive learning media showed that media experts were 85%, material experts were 79%, and language experts were 79% in the Very Valid category. The Practicality of Use Test results show that the Practicality from the student aspect is 88.14% and the Practicality from the teacher aspect is 82.60% in the Very Practical category. Meanwhile, in the effectiveness test, the results showed that the 7E Learning Cycle Based Interactive Learning Media product developed could improve learning outcomes with an increase of 6.29. However, there are several things that need to be evaluated for the improvement of the media such as the addition of several variations of question types, the addition of several sub-pages for videos and more diverse simulation examples. It is recommended that students utilize the Interactive Learning Media Based on Learning Cycle 7E to facilitate meaningful learning experiences, foster critical thinking skills, promote independence, and enhance conceptual understanding of the subject matter. Furthermore, subject teachers are encouraged to utilize the outcomes of this Interactive Learning Media Development as a framework for developing teaching materials on other topics.

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