https://doi.org/10.24036/jep/vol7-iss2/781

JEP (Jurnal Eksakta Pendidikan)
Volume 7, Issue 2, 289 - 300
ISSN: 2579-860X (Online), ISSN: 2514-1221 (Print)
https://jep.ppj.unp.ac.id/index.php/jep

Needs Analysis to Develop Physics Learning E-Modules on Static Electricity Material

Korry Nilyani[1*], Hilmi Rizki Anjani[2], Desnita[3], Usmeldi[4]
[1,2] Physics Education Masters Study Program, FMIPA, Universitas Negeri Padang, Padang, Indonesia
[3] Physics Department, FMIPA, Universitas Negeri Padang, Padang, Indonesia
[4]Electrical Engineering Department, FT, Universitas Negeri Padang, Padang

Received: June 07, 2023 ▪ Revised: July 27, 2023 ▪ Accepted: October 27, 2023

ABSTRACT

Science and technology continue to experience developments in education at the school level, giving rise to demands and improvements in the learning process. In the 21st century, students need the right learning resources in order to understand the lesson well. It is necessary to do a needs analysis to develop learning media. This study aims to analyze the need for e-module development for physics learning. The urgency of this research is due to the difficulties faced by students in understanding physics concepts and solving physics problems. The problem discussed in this study is the need for effective learning media that can improve learning outcomes and students' interest in physics. The solution proposed is the development of an e-module learning physics on static electricity that can help students understand concepts and improve problem solving and critical thinking skills. This type of research is qualitative descriptive research. Research data collection instruments in the form of a questionnaire analysis of teacher needs, and a questionnaire analysis of student needs. The results of this study are the use of learning media on static electricity material in the four schools is very low. They only rely on textbooks as the only source in the learning process, so that students in the four schools may experience limitations in the exposure of information and learning experiences. Limitations in the use of textbooks can hinder creativity, interactivity, and in-depth understanding in learning, so it is necessary to develop e-modules as learning media for this material.

Keywords: Need analysis, E-module, Physics teaching media, Static electricity

INTRODUCTION

The learning implemented should be able to prepare graduates to effectively face the 21st century. Education graduates should possess adequate skills to thrive in the 21st century. There are at least four essential skills that education graduates need to have in the 21st century, namely: thinking strategies, work methods, tools for work, and adaptability skills for living in the world (Asrizal et al., 2017). Technology has become an inseparable part of human life. In the 21st century, everyone is expected to understand and master science and technology. Communication requires communication tools, which are the result of communication technology engineering. Transportation requires transportation tools, which are also the result of technological engineering. Almost all activities in human life today

***Correspondence:**
Korry Nilyani , Physics Education Masters Study Program, FMIPA, Universitas Negeri Padang, Padang, Indonesia
✉ email : knilyani@gmail.com

require technology as part of their processes. However, technology does not emerge spontaneously and requires a foundation of scientific knowledge. The mastery of science and technology requires innovative and high-quality human resources. Education plays a crucial role in developing high-quality human resources. Without education, humans would be blind, making it difficult to progress in an increasingly sophisticated life, like walking in the darkness without a guiding light (Sasmita et al., 2020).

Education is one way to nurture one's potential (Azhar et al., 2017). In the effort to achieve the set goals, learning is an essential component of the educational process (Arfani, 2016). Students not only interact with teachers as learning sources during the learning activities but also interact with all learning resources that can be used to achieve the learning goals. As a result, students require appropriate teaching materials to understand the lesson content well (Supriadi, 2015). Static electricity material is one of the important materials in learning physics. However, students often experience difficulties in understanding the concept of static electricity. So, it is necessary to develop e-modules for learning physics on static electricity. Physics learning e-modules can help students understand physics concepts and improve their problem-solving skills and critical thinking skills. In addition, this e-module is also expected to increase students' interest in learning physics. The development of e-modules for learning physics on static electricity needs to be done by taking into account the needs of students in learning physics. Needs analysis can be carried out by conducting literature studies, observations, and interviews with students and teachers. The development of physics learning e-modules on static electricity also needs to refer to the applicable curriculum standards (Solihudin, 2018; Taqwa et al., 2022).

