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Comparison of Perception and Implementation of Mathematical Physics for Matrices

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Abstract

This study aims to find out how students perceive and see which students have a positive perception of the e-module physics-mathematics matrix based on gender differences. The type of research used is survey research. The research approach used is quantitative research. The research population is Jambi University physics education students with a total sample of 120 students. The data analysis technique used is descriptive statistical data analysis and inferential data analysis with Anova and post hoc Tukey B tests. The results of the study through the Anova test showed that female students and male students obtained sig. smaller than 0.05, namely 0.001 and 0.037, which means that the perception is significantly different from the post hoc results of the Anova test as a whole, indicating that the average perception does not have a significant difference. Male students have a more positive perception than female students. Gender differences that exist in students have an influence on student perceptions. Student perceptions can be used as a guide for lecturers to choose learning media that will be used in the classroom. This research can be used as a guideline for the development of student perception assessments on the mathematical physics e-module in the future with an update in this study, namely student perceptions of the mathematics physics e-module based on gender differences.

Keywords*: Student Perception, E-Module, Math Physics*

Perbandingan Persepsi dan Implementasi Matematika Fisika untuk Matriks

Abstrak

Penelitian ini bertujuan untuk mengetahui bagaimana persepsi mahasiswa dan melihat manakah mahasiswa yang memiliki persepsi positif pada e-modul fisika matematika materi matriks berdasarkan perbedaan gender. Jenis penelitian yang digunakan penelitian survei. Pendekatan penelitian yang digunakan adalah penelitian kuantitatif. Populasi penelitian adalah mahasiswa pendidikan fisika universitas Jambi dengan jumlah sampel 120 mahasiswa. Teknik analisis data yang digunakan adalah analisis data statistik deskriptif dan analisis data inferensial dengan uji anova dan post hoc Tukey B. Hasil penelitian melalui uji anova menunjukkan bahwa mahasiswa perempuan dan mahasiswa laki-laki memperoleh nilai sig. lebih kecil dari 0,05 yaitu 0,001 dan 0,037 yang berarti persepsi berbeda secara signifikan dengan hasil post hoc uji anova secara keseluruhan menunjukkan bahwa rata-rata persepsi tidak mempunyai perbedaan yang signifikan. Mahasiswa laki-laki memiliki persepsi yang lebih positif daripada mahasiswa perempuan. Perbedaan gender yang ada pada mahasiswa memberikan pengaruh terhadap persepsi mahasiswa. Persepsi mahasiswa dapat dijadikan sebagai pedoman bagi dosen untuk memilih media pembelajaran yang akan digunakan di dalam kelas. Penelitian ini dapat dijadikan sebagai pedoman untuk pengembangan penilaian persepsi mahasiswa pada e-modul fisika matematika ke depannya dengan pembaharuan dalam penelitian ini yaitu persepsi mahasiswa pada e-modul fiska matematika berdasarkan perbedaan gender.

Kata Kunci: persepsi mahasiswa, e-modul, fisika matematika

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INTRODUCTION

Technological progress is growing rapidly along with the times. The development of science and technology makes the world seem limitless so that students are guided in utilizing science and technology appropriately and positively in the world (Yu et al., 2005; Lin et al., 2018; Sopacua et al., 2020).Technology is directly used as a thinking tool to facilitate learning (Dasgupta et al., 2002; Landry et al., 2006; Garcia et al., 2020). The presence of technology in learning has changed as the type of learning media has increased so that it does not provide any other choice but to participate in using it to solve learning problems (McCormick, 2004; Kola, 2017; Furi & Mustaji, 2017; Warsita, 2017; Widyastono, 2017). To stimulate and trigger students to learn, technology is needed so that the information obtained is not slow and minimal (Chittleborough, 2014; Istiyarti, 2014;Warsita, 2014). Technology is needed to facilitate learning in education.

