



Students' Perceptions of Mathematical Physics E-Module on Multiple Integral Material

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ABSTRAK

Fisika Matematika sering dianggap mata kuliah yang sangat sulit untuk dipelajari, salah satu alasan yang membuat hal tersebut terjadi ialah kurangnya media pembelajaran yang mendukung mahasiswa. Selain itu, media yang sudah ada kebanyakan berbahasa asing sehingga dalam hal ini diperlukan sebuah media pembelajaran berbahasa Indonesia, yaitu e-modul fisika matematika pada materi integral ganda. Penelitian ini bertujuan untuk melihat level persepsi mahasiswa terhadap e-modul fisika matematika materi integral ganda yang sudah dibuat. Pendekatan penelitian ini menggunakan mixed method dengan model explanatory. Teknik pengambilan sampel pada penelitian ini ialah purposive sampling dengan subjek penelitian 68 mahasiswa aktif pendidikan fisika yang mengontrak mata kuliah Fisika Matematika. Instrumen yang digunakan dalam penelitian ini berupa angket persepsi mahasiswa berjumlah 15 pertanyaan dan lembar wawancara sebanyak 10 pertanyaan. Analisis data yang digunakan pada penelitian ini ialah statistik deskriptif. Hasil persepsi mahasiswa pendidikan fisika terhadap e-modul fisika matematika materi integral ganda dikategorikan baik dengan presentase 66,17% dan dikategorikan sangat baik dengan presentase 33,83%. Dari hasil dapat diketahui bahwa e-modul fisika matematika pada materi integral ganda dapat mendukung proses pembelajaran dan meningkatkan motivasi mahasiswa.

ABSTRACT

Mathematical physics is often considered a very difficult subject to study, one of the reasons that makes this happen is the lack of learning media that supports students. In addition, most of the existing media are in foreign languages, so in this case we need an Indonesian language learning media, namely the mathematical physics e-module on dual integral material. This study aims to see the level of students' perceptions of the mathematics physics e-module on the dual integral material that has been made. The approach of this study uses a mixed method with an explanatory model. The sampling technique in this research was purposive sampling with 68 research subjects active physics education students who contracted Mathematics Physics courses. The instrument used in this study was a student perception questionnaire with 15 questions and an interview sheet with 10 questions. The data analysis used in this research is descriptive statistics. The results of physics education students' perceptions of the mathematics physics e-module of multiple internal material were categorized as good with a percentage of 66.17% and in the very good category with a percentage of 33.83%. From the results it can be seen that the mathematical physics e-module on dual integral material can support the learning process and increase student motivation.

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1. INTRODUCTION

Technology in the 21st century has advanced in various sectors of everyday human life (Bervell & Umar, 2017; Lase, 2019; Ong et al., 2020; Weng et al., 2019). In view of this, technology also has a large and significant share in the development of education (Raja & Nagasubramani, 2018; Buchanan et al., 2019). Educational technology in helping students and educators can be said to be a very effective partner or tool (Bingimlas, 2009; Putrawangsa & Hasanah, 2018; Hidayat et al., 2020) Aids used in the field of education have a function as a presentation of information for teachers and learning resources for students (Astashova et al., 2017; Muhametjanova & Akmatbekova, 2019) In presenting information, there are various forms, one of which is electronic based, one of the electronic based material presentations that educators often use is electronic modules (e-modules). The use of learning media is believed to be able to help students in learning especially in mathematical physics lessons. Mathematical physics as the name suggests contains analytical equations

regarding theoretical physics which are solved using mathematical equations (Tandililing, 2015; Gunada et al., 2017; Saputri et al., 2016). The results of several previous studies from several experts show that most college students experience difficulties and also get unsatisfactory grades (Ellianawati & Wahyuni, 2012; Marisda, 2019). Most of the students thought that the media used, namely the Mathematics Physics book, was still in a foreign language, so that in this case students had difficulties both in terms of explaining the material and analyzing the equations contained in the source material. In addition, previous research stated that examples of application and discussion in the textbook of mathematical physics, namely Mathematical Methods in the Physical Sciences written by Mary L. Boas, which are 839 pages thick, are still lacking (Ellianawati & Wahyuni, 2012). As stated by This indicates the need for mathematical physics teaching materials which contain more examples of questions and their discussion. So in this case, the researcher wants to see the students' perceptions of the mathematical physics e-module on the dual integral material.