In the era of globalization, the development of all aspects of human life is integrated. The field of education is one of the tangible effects (Purwoko et al. 2020). As it influences the creation of new teaching materials, education related to science and technology (becomes very important. E-modules in the form of soft file books that can be opened and read by students anytime and from anywhere are an example of innovative teaching material development (Andani & Yulian, 2018). According to Wijayanto & Zuhri (2014), an e-module is an electronic book that can be read on a computer. E-modules greatly assist students in understanding the learned material and open doors for students to compete, investigate, and succeed (Ambarsari, 2016; Ristanto, 2011).

Physics is an interesting field of study because it can explain how the world works (Arizal et al., 2018). Teaching materials in the form of electronic modules or e-modules are highly needed for the physics subject. Physics is one branch of science that uses human senses to investigate the properties and phenomena of natural objects. However, learning physics is often considered challenging due to its abstract concepts and difficulty in connecting them with everyday life, such as static electricity. To help students understand static electricity, visualization aids are needed. Students struggle to understand the concept of static electricity because electricity seems to be the result of electrical events (Afriana & Jaka, 2015). As a result, educators must create engaging learning materials to enhance students' interest and understanding of the subject (Sutrio, 2017; Amin, 2020).

In illustrating the science of physics, numerical skills, consistent thinking, and great thinking abilities are required. According to Hartini, T.I., & Martin, M. (2020), for students to develop reasoning, communication, problem-solving, and application of physics in everyday life, a systematic understanding of physics concepts is necessary. According to (Sukiminiandari, 2015), physics is a very important subject that teaches students how to master physics knowledge, concepts, principles, scientific skills, and processes. According to Trigono (2017), physics problems often have connections with natural phenomena and phenomena. However, each student's understanding of the material may be unique, where some have a good understanding of the standards, speculations, and laws of physics, while

others may struggle (DiSessa, 1993).

The research conducted focuses on class XII SMA by analyzing several materials such as Direct Current Electricity (DC), Static Electricity (SE), Magnetig Field (MF), Back Electricity (BE), Electromagnetic Wave (EW), Special Relativity (SR), Quantum Physics (QP), Digital Technology (DT), and Core Physics (CP). In addition, this research also analyzes based on the media used by teachers and students such as: Smartphone (SP), Phet (PT), Power Point (PP), Computer (CP), Printed Book (PB), Worksheet (WS), Module (MD), and the last Internet (IT). Based on the observation results, it was found that the teaching materials used by teachers in schools are mostly textbook packages. The findings indicated a prevailing reliance on textbook packages among teachers in schools, representing 65% of the distributed questionnaires in four schools. This observation highlights a concerning lack of diversity in the teaching materials employed, indicating potential shortcomings in the current physics education practices at this level. These outcomes align with a prior study conducted by (Rahman et al., 2019), which also emphasized the prevalent use of textbook packages and worksheets among educators. Moreover, the research brought to light a notable disparity in the use of instructional media for teaching the topic of static electricity, which stood at only 82% compared to other physics topics. This suggests the need for more effective integration of media to enhance the learning experience for this specific subject matter. In essence, the research underscores the significance of addressing the dearth of diverse teaching materials and instructional media in class XII physics education, by exploring innovative approaches and embracing a variety of instructional resources, educators can create a more engaging and enriched learning environment, fostering a deeper understanding of physics concepts and improving overall academic outcomes for students. The incorporation of interactive and technology-based learning tools could play a pivotal role in revitalizing physics education and cultivating students' interest and enthusiasm in the subject.

Based on the identified issues, there is a need for a solution to overcome this problem. To foster independent learning in students, instructional materials in the form of modules can be utilized. Learning modules are teaching materials, tools, or resources that are carefully designed to contain content, methods, limitations of learning materials, learning activity instructions, exercises, and methods of evaluating learning (Santoso, 2013). This research differs from previous studies such as the development of modified inquiry-based physics modules on static electricity (Setyani, 2017), the development of contextual-based e-modules on static electricity (Yolanda, 2021), and the development of web-based e-modules to enhance physics knowledge competency in static and dynamic electricity topics for high school (Solihudin JH 2018). This study focuses on analyzing the development needs of e-modules for teaching physics in the context of static electricity. The proposed solution in this research is the development of a physics e-module for static electricity, with the aim of improving the quality of physics education in schools. The novelty of this solution lies in the use of Flip PDF Professional in developing physics e-modules on static electricity, which can assist students in comprehending physics concepts more holistically and integrated with technology. Using the Flip PDF Professional application is one way to create electronic modules or e-modules. Flip PDF Professional is an application for creating rich flipbooks with interactive media such as images, videos, audios, hyperlinks, and more. It has many benefits, including the ability to combine PDF files with instructional materials, images, and videos, attention-grabbing displays for students, and user-friendly features even for inexperienced users (Nurcahyono & Kustijono, 2019; Kurniadewi, 2019; Watin & Rudy, 2017).

