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Students' Perceptions of the Physics-Mathematical E-Module on Partial Differential Material Based on Gender

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Abstract

Some obstacles in teaching and learning activities could be seen in the lack of teaching materials that students could easily understand. This is because the main books used are books in English as a whole. Therefore, the researcher developed an electronic book, namely the e-module of mathematical physics I on partial differential material created using 3D Page Flip Professional application. The type of research used is a comparative type of quantitative research. The population in this study were students of Physics education class 2019 with a sample of 80 regular classes A and B. The sampling technique used is simple random sampling. The data were analysed by descriptive and inferential statistics using IBM SPSS Statistic 25 application consisting of descriptive test, normality test, homogeneity test, and t-test. In the assumption test, the data is normally distributed and homogeneous so that a t-test can be performed. The t-test obtained a sig value of 0,043 for gender differences in class A and 0,010 for gender differences in class B. Therefore, it can be concluded that Ho is rejected and Ha is accepted, meaning that there are significant (significant) differences in perceptions based on gender in each class A and B. Meanwhile, the perception of female students is higher than the perception of male students, but overall students gave a good perception of the mathematics physics e-module on partial differential material.

Keywords: Mathematical Physics, Perception, E-Module, Gender

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1. INTRODUCTION

The development of times has changed many things to provide new challenges for humans. As in the 21st century which is a big challenge in the world of education, where education has an important role in human life (Astalini et al., 2018; Syafrijal & Desyandri, 2019). Education is needed by students to achieve their goals because education help students to develop their potential to produce good quality human resources and to meet their needs. In this case, a developed country can be seen from the quality of education (Astalini, Kurniawan, & Putri, 2018; Diani & Hartati, 2018; Astalini et al., 2019). In line with the 4.0 era, changes in the world of education are growing rapidly to encourage creativity and high competitiveness and demand modern education management (Yayang, 2019). Therefore, the world of education needs to be prepared to face all its development, such as through technology.

Technological developments are very influential in the world of education. The development of technology is increasing rapidly, making everything in the world of education easier and various innovations can be made to meet the learning needs of students and can be accessed via the internet (Khasawneh et al., 2016). It can be said that the development of technology (ICT) is very rapid in the field of education, with the emergence of technology-based activities such as e-commerce, e-government, e-medicine, e-laboratory, and digital-based e-education (Syahrowardi & Permana, 2016; Diani & Hartati, 2018). Utilization technology as digital hardware and software is used to improve the effectiveness, efficiency, and attractiveness of learning through e-learning where the dissemination of

information can be easily reached by everyone (Wardoyo & Article, 2016). So that e-learning can be used as an alternative to optimizing technological developments.

E-learning is a platform that can support the learning process. E-learning appears to meet the challenges posed by the development of information technology that offers a new way in the world of education for greater access and can improve students' communication skills (Aldhafeeri et al., 2006; Greenhow et al., 2009; Augustine, 2016). This e-learning provides innovation for teachers, where teachers act as facilitators and students as knowledge constructors who can learn anytime and anywhere (Maudiarti, 2018; Sadikin & Hakim, 2019). Many educational institutions have implemented e-learning with various applications, but success in learning is not only determined by human resource factors but also the selection of models, methods, strategies, to the selection of teaching materials (Andani, 2020; Fatkhiyani & Dewi, 2020; Febliza & Okatariani, 2020). Many teaching materials can be used, one of them is an e-module.

Teaching materials are a set of learning tools that are important in helping students learn a particular material (Irawati & Saifuddin, 2018; Rismaningtyas, Slamet, Kurniawati, & Pranoto, 2019; Syafrijal & Desyandri, 2019). The teaching materials used must be chosen appropriately, well, and interestingly, such as in the form of soft files so that they can facilitate learning and help students achieve the expected competencies (Rizki & Linuhung, 2016). Modules that are in line with times are electronic-based modules or e-modules that aim to enable students to study independently (Sofyan, Angereini, & Saadiah, 2019; Ilmi, Arnawa, Yerizon, & Bakar, 2021). Therefore, the module used must meet the requirements and be attractive. In this study, researchers used a flipbook-based e-module using a professional 3D page flip on mathematical physics material, namely partial derivatives.

