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Development of Multimedia-Based Interactive Module Teaching Materials to Increase Learning Independence Learners

Septi Suarmita[1*], Suarman[2], Gusnardi[3]

Magister of Economic Education, Universitas Riau, Pekanbaru, 28293, Indonesia

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[*] *Corresponding author.*

E-mail: septi.suarmita@student.unri.ac.id

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A B S T R A C T

This research aims to develop multimedia-based interactive module teaching materials. This research uses the method Research and Development (R&D), a 4D model developed by Thiagarajan, Semmel, and Semmel which includes the definition stage, design stage, development stage and deployment stage. Data was collected from the assessments of 5 experts through expert validation sheets and responses from 38 students through student response questionnaires. Data analysis uses quantitative descriptive techniques. The results of the research show that the interactive module teaching materials are suitable for learning in Basic Accounting subjects from material experts with valid categories and the results of product trials, it is known that the interactive module teaching materials are effective in increasing students' learning independence, especially in the basic accounting equation material in vocational school. The students' positive response to the use of this interactive module teaching material, the majority of students stated that it was useful and at the same time could increase their learning independence, especially in the basic accounting equations material.

1. Introduction

The rapid development of technology makes it easy for students to study independently, they can use written study materials and so on via computers or devices, smartphone and internet, this kind of learning is known as learning e-learning (Elvarita et al., 2020). During this Pandemic, we are required to understand technology more seriously because one of the Government Policies to overcome the learning process during the Covid-19 pandemic is to implement Distance Learning (PJJ) or known as Online Learning. This policy causes a change in learning activities which provide a new atmosphere for students which is usually done directly in a real class to an online system which is carried out indirectly in a virtual class. This online system encourages the use of information technology and computers in the student environment.

Government decision. especially the Ministry of Education and Culture regarding the teaching and learning process being carried out online in order to prevent the spread of Covid-19 as an alternative

choice so that learning can continue online. During the pandemic online learning was carried out using whatsapp (WA) personal, whatsapp group (WAG) class, googleform, learning sites, and social media such as YouTube. (Dede, 2020; Zahro et al., 2021).

Implementing online learning demands independence from students. Student independence is an important factor because of limited interaction between educators and students and interaction with fellow students. Based on a survey by researchers who are also students, self-study habits are needed in the online learning system because students are required to be able to understand their own learning. The level of student learning independence in online learning during Covid-19 tends to be low (Hidayat et al., 2020; Zahro, 2021). Factors causing low independence are unsupportive learning habits and technology.

In learning using teaching materials, students learn individually in the sense that they can adjust their learning speed to their respective abilities. Students with the ability to learn quickly will complete their learning before their friends without any obstacles from their friends who are slower. The success of online learning depends on the independence of students to learn independently.

Students cannot learn independently; support from the school is needed to facilitate the online learning process. This has been done by utilizing various online media such as zoom, google meet, google classroom, google form, whatsapp, microsoft office etc. Supported by learning resources that can help students understand the material independently.

Learning innovations need to be developed and implemented in order to prepare students and teachers who are ready to act as educators (agent of education) as well as researcher (agent of research and development) and ready to face the challenges of the 21st century (Suarman et al., 2018). Learning success in learning activities is influenced by many factors, both internal and external. One factor in the success of the learning process is the learning used. The learning implemented by teachers is expected to increase success in the learning process.

The 2013 curriculum learning is more student-centred, requiring teaching materials with learning models that provide opportunities for students to be more active and develop themselves. The need for innovation to be creative in developing models. methods and strategies as well as teaching materials to be as interactive as possible so that learning can be provided to students without being limited by space and time. The development of teaching materials is carried out to help solve problems in learning by adjusting the competencies that students must achieve (Haryanto. 2016). knowledge and learning systems are constructed by students, and teachers act as guides, facilitators, reflectors and evaluators (Asrizal, 2008).

One of the lessons taught in the department of accounting and institutional finance at Vocational High Schools is Basic Accounting. The hope of completing this subject is that students will have the ability to apply it to service companies and trading companies, as well as manufacturing companies, both manually and computer-based. The function of accounting subjects for students is to be able to develop knowledge. skills. a thorough, honest and responsible attitude and being able to apply the basics of accounting for use in everyday life. For this reason, it is necessary to develop teaching materials that can make it easier for students to understand the material independently.

