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Investigating Student Perceptions Based on Gender Differences Using E-Module Mathematics Physics in Multiple Integral Material

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Abstract. Mathematics physics is a difficult learning and becomes a scourge in studies in physics education. Learning physics and mathematics itself will be very effective when using e-modules, but in terms of making e-modules, students' opinions or perceptions are needed regarding this matter. This study aims to look at student perceptions and also compare these perceptions with other classes based on gender or gender. The research conducted is a survey type quantitative research. The sampling technique used in this study was simple random sampling with the research subject as many as 92 physics education students who contracted the mathematics physics course. The instrument used in collecting data is 15 questions containing 4 choices that must be filled out by students. Analysis of the data used in this study in the form of descriptive analysis and ANOVA test to determine whether there is an average difference in each student's perception. The results obtained indicate that girls have different perceptions in class A and class B, while for boys there is a difference between class A and class C. These results indicate that girls have a fairly large average difference in perception with each other, while for boys the perception tends to be uniform compared to girls.
Keywords: Mathematics physics, E-module, Perception, Gender

Introduction

Global technological developments have brought an era where information and innovation can be developed very rapidly and not limitedly (Widyastono, 2015; Setyawan, 2019; Zoebaidha, 2020; Rokhim et al., 2020). Every innovation created is used to provide positive benefits for human life (Jamun, 2018; Rusyda, 2019; Sabri et al., 2021). Unlimited access to technology can also help improve living standards and accelerate in all areas of human life (Hasibuan, 2016; Rastati, 2018; Smith et al., 2018). The existence of positive and negative impacts in technological developments, of course, can have an influence on the educational learning process in the future (Nurdin, 2016; Rais et al., 2018). One that significantly affects the educational learning process is the use of appropriate and effective teaching materials.

Teaching materials are all forms of materials used to assist teachers/instructors in carrying out teaching and learning activities in the classroom (Aditia & Muspiroh, 2013; Nugraha et al., 2013; Zulmaulida & Saputra, 2014; Latifah, 2015). The existence of teaching materials will greatly help teachers design learning, while for students, teaching materials will greatly help their competence (Sundayana, 2015; Harahap & Aini, 2019;

Kimianti & Prasetyo, 2019). If teaching materials have many shortcomings, it will directly affect the effectiveness of classroom learning, especially in universities (Lee, 2011; Effiong & Igiri, 2015; Arsanti, 2018). Therefore, it takes an interactive, effective, and flexible teaching material to be applied in the classroom, one of the teaching materials that have these properties is the use of e-modules.

E-modules were chosen because there are several materials that can support learning such as audio, animation, images, videos, and can be used flexibly (Fonda & Sumargiyani, 2018; Sari & Ariswan, 2021; Ummah, et al., 2020). E-modules can train and assist students in understanding the material and being responsible according to their abilities, as well as facilitating educators in measuring student learning outcomes (Lim, et al., 2005; Hidayati, et al., 2019; Haspen & Syafriani, 2020). In addition to understanding the material, e-modules can train students to learn independently and responsibly according to their abilities (Perdana, et al., 2017; Nurhasnah, et al., 2020). Independent learning is very important to see how effective the use of e-modules is in classroom learning, researchers see that for science learning in higher education, especially Physics education, there is still a shortage of e-module teaching materials that speak Indonesian and discuss mathematics physics material.

Physics is one of the foundations for building students' conceptual understanding (Taqwa & Rivaldo, 2019; Hasanah, et al., 2020; Ramadhan, et al., 2020). Physics discusses the symptoms and properties of objects in nature (Martawijaya, 2015; Darmaji, et al., 2019; Neldawati, 2020). One of the objectives of learning physics is to guide students to apply their knowledge in problem solving activities (Nurhayati, et al., 2016; Maliki, et al., 2017; Sari, et al., 2020). Problem solving ability is usually often used on materials that are difficult for students to learn, one of the materials that is often the scourge of Physics education students is mathematics physics material.