Science is one of the studies that has a complex and abstract nature, in this case it requires high teacher skills in teaching and the selection of learning media (Finley et al., 1982; Furner & Kumar, 2007; Taştan et al., 2018). One of the objectives of learning science is to introduce students to scientific concepts in everyday life (Muakhirin, 2014; Suryaningsih, 2017; Faize et al., 2018). The concepts in science learning do not necessarily come from the results and data analysis but come from the human brain that has thoughts through imagination and the curiosity of scientists (Muna et al., 2017; Gunawan et al., 2018; Sumarni et al., 2019). In science itself, it can be divided into several fields that have different studies, one of which is Physics. Physics is one of the scientific studies that studies how the influence or a complex phenomenon is then used as a concept or theory (Trianggono, 2017; Wartono et al., 2018). With physics learning, phenomena that occur through observation are not only observed but also look for problem solving and solutions that are drawn from the human mind (Lesmono et al., 2012; Darmaji et al., 2019; Huseby & Bungum, 2019). In education, physics has various applications that are very important in advancing students and educators themselves (Wambugu & Changeiywo, 2008; Shishigu et al., 2018). Specifically, physics has various other fields of study that specifically discuss a material, one of the fields of study of physics that is specifically taught in higher education is Mathematical Physics. In addition to this, the attractiveness of learning is also a very important key in helping to understand material that is quite difficult, the attractiveness of learning can be found in the use of interactive e-modules that are integrated with the Mathematics Physics course, folding integral material.

Electronic-based modules or better known as e-modules are innovative learning media whose access is integrated with software supported by e-module access applications (Priatna et al., 2017; Matsun et al., 2019; Linda et al., 2018). The completeness of the contents of the e-module is in the form of a synthesis of issues and materials whose presentation can be viewed using electronic goods (Gavrilenko, 2018; Pratono et al., 2018; Elvarita et al., 2020). A good e-module can be arranged based on students' abilities and has a systematic order of presentation (Jaenudin et al., 2017; Laili et al., 2019; Afriyanti et al., 2021). According to several previous studies from experts (Istuningsih et al., 2018; Sitorus et al., 2019; Hadiyanti et al., 2021) it was found that the use of e-modules can help students effectively absorb the material taught by educators. The material used in the e-module can be selected according to the needs of the educator, in science learning itself this e-module is very useful as a simplification of material, some of which have complex and abstract properties.

The e-module being developed is an e-module that is integrated with Mathematical Physics I material, namely Multiple Integral. Mathematical physics is a combination of physics and mathematics subjects. Mathematical physics aims to make students have the ability to formulate various physics processes into mathematical statements and be able to solve them analytically, quantitatively, and predictive based on the reasoning model formulated (Tandililing, 2015; Saputri et al., 2016; Gunada et al., 2017). Mathematical physics is often considered difficult to learn due to several factors, one of which is the learning media used in foreign languages and the use of words that are too high for students. The use of learning media certainly cannot be arbitrary, good learning media will have a direct impact on student achievement in class. To see the quality of a product, namely the e-module created, it is necessary to measure perceptions. The perception is a process of receiving a stimulus from the five senses, then processed and concluded so as to produce a stimulus that will be accepted by other individuals (Erdemir & EKŞİ, 2019; Yodha et al., 2019). Perception is defined as a view or understanding, namely how individuals perceive or interpret certain objects (Kusuma & Luffiany, 2018; Yunita & Maisarah, 2020). Perception can be divided into two, namely negative perception and positive perception. The findings of previous research also stated that e-modules can help students in learning so that they can improve student learning outcomes (Asrial et al., 2020; Fonda & Sumargiyani, 2018; Velan et al., 2015). Based on the description stated, the purpose of this study is to analyze the level of student perception after using the e-module Mathematics Physics multiple integral material.

