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Implementation of Interactive Mathematics Teaching E-Modul To Improve Student Motivation and Learning Outcomes

Adi Candra Kusuma[1]*, Silvia Rahmi Ekasari [2], Eva Weddakarti[3]
[1,2,3] Politeknik Negeri Malang, Indonesia

*Corresponding Author. E-mail: candraraden45@gmail.com
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Abstract

Online learning requires lecturers to have creativity in choosing the right learning method to be able to create fun learning facilities. Mathematics synonymous with difficult courses needs an interactive learning approach. The purpose of this research is to Effectiveness produce interactive mathematics teaching materials to improve student motivation and learning outcomes. This type of quantitative research is carried out on students of class 1A as an experimental class and 1B as an even semester control class for the academic year 2021/2022. Data collection methods use questionnaires, observations, and test questions by processing normality test data, homogeneity test, completion test, bending test, and regression test. The results showed that individual learning completion surpassed KKM (68), and student learning outcomes with Interactive Mathematics teaching materials were higher than using expository learning. There is support for the influence of motivation on student learning outcomes by 78.6% with regression equation Y = 59.064 + 1.421 X, the with positive motivation of experimental class by 83% compared to control class 69%. The math learning that students expect is more fun and less boring.

***Keywords**: E-Modul, Interactive, Motivation, Learning Outcomes*

INTRODUCTION

Government policies during the Covid 19 pandemic in the learning process are carried out hybrid learning, which combines online and offline learning. Seeing that the Covid 19 pandemic is still quite high, the government policy is supported by the Malang State Polytechnic (Polinema) institution by continuing the policy throughout the study program to do this. Theoretical courses are still conducted online, including Mathematics courses. Online learning methods are still the main alternative to distance learning (Kusuma & M Junus, 2022). The rapid development of science and technology today is

considered the answer to riding the dynamic globalization that hit the world. The existence of technology shows the progress of the times. Technology can be applied in various aspects of life, such as in the field of Education (Lestari, 2018). The use of information technology is a demand of all academicians, which is growing rapidly today, so students and lecturers must be literate about technology. Online learning that uses the internet network and tools such as Zoom, Whatapps, google classroom, or others. This connection in online learning makes lecturers and students separated in real space (Nihayatus Sa'adah, 2020).

Mathematics is a course that is often the scourge of difficult and boring subjects. The existence of this online learning requires lecturers to do interactive learning methods so that they can attract students to study mathematics. The observation results found that students feel saturated with mathematics learning because the learning methods taught are still conventional, student participation in learning tends to be passive, and the learning media used is still a book in the form of hard files (Dewi, 2018). There need to be interactive learning improvements that will have an impact on improving student motivation and learning outcomes. Where interactive learning is student-oriented learning so that student participation is more dominant than educators, so that it can cause feedback responses both, students are allowed to think critically in conveying the issues discussed. (Hasibuan & Damanik, 2020). Interactive learning can be done with an unattractive learning supporting medium, not enough packaged in the form of textual material delivery can also be made video tutorials, PowerPoint presentations, online or soft file. In conveying information about the scope of the internet network (online) to be conveyed clearly, an interactive multimedia approach is needed, it is no exception with E-Modul Teaching Mathematics. Where multimedia is intended as a medium that combines several things, namely text effects, animation, video, and sound (Partono et al., 2020). E-Modul teaching mathematics is a learning medium that can be accessed anywhere and anytime. E-Modul Teach mathematics made using Flip PDF Professional intended for this software to operate more easily.