Mathematical physics is a subject at several universities that is often considered not easy and difficult to learn (Ellianawati, et al., 2017; Agustina, et al., 2019; Marisda, 2019). The fact that shows that the mathematics physics course is a difficult subject can be seen from the low student exam results and the large number of advanced students who repeat this course (Fadillah, et al., 2017; Bustami, et al., 2020;). Mathematical physics itself has a very close relationship with the completion of mathematics in any given problem or concept (Tanjung, et al., 2018; Kurniawan, et al., 2018; Jufrida, et al., 2019). The problem solving concepts given mostly only use a few teaching materials and tend to use English, this of course makes researchers interested in creating a source of complementary teaching materials in the form of e-modules that are in Indonesian, interactive, flexible, and effectively used in the classroom.

The integrated e-module in the mathematics physics course takes a fairly difficult material, namely multiple integral. The double or fold integral is a branching of the integral further material that often appears in the form of a double integral and a triple integral (Rahayu, & Zuhairoh, 2017). According to Apriandi & Krisdiana (2016) the causes of students having difficulty in learning folding integral material are: (1) Difficulty in drawing a function; (2) Difficulty converting variables; (3) Difficulty in determining the limits of integration; (4) Difficulty in determining the form of integration. These difficulties will

certainly be overcome if the source of teaching materials is equipped with appropriate complementary sources of teaching materials. One way to see whether the teaching materials made are good or not can be done by looking at student perceptions.

Perception is basically a process that is preceded by sensing, organized, and then interpreted so that individuals realize and understand what is felt by the senses (Purwanti, 2013; Hamidah, et al., 2014; Cahyono, 2017). Perceptions examined in this study were reviewed based on gender in each class, namely regular a, b, and c. Gender is one of the differentiating factors that refers to gender identity which is generally divided into men and women (Perry, 2019; Sullivan, 2020). Gender differences between men and women significantly affect decisions about something, women tend to think more carefully and effectively the decisions they will make. By looking at the importance of students' perceptions of the mathematics physics e-module made of multiple integral material, the researchers conclude the formulation of the problem as follows:

1. How are the students' perceptions of regular class a, regular b, and regular c regarding the multiple integral material of the e-module in mathematics physics with gender?
2. How is the average difference in perception for each class of regular a, regular b, and regular c in terms of gender?

Methods

The research method used is a survey type quantitative research. Quantitative research methods are research methods used to examine certain populations or samples with data results in the form of numbers (López, et al., 2018). The sampling technique used in this research is simple random sampling. Simple random sampling is a method of drawing from a population in a certain way so that each member of the population has an equal chance of being selected (Acharya, et al., 2013; Cahyono, 2017; Etikan, 2017). By using a simple random sampling technique, the researcher will obtain data that is in accordance with the objectives and needs of the researcher.

The data collection instrument used in this study was a student perception questionnaire distributed to 92 students in three different classes, namely regular a, regular b, and regular c. Questionnaire is a method of collecting data through a statement factor filled in by the respondents which is used to find out student responses regarding the e-module given (Wahyudin, et al., 2010). The grid of data collection instruments used in this study can be seen in Table 1.

Table 1. Student Perception Questionnaire Instrument Grid

Assessment Indicators	Rated aspect
E-Module Display	Text clarity
	Multimedia size suitability
	The clarity of the color and shape of the image
	Good multimedia display quality
	Multimedia that is presented is attractive
Presentation of Material in the E-Module	The material is easy to understand
	The order of the material is clear
	The sentences used are simple and easy to understand
	The language used is communicative
	Sample suitability with material
	The suitability of multimedia with the material
Benefits of the E-Module	Ease of use of modules
	Media can help students understand the material
	Interest in using modul
	Increased motivation to learn

The collected data is then made into a scoring category which states the level of student perception of the e-module made. The Likert scale used in this study were: 1 (Strongly disagree), 2 (Disagree), 3 (Agree), 4 (Strongly Agree) with 15 questions given to students. The category level of student perception of the e-modules made can be seen in Table 2.