2. METHOD

This study used a mixed method with an explanatory model, the variables in the form of students' perceptions of the mathematical physics e-module on the dual integral material. Mixed method explanatory model is a mixture of research methods with quantitative and qualitative research sequentially (Tanti et al., 2021). In the first stage, quantitative data collection was carried out followed by the second stage, namely, qualitative data collection. In quantitative research, the sample used is analyzed systematically and the results are in the form of numbers. Collecting quantitative data using a survey method which is intended to determine in general the characteristics of the sample under study (Tanti et al., 2021). Strengthening and completing quantitative data can be done using qualitative data. This qualitative data is obtained from the results of the analysis of the questionnaire which is equipped with an interview to describe the data. The sampling technique in this study is using purposive sampling technique. Purposive sampling is a sampling technique from data sources with certain considerations (Rosdianto et al., 2017). Sampling in this study was based on seeing the level of student perceptions of the mathematical physics e-module. The research was conducted online using google form as a data collection tool. The subjects of this study were 68 active physics education students who contracted mathematical physics courses. The perception questionnaire used is 15 statements and for the interview sheets as many as 5 statements, the data collection instrument grid 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 |
| | The material is easy to understand |
| Presentation of Material in the E-Module | 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 |
| | Ease of use of modules |
| Benefits of the E-Module | Media can help students understand the material |
| | Interest in using modul |
| | Increased motivation to learn |

Student perception data of the mathematics physics e-module on multiple integral material were collected using a Likert scale with the following scores; 4 (strongly agree), 3 (agree), 2 (disagree), and 1 (strongly disagree). The level of students' perceptions of the e-module mathematics physics material multiple intervals, is used to determine the level of each categorized student perception, namely; Very good, good, bad, and very bad. By using quantitative descriptive, several values are obtained, namely; mean, median, mode, range, standard deviation, maximum and minimum. To get this value, SPSS 22 is used as a data processing tool.

3. RESULT AND DISCUSSION

Result

The results of the student's perception data on the e-module of mathematical physics on dual integral material. Based on the results of data analysis, shows that of the 68 respondents, a minimum value of 45.00 and a maximum value of 58.00 is obtained and with an average (mean) value of 50.53, a mode of 55.00, and a standard deviation. equal to 3.51. To show students' perceptions according to their categories, an interval score is needed to differentiate them. The level or level of student perceptions of e-modules on multiple integral material can be seen in Table 2.

Table 2. The score ranges for the quantitative criteria for the perception questionnaire

| No | Score Interval | Student Perception Level | F | (%) |
|--------------|----------------|--------------------------|----|-------|
| 1 | 48,76 – 60,00 | Very good | 45 | 66,17 |
| 2 | 37,51 – 48,75 | Good | 23 | 33,83 |
| 3 | 26,26 – 37,50 | Bad | 0 | 0 |
| 4 | 15,00 – 26,25 | Very Bad | 0 | 0 |
| Total | | | 68 | 100 |

The results of the perception questionnaire from 68 students who contracted the mathematics physics course showed that students had a good perception of the products made by researchers. Good perceptions certainly have an impact on the quality of the products made. These results indicate that the use of mathematical physics e-module with dual integral material can support the learning process as well as a good complementary source of learning for students, especially those contracting Mathematics Physics courses. For the results of the interview, it was found that most of the students answered positive choices with a variety of different reasons. In the first question, "Is the use of e-modules in learning a good idea", one respondent answered "Yes, because it can be used anytime and anywhere". Meanwhile, other respondents answered "Yes, because learning can be interesting". In the second question, "Do you agree that the use of e-modules can help you study anywhere and anytime? Many respondents answered" Yes, because it can be easily opened on a smartphone anytime and anywhere ". In the third question, namely "Is learning through e-module media interesting ?", most students answered" Yes, because in the e-module there are videos, images and animations ". In the fourth question "Can learning using e-modules increase your learning motivation ?", students answered" Yes, because the more we know ". And in the last question, "Is using e-module learning flexible and clear ?", students answered" Yes, e-module learning is very easy to understand ".