Research (Nisa et al., 2020) resulted in the effectiveness of the e-module with Flip Pdf Professional of 0.47. Research (Partono et al., 2020) with the title Interactive Multimedia in online learning to improve student motivation and learning outcomes, resulted in student learning completion in Cycle I by 36.36% and cycle II by 9by91%,

and there was an average increase from 60.9s1 to 85.41. Research (Martin Kahfi, Erna Srirahayu, 2021) in the application of interactive multimedia increased learning motivation by (high) and obtained learning outcomes in IPA learning of 0.3 (moderate). Research (Endang Ssri Mureiningsih, 2014) increased learning motivation from low to somewhat high, and an increase in learning outcomes of 47.43% from the average pre-cycle test result of 66.05 completion of 47.37%, cycle I increased to 72.36 with the completeness of 78.95% while the cycle II test averaged 81.08 completeness 94.74%. Research (Mahendra, 2021) resulted in increased motivation and learning outcomes in cycle I and cycle II with the creation of interactive student learning videos based on Creativity, Integrity, and Actual through SFH (Study From Home). In line with this research, this resulted in the effectiveness of interactive mathematics teaching materials to improve student motivation and learning outcomes

METHOD

The type of research that quantitative research uses. Where the research was carried out in the even semester of the academic year 2021/2022, in the Div Electronic Engineering Study Program of The State Polytechnic of Malang, 1A students in class 1A numbered 26 students as experimental classes and class 1B a total of 27 students as a control class in the Integral sub-materials. The research collection was carried out a random sampling from 6 classes (A-F) by paying attention to the acquisition of odd end-of-semester scores. Data collection methods use observations, questionnaires, and tests. Observation sheet research instruments, questionnaire sheets, and test question sheets. Observation is used to observe the activities of the teaching and learning process. It's a matter of knowing the cognitive success rate of students. Questionnaires are used to find out the magnitude of the influence of motivation on student learning outcomes after participating in learning using E-Modul teaching mathematics. The motivational indicators are a) Attention to Learning, b) Want to explore further the material learned, c) Learning Followed By Pleasure, d) Willingness To Learn, e) Always Trying to Achieve Better, f) Diligent in Doing Questions and Tasks and g) Discuss when Experiencing Difficulties. Test questions are used to obtain student learning completion data so that they can compare the effectiveness of learning. Data analysis techniques with normality tests, homogeneity tests, completion tests, banding tests, and regression tests. The quantitative research design can be seen in figure 1 below

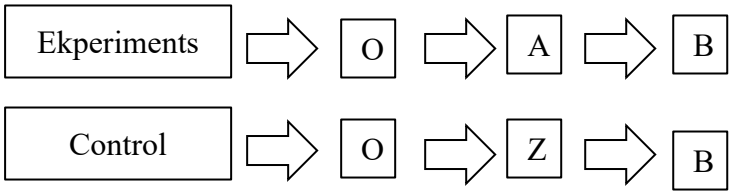

Figure 1 The quantitative research design (Kusuma & Afriliana, 2018)

Description: Where O class is taken by random sampling, A is learning using Interactive Mathematics Teaching E-Modul, Z is expository learning and B is student motivation and learning outcomes.

E-Modul teaching materials are compiled containing materials, quizzes, problem exercises, and learning videos which are then made with Flip Pdf Professional software. The teaching materials referred to the learning achievements contained in the One Semester Learning Plan (RPS) with the results of discussions of peers and senior lecturers of mathematics courses. Description of the average score of each learning device used Likert scale Table 1 as follows

Table 1. Learning Device Criteria (P)

Criteria	Information
$1{,}00 \leq P \leq 1{,}80$	bad
$1{,}80 < P \leq 2{,}60$	not good enough
$2{,}60 < P \leq 3{,}40$	Good sling
$3{,}40 < P \leq 4{,}20$	Good
$4{,}20 < P \leq 5{,}00$	Excellent

Validate each learning device so that it can be used with at least good criteria. Question analysis tests are carried out to obtain validity, reliability, difficulty levels and different strengths of questions to obtain good test questions to be used in measuring student cognition.

RESULTS AND DISCUSSIONS

Research data from observations, questionnaires, and tests are collected and then carefully analyzed, and then interpreted in descriptive form. Research activities are carried out during 4 meetings on Integral materials with details in table 2. Learning objectives are adjusted to the CPL (Learning Achievement) contained in RPS. At the 4th meeting, an evaluation was conducted by giving the same question to the experimental class and control class. Mathematical learning outcomes are said to be complete if they meet the

requirements for completeness of learning, namely the average grade of the class reaching KKM (68).