Education plays an important role in monitoring the development of science and technology to create intelligent, intellectual, peaceful, democratic human resources in the nation-building process (Diansyah et al., 2016; Prastia et al., 2017; Setiawan et al., 2017). Education is a must that must be owned by everyone as an effort to develop potential to face the future so that educational innovations and modern teaching strategies are needed (Asriani et al., 2017; Abood & Deranieh, 2019; Budiyanto et al., 2020; Manek et al., 2020). Education can improve one's abilities by utilizing technology. Education in Indonesia is required to be adapted from 21st century learning models that prioritize meaningful learning processes to address the era of competition (Siswono, 2017;Tristanti & Hidayati, 2020).That way, education can improve one's abilities by utilizing technology. Education is paired with technology as a means of motivating individuals (Rote, 2017; Bice et al., 2018). Interesting learning media can be accepted by students in the digital era 4.0 to keep up with technological developments (Purnami & Winoto, 2020). So that the learning that takes place is not boring but fun by using learning media.

Learning media helps students in understanding learning. Learning media is one of the learning resources that can help students in learning and is also one of the determinants of learning success (Sari & Suswanto, 2017; (Sasongko & Suswanto, 2017). Innovative learning media contains elements of entertainment and does not only contain subject matter to increase students' motivation or interest in learning (Purnomo & Akhlis, 2012; Subali & Handayani, 2012; Williamson et al., 2019). Audio, video, e-text, slides, hypermedia, and others are forms of learning media that are widely used in the teaching and learning process (Mayer et al., 2005; Mcnamara & Shapiro, 2015; Park et al., 2015; Shang, 2017; Stebner et al., 2017; Ge, 2019). Learning media that uses video, images, and audio require smart media tools to record so that students can learn without having to experience directly what they have to learn (Ferawati & Rusilowati, 2012; Leinonen et al., 2016; Vartiainen et al., 2019). So many learning media are used so that students can easily understand learning, one of the learning media that is often used is the module.

The module is one of the teaching materials that can be used independently which contains materials, methods, and evaluations that are designed systematically so that students better understand the material (Barr & Jackson, 2018; Puspa et al., 2018;; Sopacua et al., 2020; Wati et al., 2020). Modules are designed for students to facilitate student learning and independently check student understanding (Egger et al., 2013; Citrawathi et al., 2016; Fortner et al., 2018; Asrial et al., 2020). Besides printed form, there are also electronic modules called

e-modules. E-modules or electronic modules are modules that are presented in digital format containing pieces of learning material followed by questions using a hard disk, diskette, CD, or flash disk and can be read using a computer or electronic book reader which includes audio, animation, and navigation. (Suarsana & Mahayukti, 2013; Li et al., 2016; Patel et al., 2018; Seruni et al., 2019; Sofyan et al., 2019; Agung et al., 2020; Rahmat et al., 2020). Modules are widely used in various subjects at the school level and courses at the university level, one of the subjects that use modules is mathematical physics.

Mathematics Physics is a physics education course which is a combination of physics and mathematics subjects. The purpose of the mathematical physics course is that students have the ability to formulate various physical processes into mathematical statements and be able to solve them analytically, quantitatively, and predictively (Gunada et al., 2017). In the process of learning mathematical physics using printed media, namely the book Mathematical Methods in the Physical Sciences by Mary L. Boas with English language of instruction. The use of foreign languages and terms translated into Indonesian makes it difficult for students to understand so that innovative learning media are needed so that students understand mathematical physics material. Innovative learning media that can be used to make students understand mathematics physics material is e-module. E-modules make learning interesting and not boring because they are equipped with pictures, videos and audio and are also more practical to carry everywhere, and are durable so that they can increase the effectiveness and flexibility of learning (Saputro, 2009; Ummah et al., 2017; Ningtyas et al., 2019; Rahmatika et al., 2020). E – modules can help students learn subject matter independently (Bulte et al., 2006; Wulansari et al., 2018; Asrial et al., 2020; Darmaji et al., 2020). E-modules can help students understand matrix material in mathematical physics seen from the results obtained by students during the use of e-modules, to find out it can be through student perceptions.