The development of teaching materials can help students obtain alternative teaching materials besides textbooks which are sometimes difficult to obtain and can make it easier for teachers to carry out learning (Daryanto & Dwicahyono, 2014). The development of teaching materials is carried out to solve learning problems by paying attention to student targets and adapting them to the competencies that must be achieved (Haryanto, 2016) as well as learning innovations carried out by educators.

Existing teaching materials are not appropriate if used in the current pandemic situation, where students are required to be able to learn independently and be able to manage their learning activities according to time. learning style, and learning speed of each student.

The development of this teaching material is in the form of a multimedia-based interactive module because it is hoped that it will focus more on students' personal experiences in independent learning. Multimedia-based interactive module teaching materials are learning that are designed in such a way that students can discover facts. build concepts and theories with the students' own process skills and scientific attitudes.

This development research is to produce products in the form of multimedia-based interactive module teaching materials that can help increase students' learning independence. It is hoped that the development of this teaching material can increase students' independence.

2. Methodology

This research uses a model *Research and Development* (R & D) developed by Thiagarajan, Semmel and Semmel (1974) which consists of four stages known as the 4-D model, namely the definition stage, design stage, and development stage and deployment stage. This research involved research subjects of 10th grade students majoring in Accounting and Institutional Finance at the Riau Taxation Vocational School. The research instruments used expert validation sheets, independence questionnaires and student response questionnaires. Data was obtained through questionnaires from material experts and student responses in the form of questionnaire data. Based on the results of the validator assessment and independence questionnaire as well as the student response questionnaire, it is possible to determine the suitability of the teaching materials that have been created.

The instrument assessment criteria use the criteria proposed by Suharsimi Arikunto (2012) as in Table 1 of the following Teaching Material Validity Categories.

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Table 1. Category of Validity of Teaching Materials

Interval	Category
$3.25 \leq \bar{x} < 4$	Very Valid
$2.50 \leq \bar{x} < 3.25$	Valid
$1.75 \leq \bar{x} < 2.50$	Not Valid
$1.00 \leq \bar{x} < 1.75$	Invalid

Teaching materials developed in the form of interactive modules are said to be valid if they reach the average score given by the validator and are suitable for testing.

Analysis of Student Response Questionnaires and Student Learning Independence Questionnaires
Analysis of data from student responses was carried out to assess the practicality of the module being developed. Meanwhile, analysis of the student learning independence questionnaire is to assess the implementation of the modules used in the learning process. In analyzing data using a scale *liked*. For the need for quantitative analysis, the answers are given a score. Analysis of data from student response questionnaires. and student learning independence questionnaires using descriptive analysis.

To measure students' learning independence, researchers used an instrument in the form of a learning independence questionnaire developed by Hidayati and Listyani (2010). In this learning independence questionnaire. consists of 19 items that fall into 6 indicators. The types of statements in this instrument are positive and negative statements. Analysis of the results of filling out the learning independence questionnaire was carried out by giving a score to each item on the questionnaire. The learning independence questionnaire grid can be seen in Table 2 of the following Learning Independence Questionnaire Grid.

Table 2. Learning Independence Questionnaire Grid

No	Indicator	Number of Statement Items	Item Number
1	Non-Dependence on Others	4	1.2.3.4
2	Have Self-Confidence	4	5.6.7.8
3	Behave Positively	3	9.10.11
4	Have a Sense of Responsibility	4	12.13.14.15
5	Behave Based on Your Own Initiative	2	16.17.20
6	Exercising Self-Control	2	18.19

Table 3. Category of Assessment by Respondents in the Learning Independence Questionnaire

Score	Category
4	Very Often (SS)
3	Often (S)
2	Sometimes (KK)
1	Never (TS)

The results of the assessment questionnaire will be analyzed in accordance with the assessment guidelines that have been developed. The test results will be analyzed quantitatively descriptively using percentage techniques, namely by finding the average value *(mean)* and percentage of success. Descriptive analysis of each variable uses 3 (five) classifications with the following formula:

$$I = \frac{Skor\ maksimal - skor\ minimal}{Klasifikasi}$$

Information :
I = Interval
Maximum score = Number of questions x Highest score
Minimum score = Number of questions x Lowest score

The SPSS test is carried out using the Paired Sample T-Test. The paired t-test is used as a comparative or difference test. This test is also called the paired T-

test. The paired t-test is a parametric difference test on two paired data. In accordance with this understanding, it can be explained in more detail that this test is intended for a difference test or comparative test. This means comparing whether there is a difference in the mean or average of two paired groups. Paired means that the data sources come from the same subject. The paired t test (paired t-test) is a hypothesis testing method where the data used is not independent (paired). The characteristic most often found in paired cases is that one individual (research object) is subjected to 2 different treatments. Even though they used the same individuals, researchers still obtained 2 types of sample data, namely data from the first treatment and data from the second treatment.