Mathematical physics is a combination of physics and mathematics subjects and is considered a compulsory subject for students of physics education at the University of Jambi (Yanti, Trisna, Usmeldi, & Ramli, 2016). The topics discussed are related to advanced courses such as mechanics, modern physics, etc., which contain a description of the problem and how to solve it (Saputri, Fadilah, & Wahyudi, 2016; Cape, 2018; Bustami, Ngadimin, & Farhan, 2020). So far, the study program only relied on the book Mathematical Methods in the Physical Sciences written by Mary L. Boas as the main book for the Mathematics Physics I course which uses English, making it quite difficult for the students to understand. Whereas the use of teaching materials acts as a tool and in improving the quality of learning so that the materials and concepts are conveyed properly, the improvement in quality or quality itself can be measured by looking at students' perceptions of the e-modules made (Pathoni, Jufrida, Saoutri, & Sari, 2017; Jazuli, Azizah, & Meita, 2018; Darmaji, Astalini, & Kurniawan, 2019). Perception is someone’s perspective through the process of the five senses to achieve awareness and requires certain items in understanding information (Sickle, 2016; Qiong, 2017; Yunita & Maisarah, 2020). This perception is carried out to find out how students view the e-module of mathematics physics I on partial differential material using 3D page flip professional software. 3D page flip professional software is an application used to create flipbooks or e-books, e-papers, e-magazines, etc., which can be published in various formats (Bakri, Siahaan, & Permana, 2016). This perception will also look at perceptions based on gender differences, where gender differences are the differences in characteristics, traits, and ways of thinking between males and females (Desiningrum, 2015; Anggoro, 2016). Therefore, gender can be a factor that distinguishes perceptions between students.

The relevant research stated that e-module provides convenience for students, but the resulting e-module cannot be displayed in 3D (Pratono et al., 2018; Triwahyuningtyas et al., 2020). The use of e-modules can provide benefits to students (Nisa et al., 2020; Pathoni et al., 2017). Based on the research that has been done, none of them discusses flipbook-based e-modules in mathematics physics courses on partial differential material and perceptions of e-

modules based on gender. Therefore, the researchers tried to research gender-based perceptions of the physics-mathematical e-module. Based on the description above, there are several objectives of this study, namely to determine the perceptions of students in class A and B, to determine the differences in student perceptions based on gender differences in both class A and class B on the E-Module of Mathematics Physics on partial differential material.

2. METHODS

The type of research used is quantitative research with a comparative type. Quantitative research is a type of research that produces data in form of numbers about a phenomenon and analyses the data using statistical data (Hendri, Pramudya, Ika, & Pratiwi, 2020). Comparative research is used to compare two or more research variables. In addition, this study was used to see student perceptions in which the data came from questionnaires, about the students' assessments for the e-modules made by the researchers (Pathoni et al., 2017; Darmaji, Kurniawan, et al., 2019). The data collection instrument used in this study was a questionnaire. A questionnaire is an evaluation tool that contains several questions/statements that must be filled out by the respondents to obtain information (Irwansyah, Lubab, Farida, & Ramdhani, 2017) . This questionnaire uses the Likert scale 4. The Likert scale is a rating scale developed by Likert to measure something systematically and consists of four or more answer choices (Joshi, Kale, Chandel, & Pal, 2015). Likert scale (1-4) is designed to measure the perception of a person or group of people where a score of 1 to 4 is divided into 1 (not very good), 2 (not good), 3 (good), and 4 (very good) (Darmaji, Kurniawan, et al., 2019; Pranatawijaya & Priscilla, 2019). The grid of students' perception questionnaire instruments is shown in Table 1 below. Table 1 shows the student perception questionnaire grid consisting of three variables, namely appearance, material, and benefits, with 10 indicators and 15 positive statements.

Table 1. Student perception questionnaire

Variable	Indicator
Display e-module	1. Text clarity
	2. Clarity of images, animations, videos, and simulations
	3. Draw pictures, animations, videos, and simulations
E-module material	1. Presentation of material
	2. Clarity of sentences
	3. The suitability of the sample with the material
	4. Suitability of images, animations, videos, and simulations
Benefits of e-modules	1. Ease of learning
	2. Interest in using e-modules
	3. Increased learning motivation

Table 2. Perception questionnaire quantitative criteria score range

Range	Criteria
48,76 – 60,00	Very good
37,51 – 48,75	Good
36,36 – 37,50	Not good
15,00 – 26,25	Not very good

Table 2 shows the range of students' perception questionnaire scores consisting of 4 ranges and 4 criteria. The target in this study was physics education students batch 2019 FKIP Jambi University who had contracted the mathematics physics course I as the

population. Population is the entire object under study and has certain characteristics that are important in research (Asiamah, Mensah, & Oteng-Abayie, 2017; Nasution, 2017). While sample is a part of the population that represents the population but also could represent the data or the target as a whole (Otzen & Manterola, 2017). The sample used in this study were 80 students from Regular A and B classes consisting of 34 male students and 46 female students. The sampling technique used in this research is simple random sampling. Simple random sampling is a sampling technique that is carried out randomly in the management of the questionnaire (Dewa, Mukin, & Pandango, 2020; Owusu-Fordjour, Koomson, & Hanson, 2020).