Table 2. Score ranges for the quantitative criteria for the perception questionnaire

No	Score Interval	Student Perception Level
1	$48{,}76 - 60{,}00$	Very Good
2	$37{,}51 - 48{,}75$	Good
3	$26{,}26 - 37{,}50$	Bad
4	$15{,}00 - 26{,}25$	Very Bad

The data obtained were processed and analyzed using descriptive statistics and inferential statistics. Descriptive statistics are used to analyze data by describing or describing the collected data as they are without intending to make generalized conclusions (Dhani & Utama, 2017; Rulandari & Sudrajat, 2017; Zellatifanny & Mudjiyanto, 2018). The descriptive statistics used are presented using mean values, median values, maximum and minimum values, ranges, and standard deviations. Meanwhile, inferential statistics is a technique for describing data used to examine differences or relationships between groups or variables (Guetterman, 2019). Inferential statistics used in the form of testing

assumptions and hypothesis testing. For assumption test, the first stage carried out in this research is to do a prerequisite test by checking the normality and homogeneity of the data obtained, the examination can be carried out using the normality test and homogeneity test. The normality test is carried out on data that is mainly small in size and the possibility of the data being normal which in fact is not normal (Ahad et al., 2011). The homogeneity test aims to see the level of homogeneity of the data obtained through research (Jumliadi et al., 2020). If the sig value is above 0.05, then the data is said to be normal and homogeneous (Yusuf et al., 2018; Suyana et al., 2019). After testing the assumptions, the next researcher tested the hypothesis using the ANOVA test. Anova test or F test is a distribution used to analyze the ratio of variance of data obtained in research (Kim, 2017).

The research procedure that was carried out for the first time by the researcher was giving the object whose perception was measured. After that, the researcher collected data using google form as a tool to help collect data. This data collection was carried out in 3 classes with each data collection at a different time. After the data was collected, the researcher analyzed the data using SPSS 22. The analyzed data was then viewed and conclusions were drawn about how the level of students' perceptions in the three classes and also the differences in perceptions of each class were. In simple terms, the research procedure carried out can be seen in Figure 1.

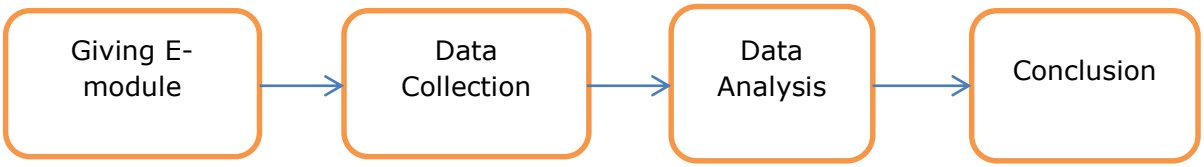

Figure 1. Research procedures on student perceptions of e-module

Results and Discussion

The data obtained from students in three different classes, namely regular a, regular b, and regular were analyzed using descriptive statistics based on gender. Descriptive analysis of regular class a statistics can be seen in Table 3.

Tabel 3. Description of the perception of class A students on the FISMAT e-module

Gender	Category	F	%	mean	median	mode	min	max
Female	Very Bad	0	0	46,94	49,00	48,00	38,00	53,00
	Bad	1	5,9					
	Good	7	41, 18					
	Very good	9	52,9					
Male	Very Bad	0	0	51,33	51,00	48,00	42,00	59,00
	Bad	0	0					
	Good	6	40					
	Very good	9	60					

From the Table 3, it can be seen that for the regular class a has a good level of perception of the developed e-module. From the table, it can be seen that as many as 9 girls have a very good perception level, 7 people have a good perception level, and 1 person has a bad perception level of the mathematics physics e-module. As for boys, 9 students have very good perception levels and the remaining 6 students have good perception levels of the multiple integral Material mathematics physics e-module. Then, the descriptive statistical analysis data for regular class b can be seen in Table 4.