Students' perceptions of the media are able to provide information stating that the media is able to help students in learning activities so that students get learning experiences (Pratama et al., 2013; Limatahu et al., 2017; Darmaji et al., 2019). Perception is part of the process of entering messages or information into the human brain related to the senses of sight, hearing, touch, taste and smell which can be important but not ideal (Hostetler, 2014; Asrial et al., 2020; Darmaji et al., 2020). Perception is divided into 2 of them are positive perceptions and negative perceptions. Positive perception is an individual's assessment of an object or information with a positive view or according to the expectations of the perceived object is called a positive perception, while the individual's view that is contrary to expectations of the perceived object or the rules applied is called negative perception (Triyono, 2018; Amin et al., 2019; Darmaji et al., 2020). Everyone has a different perception because each individual has a different interpretation of what they receive (Sipayung, 2015; Purnamaningsih & Ariyanto, 2016). Gender is one of the factors that can make each individual have a different perception, because ethical perceptions are related to demographic aspects and psychological variables(Borkowski & Ugras, 1998; Elias & Farag, 2010) Gender is the difference in roles, functions, characteristics, positions, responsibilities and behavioral rights, both women and men that are formed, created, and socialized by the norms, customs, and beliefs of the local community (Puspitawati, 2010). Given the importance of students' perceptions of e-modules, the researchers conducted this study with the aim of knowing student perceptions based on gender differences in

the mathematical physics e-module material matrix and to find out which students have positive perceptions based on gender differences in the mathematical physics e-module material matrix.

METHOD

This type of research is survey research. Survey research uses a questionnaire as a basic data collection tool starting with the basic theory and ending with an analysis of the measurement data (Maksum, 2002; Pranawati & Tuasikal, 2014). This study uses a quantitative research approach. Quantitative research is researched with a positivist paradigm using data analysis such as questionnaires (Tavakol & Sandars, 2014; Hodis et al., 2016; Koutiva et al., 2016). Quantitative research is based on the study of the philosophy of positivism used in research on a particular population or sample (Cohen et al., 2007; Darmaji, Kurniawan, Astalini, Kurniawan, et al., 2019). In addition, quantitative research was also conducted to investigate causal hypotheses by comparing one or more groups (Creswell, 2012; Syahrial et al., 2019). This study was used to look at the differences in student perceptions as a whole and gender

The population in this study were students of physics education at the University of Jambi, which consisted of 3 classes with a total population of 120 students. The population is an unordered collection of distinct units in the sample, although most sample units cannot provide meaningful information for the population (Thompson & Seber, 1996; Vincent et al., 2016; Qureshi et al., 2018). The sample of this study consisted of 40 students in class A, 40 students in class B, and 40 students in class C. Sampling needs to be determined using the method (Simpson & Lord, 2015). Proper sampling requires a strategy because the number of samples is the total population (Cottrell & Mckenzie, 2011; Akram & Farooqi, 2014; Sumual & Ali, 2017). In taking the population and samples in this study using certain sampling techniques.

The population and sample in this study were taken using purposive sampling technique. The sampling technique with certain considerations or criteria in depth is called purposive sampling (Sugiyono, 2013; Mustofa & Rusdiana, 2016; Melesse & Mekonnen, 2020; Tegeh et al., 2020). Purposive sampling is based on special considerations, namely research needs or what is expected in the research used to obtain research subjects (Sugiyono, 2013; Susilawati et al., 2020; Rahmawati & Anwar, 2020). This study used purposive sampling in sampling because the research sample was determined based on the consideration of online learning used using a PC or cellphone so that to assist students in understanding learning materials, learning media such as e-modules were needed.

The research instrument used in the study was a student perception questionnaire. Questionnaire is a written statement used to collect data from respondents (Arikunto, 2006; Sukerni, 2014; Mauliza & Nurhafidhah, 2018). Instruments that are useful in data processing must go through a validation stage especially as an evaluation tool (Goh & Hu, 2013; Jang & Protacio, 2020). The questionnaire used in this study is a student perception questionnaire adopted from the Riyana (2017) student perception questionnaire with 15 statements.