The use of digital technology is becoming increasingly common (Hasanah, 2015). The advancements in digital technology and information can be utilized to facilitate educational

development (Divayana, 2016 and Sugiharni, 2018). Therefore, rapid innovation is needed in the field of education and becomes a top priority in the development of the education system, particularly in the creation of instructional media. According to Usmeldi (2017), instructional media is a tool that facilitates communication and interaction between teachers and students in educational activities. This research will utilize preliminary study stages, such as literature review and field study, to develop online instructional media. The field study, on the other hand, aims to assess the school learning environment, while the literature review is intended to gather data and identify efficient learning strategies. This is consistent with previous research (Fadli et al., 2017) that shows field studies can provide information about teachers' and students' needs for teaching materials or instructional media, as well as the conditions in the field. The purpose of this research is to determine students' needs for learning resources, the difficulties they face during learning, and the learning resources used by teachers.

METHODS

The type of research conducted is qualitative descriptive research. The methods used in this research are survey and observation methods. The descriptive method with a qualitative approach was used in this study. A method used to examine the status of a group of people, an object, a set of conditions, a system of thought, or a class of events in the present is called the descriptive method itself (Prastowo, 2016). With natural methods, the expected research results are not generalizations based on quantity measures but rather the meaning (in terms of quality) and observed phenomena, whereas the qualitative research method is a systematic research method that is used to examine or research an object in a natural setting without any manipulation in it and without any hypothesis testing (Prastowo, 2016).

The subjects of the research are twelfth-grade high school students and teachers. This research was conducted in four public and private schools. The research method employed is descriptive research method. The data collection instruments in this research are questionnaires for analyzing the needs of teachers and questionnaires for analyzing the needs of students and teachers. The researcher and those who assist the researcher are the primary data collection instruments in this qualitative study. The researchers themselves collected data during the research by asking, listening, and taking notes. In this study, questionnaires, written tests, and interviews were used to collect data. Students' thinking styles are profiled with the help of questionnaires. The phrase used in the questionnaire is a reference to John Parks Le Tellier's "group test," which was used to determine a person's self-perception or classification (Deporter & Hirnacki, 2015). The profile of each student's ability to solve glasses problems is determined by the written test. In the research, interview techniques were used to get a deeper understanding of student profiles and secure responses between interviews and corner results.

Credibility, transferability, dependability, and certainty are the four factors that determine the validity of the data in this study. The adequacy of the references and technical triangulation contribute to this study's credibility. Technical triangulation is the process of comparing or checking the validity of data using something other than the data (Djamal, 2015). The data from the questionnaire, the description of the test questions, and interviews make up the triangulation method. In this qualitative study, data reduction, data presentation, and drawing conclusions are all methods of data analysis. In this study, questionnaire responses from respondents were used as data which was analyzed using qualitative and quantitative data analysis methods. To collect data, the Google form was used as an instrument to collect responses from respondents. The data analysis method

used involved the use of a Likert Scale and checklists as instruments to measure and organize responses from respondents. The data that has been collected is then analyzed qualitatively and quantitatively to obtain deeper insights and a comprehensive picture. The equation used is the percentage formula by dividing the number of students who answered by the total number of students then multiplied by 100%

RESULTS AND DISCUSSION

Results

Analysis of Media Use Based on Material in students

Based on the results of a survey and observation of physics learning with static electricity conducted in four public and private schools, it was determined the proportion of students with e-module needs analysis. Investigation of the needs of this e-module includes: student analysis, learning activities, and school media are all examined. First, an analysis of students was conducted to determine the initial abilities and characteristics of students, both individually and collectively, based on the learning media they used at school.