3. Results and Discussion

Process of Development Stages of Multimedia-Based Interactive Module Teaching Materials

This research is a type of development research, namely the development of multimedia-based interactive module teaching materials using a 4D model which consists of 4 stages, namely the definition stage (*define*), design level (*design*), development stage (*develop*) and the level of diffusion (*desseminate*). The result of this research is a multimedia-based interactive teaching material product for learning that can help increase students' learning independence, especially class Based on stages *flowchart* 4D development model as follows:

Definition Stage (Define)

The definition stage aims to determine and define the conditions for making teaching materials that suit user needs and development models that are suitable for use. In this stage there are five activities, namely beginning-to-end analysis, analysis of student characteristics, concept analysis, task analysis, and specification of learning objectives. The following is an explanation of the activities at the definition stage.

Initial Final Analysis

The initial final analysis aims to determine the basic problems that occur in the teaching materials used by teachers at school. In this activity, researchers looked at the availability of teaching materials used in schools. Based on the results of researchers' observations of the teaching materials used in learning using simple modules, especially in Basic Accounting subjects.

The information found in the field was then used as the basis for this research to develop multimedia-based interactive module teaching materials to be used in basic equation material in the Basic Accounting subject in class X Vocational School, Department of Accounting and Institutional Finance.

Analysis of Student Characteristics

The subjects in the research were class Students are generally able to reason, think broadly and construct their own knowledge. Differences in students' intellectual abilities are taken into consideration in developing teaching materials for learning using appropriate learning models so that they are suitable for use by students who have different intellectual abilities.

From the results of the analysis of student characteristics, the development of interactive module teaching materials for class

Concept Analysis

At the concept analysis stage, researchers identify the concepts to be developed and arrange them systematically. The researcher prepared a learning activity plan which was organized into 2 learning activities, namely learning activity 1, namely proof of transactions and learning activity 2. namely the basic accounting equation.

Task Analysis

This analysis aims to formulate indicators and learning objectives based on the Core Competencies (KI) and Basic Competencies (KD) that apply at the Riau Taxation Vocational School by implementing the 2013 curriculum so that the curriculum tools refer to the 2013 curriculum. The competencies that will be achieved in research for Accounting subjects The basics of class X AKL major can be seen in Table 4 below:

The formulation of competency achievement indicators used as a reference for creating learning tools is as follows:

3.6.1. Analyze the basic accounting equation
3.6.2. Develop basic accounting equations
4.6.1. Create basic accounting equations
4.6.2. Summarize the basic accounting equation

Based on concept analysis and GPA. So the tasks carried out by students during the learning process are as follows

Students analyze the basic accounting equation
Students prepare basic accounting equations
Students create basic accounting equations
Students conclude the basic accounting equation

Learning Objective Specifications

The last step of the level *define* (definition) is the specification of learning objectives.

Table 4. Basic Accounting Subject Competencies

Basic Competency (KD)	Indicators of Competence Achievement
3.6. Apply the basic accounting equation 4.6. Create basic accounting equations	3.6.1. Analyze the basic accounting equation Develop basic accounting equations 4.6.1. Create basic accounting equations Summarize the basic accounting equation

The results of the task and concept analysis carried out by researchers are then compiled into learning objectives that are in accordance with the basic competencies (KD) that will be applied to the learning tools.Students can learn to understand subject matter with the help of interactive modules.
Students can understand how to analyze basic accounting equations.
Determine the level of student mastery.

Based on the results of the analysis from the definition stage (*define*), obtained information which was used as the basis for this research to develop multimedia-based interactive module teaching materials to be used in basic equation material in the Basic Accounting subject in class X vocational school.

Design Stage (D*esign*)
The aim of the design stage is to design teaching materials which include: compiling criteria tests, selecting teaching materials that suit the material and characteristics of students, choosing the form of presentation of the learning, and simulating the presentation of the material. The following is an explanation of the activities at the definition stage:

Preparation of Criteria Tests
The criteria test is the initial step that connects the stages *define* and level *design*. This test is a tool to measure changes in behavior in students after teaching and learning activities. List of Learning Independence Questionnaire Questions *Pre Test* And *Post Test*. Selection of media that suits the purpose, to convey lesson material, namely electronic media, namely multimedia-based interactive modules.