Quantitative data in this study were obtained using a questionnaire. Google Form is used as a way to distribute questionnaires or questionnaires to students. Questionnaires are a way to collect data using a rating scale (Cohen et al., 2007; Rozak, 2012). In this research, the questionnaire used was made using a Likert scale. The Likert scale is a scale for measuring perceptions related to statements

about a person's attitude towards something developed by Likert (Umar & Husein, 2003; Maryuliana et al., 2016; Pranatawijaya et al., 2019). The research scores given to students have different scores, namely Strongly Agree (SS) = 4 , Agree (S) = 3, Disagree (TS) = 2, and Strongly Disagree (STS) = 1. The categories of The student perception questionnaire given is as follows:

Table 1. *Student Perception Criteria*

Range	Criteria
15,00 – 26,25	Invalid
26,26 – 37,50	Less
37,51 – 48,75	Good
48,76 – 60,00	Excellent

The data analysis technique in this study used descriptive statistical analysis and inferential statistics. Descriptive statistics are used to analyze the data and present the data that has been obtained from the calculation of the mean, median, mode, maximum score, and minimum score (Anindyta & Suwarjo, 2014; Margunayasa, 2014; Shang, 2015; Marquezin et al., 2016; Paramitha & Margunayasa, 2016; Quintela-del-Río & Francisco-Fernández, 2017; Paramita et al., 2019; Hartiyani & Ghufron, 2020). Inferential statistics are used to test hypotheses which consist of prerequisite testing, namely the normality test using the Kolmogorov-Smirnov formula and homogeneity test using the Levene Test, then followed by hypothesis testing, namely the Analysis of Variance (Anova) used to test the difference in the average student perception count. (Y. W. Astuti & Mustadi, 2014; Dewi et al., 2019; Paramita et al., 2019; Lestari & Parmiti, 2020; Zulfa & Haryanto, 2021). The flow chart in this study is as follows:

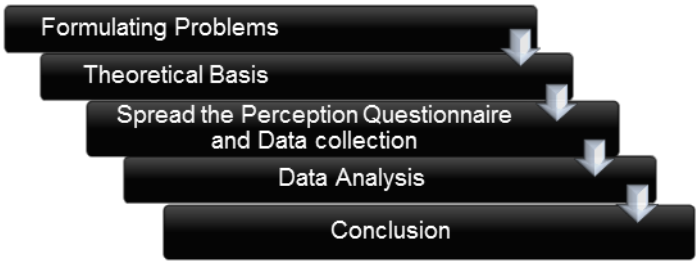

Figure 1. Research flow chart

RESULTS AND DISCUSSION

The results of the research are used as guidelines for the development of student perception assessments on the mathematical physics e-module in the future. The update in this study is to compare student perceptions with gender differences. Gender is the difference in roles, functions, characteristics, positions, responsibilities and behavioral rights, both for women and men (Puspitawati, 2010). In addition, gender is one of the factors that can make each individual have a different perception, because ethical perceptions are related to demographic aspects and psychological variables (Borkowski & Ugras, 1998; Elias & Farag, 2010). The results of the data obtained from the distribution of student perception research questionnaires to students of physics education at Jambi University as many as 120 students consisting of class A, class B, and class C.

1. Perception of Female Students

The results of descriptive statistical data analysis of female students' perceptions of the e-module of physics mathematics matrix material using SPSS 22, can be seen in table 2 below:

Table 2. *Descriptive statistical analysis of female students*

Class	Classsification		Total	%	Mean	Min	Max
	Range	Criteria					
A	15.00 – 26.25	Invalid	0	0	39.5	32	50
	26.26 – 37.50	Less	11	42.2			
	37.51 – 48.75	Good	13	50.2			
	48.76 – 60.00	Excellent	2	7.6			
B	15.00 – 26.25	Invalid	0	0	43.67	33	55
	26.26 – 37.50	Less	3	12.6			
	37.51 – 48.75	Good	16	67.2			
	48.76 – 60.00	Excellent	5	21			
C	15.00 – 26.25	Invalid	0	0	38.26	31	49
	26.26 – 37.50	Less	11	47.3			
	37.51 – 48.75	Good	11	47.3			
	48.76 – 60.00	Excellent	1	4.3			

From table 2, it can be seen that the statistical analysis of female students' perceptions of class A, class B, and class C respectively have a mean of 39.5, 43.67, and 38.26 with good criteria. Even though the three classes of female students are in good criteria based on the mean value, class B has a mean value greater than class A and class C and also class B gets a maximum score greater than the other classes, which is 55. This shows that female students in class B is better at using e-modules in learning mathematics physics on matrix material than classes A and C and is more receptive to using e-modules in understanding mathematics physics learning on matrix material.