Student analysis was obtained through an online questionnaire in the form of a google form which was given to class XII students at each of the four schools as a sample. The questionnaire consists of two aspects, including: analysis of the material studied and analysis of the media used at school and the teacher is also given a questionnaire which is used later to compare the results of the survey on students with the results of the questionnaire that was filled out by the teacher earlier. This study has several indicators and the results of the student analysis base on material, The material is like Direct Current Electricity (DC), Static Electricity (SE), Magnetig Field (MF), Back Electricity (BE), Electromagnetic Wave (EW), Special Relativity (SR), Quantum Physics (QP), Digital Technology (DT), and Core Physics (CP). The data analysis can be displayed in Figure 1

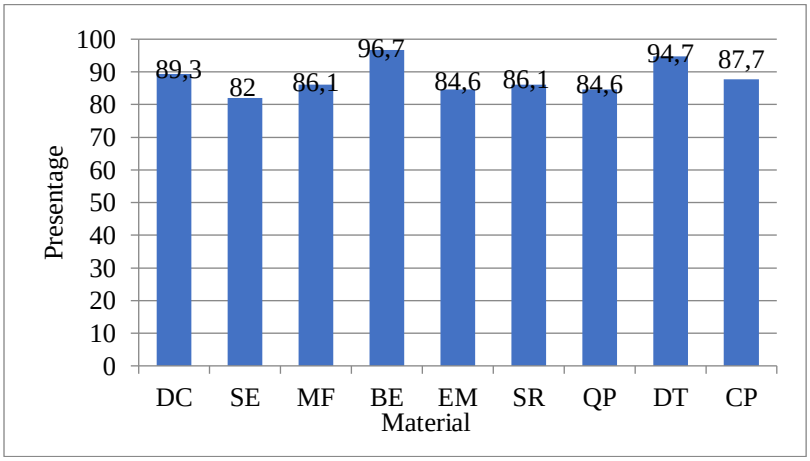

Figure 1. Analysis of Media Use Based on Material in Students

Figure 1.0 shows that according to class XII students, the percentage of media use for the topic of direct current electricity is 89.3%, static electricity is 82%, magnetic field is 86.1%, alternating current electricity is 96.7%, electromagnetic waves is 84.6 %, special relativity 86.1%, quantum physics 85.6%, digital technology 94.7%, and nuclear physics 87.7%. From the picture it can be seen that the use of media on the electric back material is the media most used by students, namely 96.7%. In addition, it can also be seen that the use of media by students on Static Electricity material is very low, namely only around 82%, which means that teaching materials on this material are still little used in schools. This figure shows that the use of media-based teaching materials in teaching static electricity in

schools is still minimal. In other words, students tend not to access and utilize the available learning media to study this topic.

Analysis of Media Use Based on Material on Teachers

In addition, researchers also analyzed the learning media used based on physics learning materials on theacher. The indicators seen are the same as in Figure 1.0 above, but the difference in Figure 2.0 which is analyzed is the media used by the teacher in each learning material. The material is like Direct Current Electricity (DC), Static Electricity (SE), Magnetig Field (MF), Back Electricity (BE), Electromagnetic Wave (EW), Special Relativity (SR), Quantum Physics (QP), Digital Technology (DT), and Core Physics (CP). Here below is a figure analysis of media use based on material on teachers on Figure 2.