Tabel 4. Description of the perception of class B students on the FISMAT e-module

Gender	Category	F	%	Mean	median	mode	min	max
Female	Very Bad	0	0	51,43	53,50	48,00	37,00	59,00
	Bad	2	13,34					
	Good	5	33,33					
	Very good	8	53,33					
Male	Very Bad	0	0	46,50	47,50	45,00	36,00	54,00
	Bad	3	20,00					
	Good	7	46,67					
	Very good	5	33,33					

From the table above, it can be seen that the regular class b has a good level of perception of the developed e-module. From the table it can be seen that as many as 8 girls (53.33%) have a very good level of perception, 5 people (33.33%) have a good perception level, and 2 people (13.34%) have a bad perception level to the mathematics physics e-module. Meanwhile, for boys, 5 people (33.33%) had a very good perception level, 7 people (46.67%) had a good level of perception, and the remaining 3 people (20.00%) had a good level of perception. It is good for the e-module mathematics physics multiple integral material. Furthermore, for descriptive statistical analysis data, the perception questionnaire for regular class C can be seen in Table 5.

Table 5. Description of the perception of class C students on the FISMAT e-module

Gender	Category	F	%	Mean	median	mode	Min	max
Female	Very Bad	0	0	45,27	46,00	37,00	37,00	54,00
	Bad	4	26,67					
	Good	5	33,33					
	Very good	6	40,00					
Male	Very Bad	0	0	45,00	45,50	45,00	36,00	50,00
	Bad	1	6,66					
	Good	7	46,67					
	Very good	7	46,67					

From the table above, it can be seen that the regular class c has a good level of perception of the developed e-module. From the table it is also seen that as many as 6 girls (40%) have a very good level of perception, 5 people (33.33%) have a good perception level, and 4 people (26.67%) have a bad level of perception of mathematical physics module. Meanwhile, for boys, 7 people (46.67%) had a very good perception level, 7 people (46.67%) had a good perception level, and the remaining 1 person (6.66%) had a good perception level. good for the e-module physics mathematics multiple integral material. After the data were analyzed descriptively, the data were then tested for prerequisites, namely the normality test and homogeneity test. The normality test aims to see the normality of the data, the results of the normality test in the regular classes a, b, and c can be seen in Table 6.

Tabel 6. The results of the normality test of students' perceptions of the e-module

Gender	Kolmogorov-Smirnov (Sig)		
	Class A	Class B	Class C
Male	. 107	.078	.067
Female	.200	. 112	.054

From the normality test data for the three classes above, a significance value is greater than 0.05. For girls, the significance of regular classes a, b and c was 0.107, 0.078 and 0.067, while for girls the significance was 0.200, 0.112, and 0.054 respectively. This significance value has met the requirements, which is above 0.05, which means that the data obtained are normally distributed. Furthermore, the homogeneity test or the test used to see the homogeneity of the data can be seen in Table 7.

Table 7. The results of the homogeneity test of students' perceptions of the e-module

Gender	Test of Homogeneity (Sig)		
	Class A	Class B	Class C
Male	.074	.103	.058
Female	.083	.127	.165

From the homogeneity test data for the three classes above, a significance value greater than 0.05 was obtained. For girls, the significance of regular classes a, b and c was 0.74, 0.103 and 0.058, while for girls, the significance was 0.083, 0.127, and 0. 165, respectively. This significance value has met the requirements, namely above 0.05, which means that the data obtained is homogeneous. After completing the prerequisite test, the researcher then tested the hypothesis using the ANOVA test. The results of the Anova test carried out can be seen in Table 8.

Table 8. ANOVA Test Output Results of Students' Perceptions of the FISMAT E-module

	Sum of Squares	df	Mean Square	F	Sig.	Gender
Between Groups	824,577	2	432,337	4, 177	,036	Female
Within Groups	4064,731	43	97,927			
Total	4889,308	45				
Between Groups	834,130	2	328,280	5,136	,017	Male
Within Groups	3134,251	42	66,432			
Total	3968,381	44				

From table 7 on the results of the ANOVA test output perceptions of regular class students a, b, and c, the significance value is less than 0.05, which means the data is significantly different. For boys, a significance of 0.036 was obtained and for girls of 0.017. This value smaller than 0.05 indicates that the perception data for both girls and boys are different from each other.