Discussion

With the e-module of mathematical physics, this dual integral material indirectly makes one of the learning problems resolved. Learning mathematics physics contains analytical descriptions, so that most students consider learning very difficult to understand (Kowiyah & Mulyawati, 2018; Muhtadi et al., 2018). However, with this e-module, students no longer need to translate material in English and students will quickly understand learning because difficult material has been shortened and explained using simple words. In addition, the long-term impact of using this e-module is that it can help students to graduate from the Mathematical Physics course which is notoriously difficult and often makes most students repeat the course. E-modules that have good value and quality can be shown from the level of good student perceptions (Pathoni et al., 2017; Syahril et al., 2019). An e-module that has good quality can significantly help students in their studies in Physics education. Then in terms of language, the e-module used is in Indonesian, making it very easy for students to discuss and answer analytical questions. Misinterpretation of words can also be overcome effectively, because for this module the language has been simplified and is equipped with video discussions on topics that are a little difficult. In addition to short-term effects, this e-module has long-term effects for students. Physics education students whose output produces educators certainly need a good pedagogic aspect. With this e-module, students can improve their pedagogical aspects as prospective physics teachers who are required to have analytical understanding and critical thinking. The pedagogic aspect itself is a teacher's ability and competence on how to manage and master the classroom (Gluzman et al., 2018; Machaba, 2018). Previous research by experts shows that this aspect is very crucial in educating and teaching in the classroom, teachers with high pedagogical aspects mostly enjoy and are liked by students (Moh'd et al., 2021; Pöntinen & Rätty-Záborszky, 2020). These aspects cannot be instantaneously formed, but need to be trained and accustomed to every day. One of the things that helps improve the pedagogic aspect, especially for prospective physics teachers, is to use e-modules that are integrated with analytical material.

Then for professional competence refers to the ability of a teacher to succeed in learning in class (Fitriani et al., 2017; Jamin, 2018). Professional competence is the ability to master subjects with the help of media accompanied by a sense of responsibility (Kartini et al., 2020; Supriyanto et al., 2020; Uerz, et al, 2018). With this competence, it will lead to the creation of a comfortable work environment. The relationship between professional competence and student perceptions of teaching materials is that it can facilitate students in mastering subject matter, especially physics. If a prospective physics teacher has fully mastered the material, then class learning will be comfortable and clear. In addition, for the lecturers themselves, this perception measurement is very important to see what methods are appropriate in classroom learning (Mashuri, 2017; Widyastuti et al., 2017). On the other hand, the media used, namely e-modules, can be used as a complementary source for lecturers in teaching in the classroom. The language used is also Indonesian, making it easier for lecturers to understand and explain it to students. In this case, lecturers do not need to waste time in interpreting foreign languages that some are difficult to understand.

No research is perfect in all aspects. In this study, we only looked at the level of students' perceptions and responses after using the Mathematics Physics e-module. This study is different from research from examines the relationship between perceptions of one class and another (Serevina et al., 2018; Darmaji et al., 2019; Asrial et al., 2020). This is because the sample used is not enough and only 68 people. Previous research from also used several variables so that it is more varied than research conducted by researchers (Haviz et al., 2020; Rizal et al., 2020; Rusydiyah et al., 2021). However, this research has the advantage that it uses qualitative data in the form of interviews which is not present in the previous research that has been described. Based on

these shortcomings, the researcher suggests for further research to add several variables, add more samples, and further develop data analysis such as using the ANOVA test, correlation test, and others.

4. CONCLUSION

The results obtained from the study showed that e-module learning received a positive response from students, this was also supported by the results of interviews, which were mostly satisfied with the e-modules that had been made. This positive perception has a direct impact on the experience of both students and lecturers in learning. For students, having a good experience can certainly solve problems related to difficult, abstract, or analytical materials. As for lecturers, this can help realize learning objectives according to the design that has been made.

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