Format selection
The selection of multimedia-based interactive teaching material formats is in accordance with the interactive module stages which are developed based on the following elements:

1) There is a formulation of learning objectives
2) There are instructions for using the teaching materials of the module
3) Clear numbering system and appropriate type and size of letters.
4) There are activity procedures
5) Clarity of distribution of material
6) Examples of questions in each learning activity
7) Practice questions at the end of each learning activity
8) Answer key to practice questions
9) Feedback
10) Initial design, with the initial design simulating the presentation of material through multimedia-based interactive teaching materials and in a suitable sequence.

Create a prototype or initial product design that is in accordance with the results of curriculum analysis and material analysis which will then be validated and improved according to the validator's suggestions.

Based on the analysis results from the design stage (*design*), a design was formed that will be used to develop multimedia-based interactive module teaching materials in basic equation material in the Basic Accounting subject in class X vocational school. Figure 1 shows the design.

Development Stage (*Develop*)
Once the interactive teaching materials are designed at the level *design* then continue on the level *develop* assessment and testing of multimedia-based interactive module teaching materials to increase students' learning independence, independence questionnaires and student response questionnaires to interactive teaching materials. The results at the development stage are as follows:

Develop interactive modules.
At the development stage. Researchers develop teaching materials in the form of interactive modules according to the design that has been prepared. The interactive module teaching materials on the Basic Accounting Equations material will be discussed with the two supervisors to get suggestions or input on the module. Then the draft will then be validated by the validator.

Module validation.
The teaching materials that have been developed will be validated by validators. The validation process

was carried out on 2 aspects, namely the module aspect and the material aspect, which was carried out by 5 validators, namely 3 validators on the module aspect, and 2 validators on the material aspect. The validator assesses the draft and fills in the validation sheet. Validation Analysis Results. If the module has been declared valid then a trial will be carried out. However, if not then it must be revised again. Validation results from the material aspect, namely the average of validator 1 is 4.7 and validator 2 is 4.7. The validation results from the module aspect, namely the average of validator 1 is 4.8, validator 2 is 4.7 and validator 3 is 4.8.

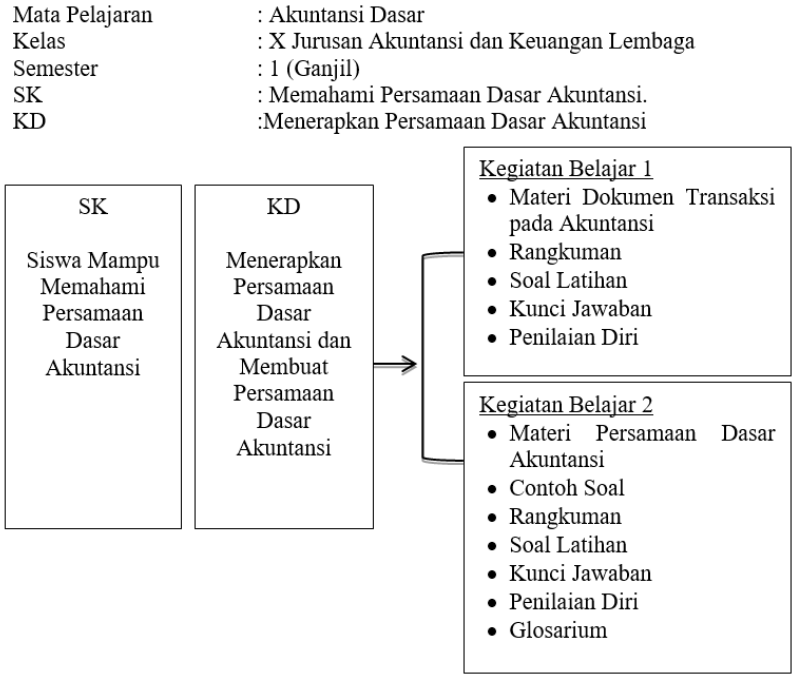

Figure 1. Initial Design of Multimedia-Based Interactive Module

Based on the validation results from 5 validators on the module aspect and material aspect, it can be concluded that the validation results are declared worthy of being tested. So next, a trial will be carried out on research subjects, namely class X students in the Department of Accounting and Institutional Finance at the Riau Taxation Vocational School.