After conducting the ANOVA test to find out whether there was a relationship between the perceptions of students in the three classes based on gender, the researchers then conducted a post hoc test to find out the differences in detail between each class and other classes. The test results can be seen in Table 9.

Table 9. Lsd Post Hoc Test Results

Kelas (I)	Kelas (J)	Mean Difference (I-J)	Sig	Gender
A	B	-.951	.131	Female
	C	3.158*	.044	
B	A	.951	.131	
	C	4.109*	.011	
C	A	-3.158*	.044	
	B	-4.109*	.011	
A	B	2.104	.018	Male
	C	-2.729	.128	
B	A	-2.104	.018	
	C	-4.833*	.007	
C	A	2.729	.128	
	B	4.833*	.007	

Based on the table above, it can be seen that for female students there are differences in perceptions between class A and class B, while for class C they have the same perception. Then for boys, there is a difference in perception between class A and class C, while class B tends to have the same perception.

Based on the table of descriptive analysis results for regular classes a, b, and c it can be said that for regular class a almost all student data are at the level of perception above good with details for women 52.9% have very good perceptions, 41.18% have perceptions good, and 5.9% have a bad perception level. In addition, for men, 40% have a good perception level and the remaining 60% have a very good perception. Then for the regular class b, there were 30 respondents, each 15 female students and 15 male students, from the table it can be seen that the level of perception is not too good compared to regular class a because for girls there are 2 people (13.34%) have a perception which is not good, then for the remaining 5 people (33.33%) the perception level is good, and 8 people (53.3%) the perception level is very good. Furthermore, regular class c has a perception level that is on average good and very good, but in class c the perception level is not better than regular class a, from the table it is found that for girls as many as 4 people (26.67%) have a perception level which is not good, while the remaining 5 (33.33%) have a good level of perception, and 6 people

(40%) have a very good level of perception. For the boys themselves, 1 person (6.66%) has a bad level of perception, 7 people (46.67%) have a good level of perception, and the remaining 7 people (46.67%) have a very high level of perception. good. From the three descriptive tables, it can be seen that 1 person out of 32 students in regular class a has a poor perception, this result is better than class b and c which have 5 people in the category of poor perception level, respectively.

Then after finishing describing the data statistically, the next researcher described the data inferentially. Before testing the hypothesis, the researcher first conducted a prerequisite test, namely the normality test and homogeneity test. Based on table 6, the significance of the normality test for boys is 0.107 (class a), 0.078 (class b), 0.067 (class c). As for girls, the significance was 0.200 (class a), 0.112 (class b), and 0.054 (class c). This significance result has met the requirements, which are above 0.05 (Darmaji, et al., 2019), so the data obtained can be said to be normally distributed. Then for the next prerequisite test is the homogeneity test, this test is used to see whether the data is homogeneous or not. From the test table of homogeneity, the significance for boys was 0.074 (class a), 0.13 (class b), 0.058 (class c). As for the results of the significance of girls obtained 0.083 (class a), 0.127 (class b), 0.165 (class c). For the condition that the significance value of the homogeneity of the data is the same, that is 0.05, so it can be concluded that the data is homogeneous.

After the two conditions were met, the researcher then conducted the ANOVA test to see the relationship between the perception data between the regular classes a, b and c. ANOVA is a test used to see the average difference in variables, if the significance is less than 0.05 then there is an average difference, on the other hand, if it is greater than 0.05, it means that there is no difference in the data (Zakaria & Nordin, 2008; Mailizar, et al., 2020; Yang, et al., 2021). The ANOVA table shows a significance of 0.036 for girls and 0.017 for boys. The result of this ANOVA test is smaller than the value of 0.05 which indicates that there is an average difference in each gender, namely male and female.