After conducting descriptive statistical analysis, then an inferential analysis was carried out, namely the Anova test with the Post Hoc Test, namely Tukey B. However, before carrying out the Anova test, the normality test and homogeneity test were carried out first to see whether the research data were normal and homogeneous. The results of the normality test data using SPSS 22 can be seen in table 3 below:

Table 3. *SPSS Output Normality Test Results*

	Class	Shapiro – Wilk		
		Statistic	df	Sig.
Perception	A	.941	26	.144
	B	.980	24	.902
	C	.968	23	.631

a. Test distribution is normal

From table 3, it can be seen that the results of the SPSS normality test for female students in class A, class B, and class C have a Sig value. of 0.144, 0.902, and 0.631. All three classes get Sig. > 0.05. This means that the perception data of female students in class A, class B, and class C is normal because the value of sig. obtained is greater than 0.05. The homogeneity test was then carried out to see whether the data were homogeneous or not. The homogeneity test was carried out using SPSS 22, the results of the homogeneity test can be seen in table 4 below:

Table 4. *SPSS Output Homogeneity Test Results*

Levene Statistic	df_1	df_2	Sig.
.537	2	70	.587

From table 4, it can be seen that the SPSS output homogeneity test for female students in class A, class B and class C has a sig value. of 0.587. Value of Sig. The results of the homogeneity test of female students' perceptions were greater than 0.05 (0.587 > 0.05). This means that the perception data of female students is homogeneous or the same.

The perception data of female students was normal and homogeneous, then the Anova test was carried out using SPSS 22. The results of the Anova test using SPSS 22 can be seen in table 5 below:

Table 5. *ANOVA*

	Sum of Square	df	Mean Square	F	Sig.
Between Groups	381.951	2	190.976	8.312	.001
Within Groups	1608.268	70	22.975		
Total	1990.219	72			

From table 5, the results of the SPSS Anova test output are obtained which have a sig value. of 0.001. Value of Sig. obtained is small from 0.05, namely 0.001 <0.05. This means that the average perception of female students on the mathematical physics e-module on the matrix material is significantly different. Furthermore, to strengthen the results of the ANOVA test obtained, the ANOVA test was carried out by selecting the Post Hoc Test, namely Tukey B. This test was conducted to see whether the perceptions of female students in the 3 classes differed significantly in the amount of analysis of variance or not. The results of the Anova test with the Post Hoc Test, namely Tukey B, can be seen in table 6 below:

Table 6. *Post Hoc Test*
Homogeneous Subsets

Tukey B [a,b]

Class	N	Subset for alpha = 0.05	
		1	2
C	23	38.2609	
A	26	39.5000	
B	24		43.6667

From table 6 it can be seen that there are 2 subsets for data on female students' perceptions. In subset 1 there is data on the perception of female students in class C and class A. This means that the average perception of class C and class A students does not have a significant difference or in other words, the average perception of female students in class C and class A is the same. Then, in subset 2 there is data on the perception of female students in class B. This means that the average perception of female students in class B does not have a significant difference or in other words the perception of female students in class B is the same.