The data analysis techniques used in this research were comparative analysis and inferential analysis. Comparative data analysis is used to compare perceptions with two or more variables. While statistical inferential data analysis was carried out with non-parametric types, namely t-test or independent sample t-test which used to see the differences in the students' perceptions in class A and B or based on gender differences in each class (Zhu, Srivastava, Ibrahim, Patro, & Love, 2019). Before the t-test is carried out, an assumption test or prerequisite test is carried out consisting of normality and homogeneity tests (Huda et al., 2020; Suprianto, Ahmadi, & Suminar, 2019).

The normality test was carried out to see whether the data were normally distributed or not as seen from the significance value. The guideline for decision-making is if the significant value is < 0.05 the data is not normal and vice versa, if the significance value is > 0.05 the data is normal. The normality test of the data distribution used was the Kolmogorov Smirnov test using SPSS. The homogeneity test of the data was carried out to see the level of homogeneity with the assumption that the data was homogeneous by looking at Levine's Test for Equality of Variance on SPSS software with the test criteria used were sig > with a level of = 0.05. The t statistic test shows how far the influence of one independent variable individually in explaining the variation of the dependent variable. The test is carried out using a significance level of 0.05 (a = 5%). Acceptance or rejection of the hypothesis is done with the criteria, if the significant value of t < 0.05 then H0 is rejected, meaning that there is a significant influence between one independent variable on the dependent variable. Meanwhile, if the significant value of t > 0.05 then H0 is accepted, meaning that there is no significant effect between one independent variable on the dependent variable. The research process carried out can be described in the following chart:

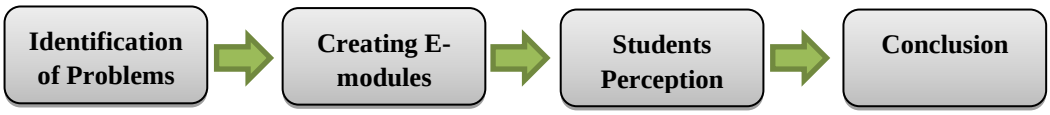

Figure 1. Research flow chart

3. RESULTS AND DISCUSSION

Results

This research was conducted on students of physics education class 2019 specifically the regular classes A and B consisting of 40 students in total. This study aims to see how students perceive the e-module of mathematics physics I based on the Professional 3D Page Flip application on Partial Differential material. This perception was obtained from a questionnaire distributed via a google form. The questionnaire contains 15 positive statements with 4 answer choices, namely strongly agree, agree, disagree, and strongly disagree. The data obtained in the questionnaire were analysed using IBM SPSS Statistic 25 that consisted of the students' perceptions in class A and B, students' perceptions in class A, students' perceptions in class B, students' perceptions in class A based on gender, and

students' perceptions in class B based on gender. The results of data analysis show that the descriptive results of the students' perceptions in class A and B were dominantly in good categories with a percentage of 61,3% and the acquisition of the mean or average value of 46,51, the median or mean value of the data 45,50, mode 42, the minimum value or the lowest value is 37, the maximum value or the highest value is 58, and the standard deviation is 5,816. After the general descriptive test has been conducted, it could be followed by a descriptive test based on class to see the descriptive results in each class.

In class A which consists of 40 students, the results show that most of the students have a perception in the good category with a percentage of 65% with an average score of 46,55, a minimum value of 42, a maximum value of 58, and a standard deviation of 54,39. As for class B which also consists of 40 students, the results show that most of the students have perceptions in the good category where the average value is 46,48, the minimum value is 37, the maximum value is 57, and the standard deviation is 6,239. Overall, the students have a good perception of the developed e-modules. To determine differences in perceptions in A and B classes based on gender, the data were analyzed using inferential statistics. In this inferential statistic, the data is tested based on assumption test and hypothesis test. The assumption test consists of normality test and homogeneity test. While the hypothesis test is done by using t-test. The data were also obtained from a questionnaire that was analyzed using IBM SPSS Statistics 25.