Product Trial

After the teaching material is said to be valid by the validator. A trial will be carried out to see the readability of the product that has been developed in the form of an interactive module in an effort to increase students' learning independence. Interactive Teaching Materials for Basic Accounting Equations were tested in accordance with the time allocation for Basic Accounting lessons that had been determined at the Riau Taxation Vocational School in class X majoring in Accounting and Institutional Finance. The trial was carried out with 2 meetings with 38 respondents who were divided into 2 shifts, namely shift 1 with 19 people and shift 2 with 19 people. The first meeting, on Friday 21 January 2022, students were asked to fill out a learning independence questionnaire (*pretest*) and answer 20 questions before the interactive module is given. Then proceed with the use of interactive modules. After the learning activity ends. Students are asked to work on practice questions in the interactive module.

At the second meeting. on Tuesday. January 25 2022, students are asked to fill out a learning independence questionnaire (p*osttest*) and answered 25 questions after the interactive module was given and researchers also gave student response questionnaires to see practicality based on data obtained from students. If it is practical then the module has met the valid and practical criteria. Figure 2. The show product trial documentation photos.

Uji Coba Modul Interaktif Berbasis Multimedia di Kelas Akuntansi Shift 1

Uji Coba Modul Interaktif Berbasis Multimedia di Kelas Akuntansi Shift 2

Figure 2. Product Trial Documentation Photos

Analysis of Product Trial Results

Researchers carry out learning activities based on what has been planned in multimedia-based interactive module teaching materials. The results of the product trials after analysis can be seen from the students' responses to the interactive module teaching materials and the assessment of students' learning independence was carried out before learning with the interactive module and after learning using the interactive module.

Based on the results of the analysis from the development stage (*develop*), namely assessing and testing multimedia-based interactive module teaching materials. The assessment results or validation results are declared worthy of being tested. Then, trials will be carried out on research subjects. And the results of the product trials after analysis can be seen from the students' responses to the interactive module teaching materials and the assessment of students' learning independence to increase students' learning independence in basic equation material in the Basic Accounting subject in class X vocational school.

Spread Level *(desseminate)*

At this stage, the researcher publishes it when presenting the research results in the results seminar and has received an E-ISBN number.

The development process has followed the steps and guidelines of the 4D development model developed by Thiagarajan, Semmel, and Semmel. The results of this development research are also in accordance with research by Suarman et al., (2018), Fitriyani, (2020), that the research and development process with 4-D models starts from the definition stage (*define*) namely determining the initial problem and collecting information which is the basis for developing multimedia-based interactive module teaching materials. The second stage is the design stage (*design*) namely determining the design form that will be used to develop multimedia-based interactive module teaching materials. The third stage is the development stage (*develop*), namely validation results obtained from experts including module experts and material experts whose results were valid and suitable for trial and product trial results carried

out on research subjects, namely class X students majoring in Accounting at Riau Taxation Vocational School. The final stage is the deployment stage (*desseminate*), published during the presentation of research results in a results seminar.

Effectiveness of Using Multimedia-Based Interactive Module Teaching Materials to Increase Students' Learning Independence

Research was conducted on learning activities based on the results of the design stages that had been planned for multimedia-based interactive module teaching materials. To see the effectiveness of using multimedia-based interactive module teaching materials on students' learning independence, researchers distributed questionnaires to students' learning independence before learning with interactive modules and after learning using interactive modules.

Descriptive Analysis
Based on the results of the questionnaire *pretest* And *posttest* The learning independence of class

Table 5. Frequency Distribution of Students' Learning Independence *Pre-Test Results* Class X Students in the Accounting and Finance Skills Program at the Riau Tax Vocational School

Category	Classification	Frequency	Percentage (%)
Low	1.65 – 2.22	11	28.95%
Currently	2.23 - 2.79	12	31.58%
High	≥ 2.80	15	39.47%
Amount		38	100

From Table 5 it can be seen that the learning independence of class And 12 respondents (31.58%) were in the medium category at the time *Pre-Test*.

Table 6. Frequency Distribution of Student Independence Results *Post-Test* Class X Students in the Accounting and Finance Skills Program at the Riau Tax Vocational School

Category	Classification	Frequency	Percentage (%)
Low	2.35 – 2.87	7	18.4%
Currently	2.88 – 3.40	13	34.2%
High	≥ 3.41	18	47.4%
Amount		38	100

From Table 8 it can be seen that the learning independence of class And 13 respondents (34.2%) were in the medium category at the time *Post-Test*.
From the results of the questionnaire *pre-test* And *post-test* on students' learning independence, when testing multimedia-based interactive teaching materials for class *pretest* 15 respondents (39.47%) were in the high category and after being given interactive module-based learning on Basic Accounting Equation material the average score *posttest* in the high category there were 18 respondents (47.4%).