Perceptions of female students based on descriptive statistical analysis of the study showed the mean value on good criteria, but female students in class B showed better perceptions than class A and class C so that in the use of e-

modules in learning mathematics physics on matrix material class B was better than class B. A and class C. Based on the inferential analysis using assumption test and hypothesis testing, research results are obtained that support the results of descriptive statistical analysis. The results of the assumption test through the normality test and homogeneity test show that the perception data of female students is normal and homogeneous by looking at the sig value. greater than 0.05. After knowing the perception data of female students are normal and homogeneous, hypothesis testing is carried out through the Anova test. The Anova test showed that the perceptions of female students were significantly different. The results of the Anova test are also supported by the post hoc test, namely Tukey b in the ANOVA test. The results obtained in Tukey B show that the average perception of female students in class A and C does not have a significant difference or the same as in subset 1, while the average perception of female students in class B also does not have a significant difference or the same as in subset 1 in subset 2. The perception of class B female students is different from that of class A and class C. The perception of class B female students is better than that of class A and class C based on the research results obtained. This means that female students in class B have a more positive perception in the use of e-modules in learning mathematics physics on matrix material. Class B female students are already able to take advantage of technological advances through learning media such as e-modules. Female students in class A and class C have also been able to take advantage of technological advances in understanding learning, it's just that female students in these two classes still can't use e-modules better than female students in class B, which is shown through the perceptions given by these students. Student perceptions can be used as an assessment to see that students take advantage of technological advances in learning such as the use of e-modules in mathematics physics learning on matrix material. Students' perceptions of the media are able to provide the right information to get learning experiences in learning activities (Pratama et al., 2013; Limatahu et al., 2017; Darmaji et al., 2019).

2. Male Student Perception

The results of the analysis of descriptive statistical data on male students' perceptions of the e-module mathematics physics matrix material using SPSS 22, can be seen in table 7 below:

Table 7. *Descriptive statistical analysis of male students*

Class	Classsification		Total	%	Mean	Min	Max
	Range	Criteria					
A	15.00 – 26.25	Invalid	0	0	40.21	33	48
	26.26 – 37.50	Less	4	28.4			
	37.51 – 48.75	Good	10	71.6			
	48.76 – 60.00	Excellent	0	0			
B	15.00 – 26.25	Invalid	0	0	45.37	37	55
	26.26 – 37.50	Less	1	6.3			
	37.51 – 48.75	Good	10	63			
	48.76 – 60.00	Excellent	5	31.5			
C	15.00 – 26.25	Invalid	0	0	44.11	30	55
	26.26 – 37.50	Less	2	11.8			
	37.51 – 48.75	Good	10	59			
	48.76 – 60.00	Excellent	5	29.5			

From table 7 it can be seen that the statistical analysis of male students' perceptions of class A, class B, and class C respectively have a mean of 40.21, 45.37, and 44.11 with good criteria. The perceptions of male students in the three classes are in good criteria based on the mean value, but class B has a mean value greater than class A and class C. However, the maximum score obtained by class B and class C is the same, namely 55 with good criteria and also the difference in mean between class B and C is not as far as class A. This shows that male students in class B and class C are better at using e-modules in learning mathematics physics on matrix material than class A and more receptive to using e-modules. in understanding mathematics physics learning on matrix material.

After conducting descriptive statistical analysis, then an inferential analysis was carried out, namely the ANOVA test with the Post Hoc Test, namely Tukey B. However, before carrying out the ANOVA test, the normality test and homogeneity test were carried out first to see whether the research data were normal and homogeneous. The results of the normality test data using SPSS 22 which can be seen in table 8 below:

Table 8. *SPSS Output Normality Test Results*

	Class	Shapiro – Wilk		
		Statistic	**df**	**Sig.**
Perception	A	.964	14	.786
	B	.970	16	.835
	C	.975	17	.904

b. Test distribution is normal

From table 8 it can be seen that the SPSS output results of the normality test for male students in class A, class B, and class C have a Sig value. of 0.786, 0.835, and 0.904. All three classes get Sig. > 0.05. This means that the perception data of female students in class A, class B, and class C is normal because the value of sig. obtained is greater than 0.05. The homogeneity test was then carried out to see whether the data were homogeneous or not. The homogeneity test was carried out using SPSS 22, the results of the homogeneity test can be seen in table 9 below:

Table 9. *SPSS Output Homogeneity Test Results*

Levene Statistic	**df_1**	**df_2**	**Sig.**
1.092	2	44	.344

From table 9, the results of the SPSS homogeneity test for male students in class A, class B and class C have a sig value. of 0.344. Value of Sig. The results of the homogeneity test of female students' perceptions were greater than 0.05 (0.344 > 0.05). This means that the perception data of female students is homogeneous or the same.