Table 2. Integral Material Scope

Meeting to-	Learning Goals
I	1. Students can explain the concept of Integral 2. Students can explain Indeterminate Integrals to algebraic and trigonometric functions, exponents 3. Students can explain Certain Integrals on algebraic and trigonometric functions, exponents 4. Students can apply indeterminate integrals 5. Students can explain integral (substitution & partial) methods
II	1. Students can explain folding integrals 2. Students can approach special integrals (root forms) 3. Students can explain the integral of rational form
III	1. Students can explain the area on the curve 2. Students can explain the volume on the curve 3. Students can explain hyperbolic functions
IV	Posttest

The learning tools that have been prepared include RPS, Learning Implementation Plan (RPP), teaching materials, Student Worksheets (MFI), and Questions based on discussions with colleagues and senior lecturers to validate the ability of learning devices. The validation results from 2 colleagues and 1 expert lecturer (senior) are as follows

Table 3. Learning Device Validation Results

No	Device	Score	Criteria
1	RPS	4,02	Good
2	RPP	4,18	Good
3	E-Material	4,05	Good
4	LKM	4,08	Good
5	Question	4,13	Good

After validation of each learning device so that it can be used with at least good criteria, continue to test the test question process in the 1D class that has the same value acquisition characteristics as grades 1A and 1B. The selected class by random sampling is then tested to find out whether the class taken already represents the population and has the same characteristics (homogeneous). Analysis of the questions is done to get a good test question. The test results are described in the table 4.

Table 4. Recapitulation of Question Item Test Results

No Quest	Validity	Reliability	Level of difficulty	Distinguishing power	Information
1	Not Valid		Easy	Good Enough	Not Used
2	Valid		Difficult	Good	Not Used
3	Valid		Medium	Good	Used
4	Valid	tall	Medium	Good	Used
5	Valid		Medium	Good	Used
6	Valid		Medium	Good Enough	Not Used
7	Valid		Medium	Good	Used

The question tested several 7 questions, then used in the research of 4 questions by paying attention to the time and adequacy of the achievement of CPL (Learning Achievement). The selection of assessment classes and control classes was carried out normality and homogeneity tests in class 1A totaling 26 students and 1D totaling 27 students in the even semester academic year 2021/2022 then conducted post-test (evaluation) of student mathematics learning results.

Table 5. Normality Test Results

	Kolmogorov-Smirnov[a]		
	Statistic	Df	Sig.
Posttest	.087	53	.200*

a. Lilliefors Significance Correction

The normality test was conducted jointly with a total of 53 (26 class A and 27 class B). The hypothesis results are obtained if the significant value in Kolmogorov Smirnov's column > 5% then H0 is accepted, which is 0.200 or 20% >5%, and H1 is rejected. This means that student mathematics learning outcome data is distributed normally. The homogeneity test for the class is carried out with the Independent Sample Test

Table 6. Homogeneity Test Results

		Levene's Test for Equality of Variances	
		F	Sig.
Posttest	Equal variances assumed	1.244	.764
	Equal variances not assumed		

The sig value is 0.764 or 76.4%. The significant value is greater than the 5% H0 received. Then it can be concluded that students in the class with learning using interactive mathematics teaching materials and in expository learning classes have the same variant or both classes have homogeneous / the same ability. The results of the selection of researchers obtained class1A as an experimental class, namely learning using interactive mathematics teaching materials, and class 1B as a control class using expository learning.

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Learning content activities were carried out in as many as 3 meetings with the closing of 1 post-test meeting. The content activities of experimental classes and control classes are given the same material with each different learning treatment. Class 1A is quite active in learning participation by asking questions and responses, while class 1B educators need to provide high baiting to prevent student activity. Student learning is given a Student Worksheet (MFI) containing group worksheets and self-contained worksheets. Group worksheets are intended to discuss exchanging information with peers and self-contained worksheets to train students' comprehension skills at home. At the close of the meeting, cognitive value collection was taken with a posttest. The results of this posttest are analyzed to see the completeness and comparison of each student.