Gender differences greatly affect a person's perception of something specific, namely the object to be assessed (Anggoro, 2016). The perception process itself describes how the stimulus in the form of an object or event is received and interpreted so that it can give meaning to something for those who perceive it (Dzakirin, 2013). Men are described as having a firm attitude in judging things, while women are more critical in judging things than men (Duarte, et al., 2017; Klein, et al., 2018). Furthermore, according to Sulistiyawati & Andriani (2017) argues that female students have a broader and deeper mindset than boys, so in this case it certainly causes a difference in perception. In addition to the innate influence of gender, students' perceptions of good or bad can be influenced by their peers (Zizka, 2017; Mucherah, et al., 2018; Conejeros-Solar, et al., 2021). Students tend to follow suit or imitate what their friends are doing, this is certainly not good because it can hinder children's creativity and independence in thinking, especially judging something.

A good perception shows that e-module products are considered to have good quality for students (Pathoni, et al., 2017; Syahrial, et al., 2019; Maison, et al., 2021). With good quality, it is hoped that the e-module can help students in carrying out mathematics physics lectures (Sari, et al., 2020; Nevrita, et al., 2020). In addition, by using the Indonesian language in the e-module, students can freely discuss the material for physics and mathematics without any errors in delivering the material in the e-module. In the long term, this e-module can guide and help students to improve their pedagogic aspects as prospective physics teachers who are required to have critical analysis and calculations. The pedalgogic aspect itself is the competence or ability of prospective teachers in mastering and managing the classroom (Yasin, 2011; Gluzman, et al., 2018; Machaba, 2018). According to research by Moh'd, et al. (2021) the level of pedagogic competence of educators plays a very important role in classroom teaching, educators or prospective educators who have a high level of pedagogic competence tend to be effective in teaching in class. One of these effective learning

can be supported by using technology, namely in this study it is offered as an e-module in mathematics physics with multiple integral material.

For a prospective physics teacher himself, a perception is needed for introspection of prospective teachers in increasing their competence to become professional teachers (Mashuri, 2017; Widyastuti, et al, 2017). On the other hand, by getting a good perception from students about e-modules, it can be said that this research helps educators to see what kind of learning students prefer. If learning is liked by students, then good learning outcomes will follow (Schoepp, 2017; Elken & Tellman, 2019; Rahardjanto, 2019). Then for mathematics physics learning, e-modules that have a good perception of course have good quality to be a complementary source for lecturers in teaching mathematics physics (Linda, et al., 2018; Gillan, et al., 2018). E-modules that are not in English make lecturers not waste time understanding the material discussed. The addition of learning resources, one of which is by using the Indonesian-language mathematical physics e-module, is certainly very helpful in terms of convenience, attractiveness, and the variety of lecturers in teaching. Lecturers in this case do not have to think about foreign grammar so that learning time will not be wasted in class.

This research has strengths and weaknesses compared to previous research. In previous research by experts (Serevina, et al., 2018; Darmaji, et al., 2019; Asrial, et al., 2020) student perception variables are used to increase the effectiveness of classroom learning and did not examine how the relationship between first-class students' perceptions and other classes was. Previous research has also only focused on student perceptions for one class, while the current research uses more data. However, the research conducted has a weakness where the researcher does not specifically explain the product that is the object of student perception. In addition, the data processed is only limited to measuring the relationship between the perceptions of students in the three classes and does not use other variables. Therefore, the researcher suggests that further research is expected to be able to add variables so that it does not only measure the relationship but the influence between variables.

Conclusion

Based on the results of research regarding students' perceptions of mathematics physics e-module dual integral material, it can be concluded that gender differences are one of the factors that cause differences in perceptions between female and male students. This can be seen in the significance value of the ANOVA test for female and male students, which were 0.036 and 0.017, respectively. The significance value of <0.05 indicates that there are differences in perceptions between female and male students. Then, this difference can be seen in detail in the LSD follow-up test where for the female gender there are differences in classes A and B, while for men there are differences in classes A and C.

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