The perception data of female students was normal and homogeneous, then the Anova test was carried out using SPSS 22. The results of the Anova test using SPSS 22 can be seen in table 10 below:

Table 10. *ANOVA*

	Sum of Square	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	213,235	2	106,617	3,554	,037
Within Groups	1319,872	44	29,997		
Total	1533,106	46			

From table 10, the results of the SPSS Anova test output are obtained which have a sig value. of 0.037. Value of Sig. obtained is small from 0.05, namely 0.037 <0.05. This means that the average perception of male students on the mathematics physics e-module matrix material is significantly different. Furthermore, to strengthen the results of the ANOVA test obtained, the ANOVA test was carried out by selecting the Post Hoc Test, namely Tukey B. This test was conducted to see whether the perceptions of male students in the 3 classes differed significantly in the number of analysis of variance or not. The results of the Anova test with the Post Hoc Test, namely Tukey B, can be seen in table 11 below:

Table 11. *Post Hoc Test Homogeneous Subsets*

Tukey B [a,b]

Class	N	Subset for alpha = 0.05	
		1	2
A	14	40,2143	
C	17	44,1176	44,1176
B	16		45,3750

From table 11 it can be seen that there are 2 subsets for the perception data of male students. In subset 1 there is data on the perception of male students in class A and class C, this means that the average perception of male students in the class does not have a significant difference or in other words the average perception of male students in the class is the same. Then, in subset 2 there is data on the perception of male students in class C and class B, this means that the average perception of male students in that class does not have a significant difference or in other words the perception of male students in the class is same.

Perceptions of male students based on descriptive statistical analysis of the study showed the mean value on the criteria was good, but male students in class B showed better perceptions than class A and class C, but male students in class B and class C had the same mean value. very close compared to class A even though the mean value of class B is still superior to the two classes, so it can be said that in the use of e-modules in mathematics physics learning in the matrix material, male students in class B are better than class A and class C. Based on the analysis inferential by using assumption test and hypothesis test, the research result that supports the result of descriptive statistical analysis is obtained. The results of the assumption test through the normality test and homogeneity test show that the perception data of male students is normal and homogeneous by looking at the sig value. greater than 0.05. After knowing the perception data of male students are normal and homogeneous, hypothesis testing is carried out through the ANOVA test. The ANOVA test showed that the perceptions of male students were significantly different. The results of the ANOVA test are also supported by the post hoc test, namely Tukey b in the ANOVA test. The results obtained in Tukey B indicate that the average perception of male students in class A and C does not have a significant difference or is the same as in subset 1, while the average perception of male students in class C and class B also does not have a significant difference. The difference is significant or the same in subset 2. From Tukey B's post hoc results, only the perception of male students in class

A is different from other classes. In line with the results of descriptive statistical analysis, male students in class B and class C do better in class A. This means that male students in class B and C have a more positive perception in the use of e-modules in mathematical physics matrix material. Student perceptions can be used as an assessment for choosing learning media that utilize technological advances so that they can easily understand learning materials. And it can also increase students' motivation or interest in learning through innovative learning media that contains elements of entertainment (Purnomo & Akhlis, 2012; Subali & Handayani, 2012; Williamson et al., 2019).