If the prerequisite test has been done, it can be continued with hypothesis testing. The hypothesis test used is t-test (independent sample t-test) for both classes. Independent sample t-test or t-test is part of parametric inferential statistics. This test is carried out to see whether there are differences or comparisons between the two samples or not. The results of t-test in classes A and B showed the significance value is 0,954. It means that the value of sig> 0,05 and there is no difference in the average perception of A and B classes. To know the differences in perceptions between class A and class B, this study also shows differences in perceptions based on gender in each class. This difference is obtained by performing a t-test. F symbolizes female students and M symbolizes male students. In class A, the significance value is 0,043 with the average value of female students is 47,96, while the average value of male students is 44.44, which means there is a significant average difference between students' perceptions of the average value. As for class B, the significance is 0,010 where the average value of female students is 48.73 and the average value of male students is 43,72, which means there is a significant difference in the average score between female and male students in class B on the physics-mathematical e-module in partial differential material.

This study was conducted to see the perceptions of students of physics education class 2019 in class A and B by conducting a descriptive test to see the descriptive results of perceptions and a t-test to see whether there were differences in student perceptions or not based on gender. The descriptive test for the students' perceptions in class A and B was carried out with 80 students as the sample, consisting of 40 students of class A and 40 students of class B. The results of the descriptive test found that 6,3% (5 students) stated that the e-module is not good, 61,3% (49 students) stated that the e-module is good, and 32,5% (26 students) stated that this e-module is in the very good category. In addition, the statistical distribution consist of mean, median, mode, minimum, maximum, and standard deviation shows that the mean or average value is 46,51, the median or mean value of the data is 45,50, the mode is 42, the minimum or lowest value is 37, the maximum or highest value is 58, and the standard deviation is 5,816. Overall, the students have a good perception of the developed e-modules.

To conduct a general perception analysis, a descriptive analysis of perceptions was also conducted in class A and B. In class A, 5% (2 students) stated that the e-module is not good, 65% (26 students) stated that the e-module is good, and 30% (12 students) stated that

the e-module is very good with the mean value of 46,54, minimum score of 37, maximum value of 58, and standard deviation of 5,439. As for class B, 7,5% (3 students) stated that the e-module is not good, 57.5% (23 students) stated that the e-module is good, and 35% (14 students) stated that the e-module is very good with the mean value of 46,48, minimum value of 37, maximum value of 57, and standard deviation of 6,239. Overall, the students have a good perception of the developed e-module.

Discussion

Perception is someone's perspective in understanding information consciously (Sickle, 2016; Qiong, 2017; Yunita & Maisarah, 2020). This perception was carried out to see how the perceptions of students in grades A and B, as well as the differences in perceptions between classes A and B based on gender, namely male and female, on the physics-mathematical e-module that had been made. The advantage of the developed e-module is it uses an electronic format that can be displayed using electronic devices or special software so it is more practical to carry and use anywhere and anytime. After conducting a descriptive test in each class, then an analysis of the differences in perceptions in class A and B and each class was carried out based on gender differences. To obtain information about perceptions based on gender differences, assumption tests and hypothesis tests were carried out. This assumption test is carried out as a condition for testing the hypothesis which consists of normality and homogeneity tests (Nurvianti & Syarkowi, 2018; Suprianto et al., 2019).

Gender is a characteristic that is placed on males and females so that it can cause different perceptions. Meanwhile, gender differences are differences in characteristics, traits, and ways of thinking between males and females (Desiningrum, 2015; Anggoro, 2016). Based on the results of the research conducted, it is found that the average perception of female students was higher than the perception of male students because female students tend to judge things based on stimuli that are influenced by various factors. Based on the results of research conducted, differences in student perceptions could be seen from the average value.

In conclusion, this study provides an overview of students' perceptions toward the mathematical physics e-module on partial differential material in which most of the students stated that the e-module is good and feasible to use. This perception is necessary because it has an impact on the continuity of the learning process. The results of this perception are expected to be able to help students understand mathematics physics material and pass this course because the e-modules made are packaged in Indonesian, which is easy to understand. In addition, it is hoped that students can prepare themselves to improve their pedagogic abilities as future lecturers, especially in physics subjects or mathematics physics courses. This research is limited to the students' perceptions of the developed e-modules.

4. CONCLUSION

Based on the results of this research, it is found that there is no different perception between the students in the two classes. However, there are significant differences between female and male students in each class. Therefore, gender can be said as one of the factors that influence differences in perception.

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