Individual completion tests of posttest results conducted by formula calculation n = 26, $\bar{x} = 81{,}30, \mu_0 = 68, s = 7{,}659$ obtain $t_{calculate} \geq t_{(1-\alpha)}$ with significance of5%, dk = (26-1) =25 is 1,706 means $t_{calculate} > t_{tabel}$ or 8.858 > 1,706 H_0 rejected an H_1 accepted means the average posts of experimental class exceeds 68. After that, the analysis of the appeal test to class 1A and 1B, respectively.

Table 7. Banding Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	.121	.730	2.164	51	.068	4.00285	2.14695	-.30734	8.31304
	Equal variances not assumed			2.166	50.996	.068	4.00285	2.14572	-.30487	8.31057

Based on Table 7 of the appeal test above that the t table value in the distribution of value t is DK = 26 +27-2 =51 with a significance level of 5% is 2.164. The conclusion that the value of t count > t table or 2,164> 2,007 H0 is rejected and H1 is accepted means that the mathematical learning results of learning students who use interactive mathematics teaching E-Modul are greater than the results of student mathematics learning taught by expository learning.

Table 8. The Magnitude of Motivation on Learning Outcomes

Model Summary				
Model	R	R Square	Adjusted R Square	Std. The error in the Estimate
1	.785[a]	.782	.786	6.971
a. Predictors: (Constant), x1				

The value of the determination coefficient that has been corrected by the number of variables and sample size (Adjusted R^2) of 0.786 indicates that motivation can explain student learning outcomes by 78.6 percent while the remaining 21.4 percent is explained by other variables. The linear regression equation can be seen in table 9 below

Table 9. Linear Regression Equation

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	59.064	8.295		7.120	.000
	x1	1.421	.523	.785	2.719	.012
a. Dependent Variable: y						

Table 9 obtained the equation Y = 59.064 + 1.421 X where the constant value is 59.064 which indicates that if the motivation is 0 units then the learning result is 59,064 units. The regression coefficient of 1,421 indicates that any increase in motivation of 1 unit can lead to an increase in learning outcomes of 1,421 units. Learning is done online with the help of zoom and LMS (Learning Management System) Polinema. The taking of experimental classes, namely class 1A, is treated using interactive mathematics teaching materials, and class 1B control classes are treated using expository learning. E-teaching materials are prepared with a combination of media containing materials, MFI, Quiz/Pretest/posttest, and learning videos that are packaged at each meeting. So that this media can be used when lecturers are not present. A form of digital publication of learning that can be accessed through electronic media, namely e-teaching materials (Watin & Kustijono, 2017).