Perception is a person's assessment of an object or information through their respective perspectives. Students' perceptions of the physics-mathematical e-module can be used as an assessment for lecturers to see student understanding in understanding matrix material through learning media such as e-modules. The results of the research on student perceptions based on gender differences in the mathematical physics e-module matrix material showed that male students' perceptions were more positive than female students based on descriptive statistical analysis and inferential analysis. Male students show a positive perception that the use of e-modules in mathematics physics matrix material is easier and more practical because the e-modules are easy to understand because the e-modules not only contain learning materials but also videos that support the understanding of learning materials and are easy to carry everywhere. The e-module can be accessed using a smartphone, providing its own convenience for male students. For male students, apart from being able to understand the learning material, the use of e-modules in mathematical physics and matrix materials can also improve their ability to work on questions without having to carry thick and heavy printed books. Male students prefer a simple and fun way of learning without having to be complicated but can improve their abilities. The use of e-modules in mathematical physics matrix material is the right medium to be used in the learning process. While female students tend to have negative perceptions in the use of e-modules because female students tend to prefer to use printed books as learning media rather than using electronic-based learning media such as e-modules. Female students do not have a problem if they have to bring thick printed books as learning resources and also notebooks used to record learning materials from the book. Because female students like everything that is neatly arranged, they also prefer to make neat and easy-to-understand notes about matrix material in written books based on printed books rather than e-modules. The way of learning applied by female students is not wrong but it should be realized that as the times progress, technological advances in education are growing rapidly so that the use of printed books as learning media will turn into electronic books such as e-modules that are practical and flexible to use anywhere and anytime. And the use of e-modules can also provide convenience for students, namely they no longer need to carry heavy and thick printed books in every mathematical physics learning activity. E-modules not only contain text such as printed books but also contain pictures, audio, video and animation as well as formative tests or quizzes that can make it easier for students to understand learning materials (Suarsana & Mahayukti, 2013; Li et al., 2016; Patel et al., 2018; Sofyan et al., 2019; Rahmat et al., 2020). So that the use of e-modules in mathematical physics allows students to easily understand matrix material easily and flexibly.

Gender is a cultural concept that seeks to make a distinction, namely in terms of the roles, behavior, mentality, and emotional characteristics of men and women

who develop in society as described by the Women's Studies Encyclopedia (Munawaroh et al., 2020). Gender differences in students' perceptions of the e-module physics-mathematics matrix material based on the results of the study showed that male students were more dominant than female students. This means that male students strongly support the role of technology in education through e-modules compared to female students. Male students tend to prefer flexible learning and not just at home and at school like female students. E-modules help male students learn without being limited by space and time. With the e-module, male students are more motivated and active in learning mathematics and physics.

The e-module which is used as a learning media for mathematics and physics helps students to understand the matrix material without waiting for an explanation from the lecturer in class. The use of e-modules can increase students' interest and motivation in learning mathematical physics so that students obtain satisfactory learning outcomes. Students can improve their ability to work on mathematical physics problems on matrix material through e-modules. Research on student perceptions on the e-module of physics-mathematics matrix material based on gender differences can be a guide for further research. Further researchers can conduct research on student perceptions of the physics-mathematical e-module with materials that have not been previously used by researchers on student learning outcomes based on gender differences.

CONCLUSION

The results of the study were analyzed using descriptive statistical analysis and inferential analysis which showed that students' perceptions based on gender differences in the e-module of physics-mathematics matrix material were different. Female students in class B have better perceptions than female students in class A and class C, which is shown through descriptive statistical analysis with the mean value of class B being greater than class A and class C. The descriptive statistical results are supported by the results of inferential analysis, namely through the ANOVA test which obtained a sig value. smaller than 0.05. This means that the perception of female students is significantly different. The results of the ANOVA test are also supported by the post hoc test, namely Tukey b in the ANOVA test. The results obtained in Tukey B show that the average perception of female students in class A and C does not have a significant difference or the same as in subset 1, while the average perception of female students in class B also does not have a significant difference or the same as in subset 1 in subset 2. Male students showed that the perception of male students in class B and class C was better than in class A which was shown through descriptive statistical analysis that the mean value of class B and class C was greater than class A. And also the results inferential analysis through the ANOVA test showed that the value of sig. obtained is smaller than 0.05. This means that the perception of male students is significantly different. The results of the ANOVA test are also supported by the post hoc test, namely Tukey b with the result that only the perception of male students in class A is different from other classes. Through the results of the study, it can be said that the perception of male students has a more positive and dominant perception than female students. Research on student perceptions of the e-module of physics-mathematics matrix material based on gender differences can be a guide for further research. Further researchers can conduct research on student perceptions of the physics-mathematical e-module with materials that have not

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