If during the learning period you have limited time for face-to-face learning. However, this teaching material can help students learn material that requires analysis, such as basic accounting with basic accounting equations.

Based on the results of the descriptive analysis of students' learning independence, it can be concluded that students' independence increases with the presence of multimedia-based interactive module teaching materials used in basic equation material in the Basic Accounting subject in class.

Table 7. Results of Assessment of the Effect of Multimedia-Based Interactive Module Teaching Materials to Increase Learning Independence

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	2.5342	38	.46238	.07501
	Posttest	3.2158	38	.41298	.06699

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pretest & Posttest	38	.960	.000

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Posttest	-.68158	.13276	.02154	-.72522	-.63794	-31.648	37	.000

From the results *output* it can be known that:
Correlation: Correlation value between these 2 variables: The result is 0.960, meaning the relationship is strong and positive. Sig.: relationship significance level: A result of 0.000 means significant at the 0.01 level. Df: degree of freedom: For T Paired analysis it is always N- 1. Where N is the number of samples. T = calculated t value: result 1,000: Must be compared with t table in DF 37. If calculated t > t table: significant. Mean: 0.02154. Positive Value: This means that there is a tendency to decrease learning independence after treatment. The average decrease is 0.02154.

Sig. (2-tailed): Probability value/p value Paired T test: Result = 0.000. Meaning: There is a difference between before and after treatment. Because: The p value is <0.05 (95% confidence). This means that there is an influence of using multimedia-based interactive modules to increase the learning independence of class. Mean: 0.02154. Positive Value: This means that there is a tendency to increase learning independence after treatment. The average increase was 0.02154.

Based on results *output* it can be concluded that from the sample studied, namely *pretest* And *posttest* with average conclusions *posttest* larger than the pretest with a total of 38 students. The use of multimedia-based interactive module teaching materials to increase students' learning independence has proven to be effective by seeing an increase in results *Pretest* And *Postrest* which has been carried out on research subjects with descriptive analysis and test results *T-Test* with average conclusions *posttest* larger than average *pretest*. The results of this development research are also in accordance with research by (Rahmawati, 2014; Swandhana et al., 2016, Guntur et al., 2017, Astuti & Prabowo, 2020, Ropiah, 2019) show that students' learning independence increases after using interactive module teaching materials, which means that the use of multimedia-based interactive module teaching materials is proven to be effective in increasing participants' learning independence. educate.

Student Responses to Multimedia-Based Interactive Module Teaching Materials to Increase Student Learning Independence.

This research activity was continued by distributing student response questionnaires to see student responses to multimedia-based interactive module teaching materials. After the interactive module was given and the researcher also gave the students a response questionnaire. If it is practical then the module has met the valid and practical criteria which can be seen in table 8 below:

Table 8. Frequency Distribution of Response Results from Class

Category	Classification	Frequency	Percentage (%)
Not enough	2.12 – 2.64	5	13.1%
Currently	2.65 – 3.17	19	50%
Good	≥ 3.18	14	36.9%
Amount		38	100

Table 8 shows the response of class medium category. Students' responses to multimedia-based interactive module teaching materials to increase students' learning independence can indicate whether the development process has been carried out correctly or not. Response is the result of stimulus behavior, namely the activity of the person concerned, regardless of whether the stimulus can be identified or can be observed. The students' positive responses can be used as a benchmark that students feel comfortable with the teaching materials. used in the learning process.

Judging from the results of the analysis of students' responses to multimedia-based interactive module teaching materials, respondents stated that the use of interactive module teaching materials can be said that the use of multimedia-based interactive module teaching materials is very useful or helps respondents in increasing learning independence, especially in the basic accounting equation material in class X Department of Accounting and Institutional Finance at Riau Taxation Vocational School.

4. Conclusion

Multimedia-Based Interactive Module Teaching Materials are developed using a 4D model, namely the definition stage, design level, development stage and the level of diffusion. The results of the product development turned out to be that all validators stated that it was valid and suitable for testing. From the results of product trials, it is known that this interactive module teaching material is effective in increasing students' learning independence, especially in basic accounting equations at vocational schools. Based on students' positive responses to the use of this interactive module teaching material, the majority of students stated that it was useful and at the same time could increase learning independence, especially in basic accounting equations. For basic accounting teachers, this interactive module can be a reference in carrying out learning, especially on basic accounting equation material. For students, it can be used as a learning resource to have more understanding and skills in basic accounting equations. For future researchers, the same research can be carried out for a wider range of material in other educational units.

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