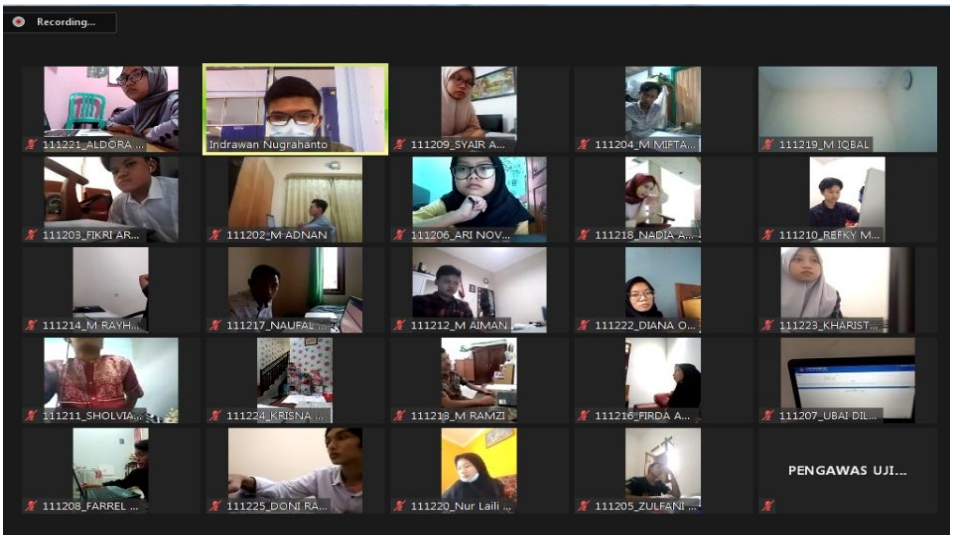

Figure 2. Online Learning Activities

Creation of interactive math teaching e-materials using Flip Pdf Professional which can be operated easily. Flip Pdf Professional feature can insert content such as sound, text, video, or animation. Output formats are provided in EXE, Mac app, HTML5, Zipp, etc (Febrianti, 2021). Ideally, an educator should be able to manage learning in the form of creativity and innovation. and can motivate students positively (Suseno et al., 2020). In the learning process, there are differences in student participation, in experimental classes tend to be active and vice versa control classes tend to be passive. Before students receive the material, they have been given E-Modul for mathematics teaching to be learned then when the beginning of learning students already have preliminary information. Lecturers have prepared MFI (Student Worksheet) consisting of LKK (Group Worksheet) and Independent Worksheet. Feedback from the results of student discussions which are then presented by each group is allowed to respond to other groups if there are differences of opinion or ask directly to lecturers to provide correct confirmation. The motivation of students in the following learning can be seen in their enthusiasm by often responding in the form of giving questions, regarding the results of discussions in, a productive atmosphere.

Table 10. Results of Student Motivation Questionnaire towards Learning

No	Motivational Aspects	Experiment	Control
1	Attention to Learning	83%	70%
2	Want to explore further the material learned	81%	72%
3	Learning Followed by Pleasure	90%	69%
4	Willingness to Learn	82%	71%
5	Always Trying to Achieve Better	78%	70%
6	Diligent in Doing Questions and Tasks	79%	62%
7	Discussing when you have difficulty	88%	71%
	Average	83%	69%

Questionnaires are distributed to all students both experimental classes and control classes, consisting of 20 questions and then grouped into 7 aspects of motivational indicators. In the table above, it can be seen that there is a significant difference in student learning motivation. Positive motivation will then have an impact on student learning outcomes so that it can be seen with the support of the influence of motivation of 78.6% in Table 8 on student learning outcomes, written in the regression equationY=59,064 + 1,421X

The completion of student learning surpassed KKM (68) in the experimental class of 25 completed students (96%) while the control class of 21 completed students (77.7%) means that the acquisition of student learning results in providing treatment to learning using interactive mathematics teaching materials is better than expository learning. The main support of one of them in the success of teachers in the learning process is the selection of the right teaching methods (Kusuma & Afriliana, 2018). Because it affects the ease of the process of transferring information to students by knowing the character of the child's mental readiness. Interactive teaching e-materials contain learning video content where when students cannot attend lectures with lecturers can also study independently where and anytime so that students will be easy to attend lectures. Learning mathematics is not enough just to memorize formulas that are then lost in the student's memory, this is because the learning done does not make students feel happy or boring. Learning is not enough to be seen that knowledge is transferred from educator to student without paying attention to how to transfer knowledge to make it easy to understand (Sumiyati, 2017). In the learning of interactive mathematics teaching E-Modul are oriented to students so that the transfer of information obtained by students from students independently studied mathematical problems so that the experience formed entered the brain memory well. Educators act as facilitators to help develop the ability that students have to be directed as potential students so that effective learning has an impact on producing quality learning outcomes (Wulandari, 2020).

CONCLUSION

From the results of research conducted that the importance of choosing the right teaching method for success in the learning process is carried out. One alternative learning method is the use of interactive mathematics teaching E-Modul which can increase student motivation and learning outcomes. The results showed that individual learning completion surpassed KKM (68), and student learning outcomes with Interactive Mathematics teaching E-Modul were higher than using expository learning. There is support for the influence of motivation on student learning outcomes by 78.6% with regression equation Y = 59.064 + 1.421 X, with the positive motivation of experimental class by 83% compared to control class 69%.

This research can be followed up in future research by focusing on the type of RnD (Research & Development) research in detail to obtain the validity, practicality, and effectiveness of learning.

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