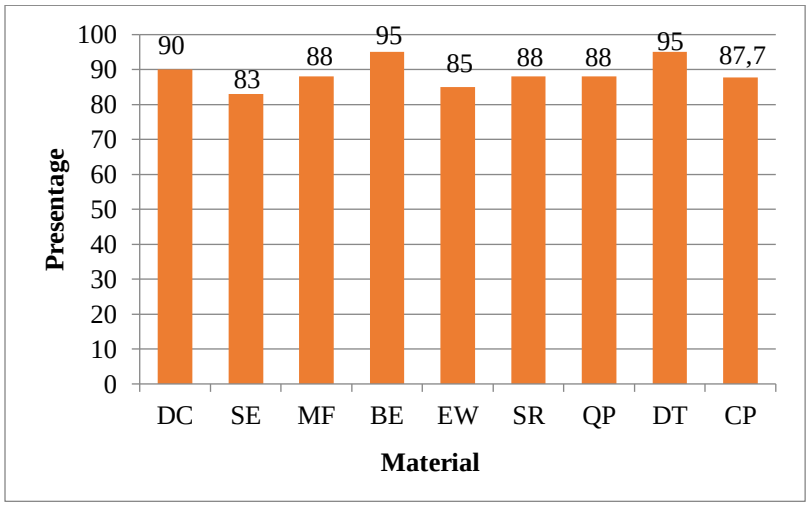

Figure 2. Analysis of Media Use Based on Teacher Material

Figure 2.0 shows that according to the teacher, direct current electricity material with the percentage of media use is 90%, static electricity is 83%, magnetic field material is 88%, alternating electricity is 95%, electromagnetic waves are 85%, special relativity is 88%, physics quantum 88%, digital technology 95% and on core physics material 87.7%. Based on Figure 2.0 above, it can be seen that the use of media by teachers in Back Electricity and Digital Technology material is relatively high, reaching 95%. While the lowest use of media by teachers is on Static Electricity material, which is only 83%, teachers do not use much media in teaching material about Static Electricity, generally teachers only use printed books. From the results of the analysis of the two images, which are based on the media used by students and teachers in class XII SMA material, it is found that the percentage of media use is on static electricity material. Therefore, the researchers focused only on analyzing the media used on static electricity material.

Analysis of Media Use on Students' Static Electricity

The results of the three student questionnaire analyzes based on the media used in the static electricity material in the four schools. In this figure what is being analyzed is the media used in static electricity material by students. Where the media are analyzed as follows: Smartphone (SP), Phet (PT), Power Point (PP), Computer (CP), Printed Book (PB), Worksheet (WS), Module (MD), and the last Internet (IT), can be seen in Figure 3 below.

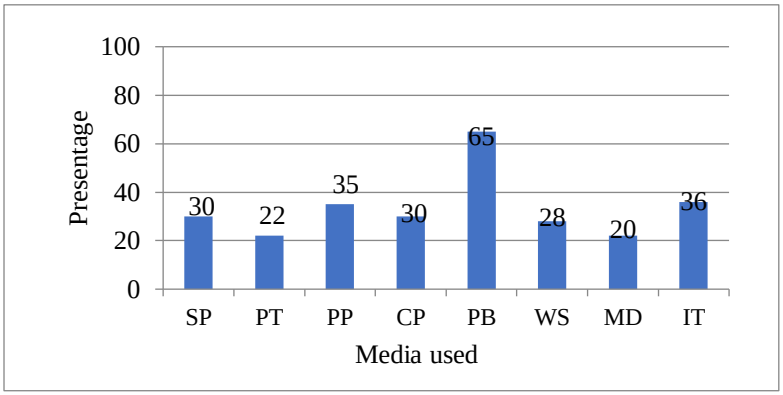

Figure 3. Analysis of Media Use in Students' Static Electricity Meter

Based on Figure 3.0, the results of the analysis of the use of media on static electricity material for students in the four schools obtained the percentage for using smartphones 30%, Phet 22%, PPT 35%, computers 30%, printed books 65%, worksheets 28%, modules 20% and internet 36 %. Based on the analysis of the media used by students on static electricity material, it was found that the media used the most namely print books which reached 65%. While the media that students use the least on static electricity is modules which only use 20%. Based on the results of media analysis on static electricity material in the four schools, it can be seen that the use of media in these materials is very low, therefore it is important to do research that will be used later as learning media used in this static electricity material and from the analysis it can be seen that the use of printed books is very dominant in learning while the use of other interactive media is very minimal.

Analysis of Media Use on Teacher's Static Electricity Meter

The results of the four questionnaire analyzes by the teacher, based on the media used in the static electricity material in the four schools. Where the media are analyzed as follows: Smartphone (SP), Phet (PT), Power Point (PP), Computer (CP), Printed Book (PB), Worksheet (WS), Module (MD), and the last Internet (IT). In this figure what is being analyzed is the media used in static electricity material by theachers, the analysis can be seen in Figure 4 below.

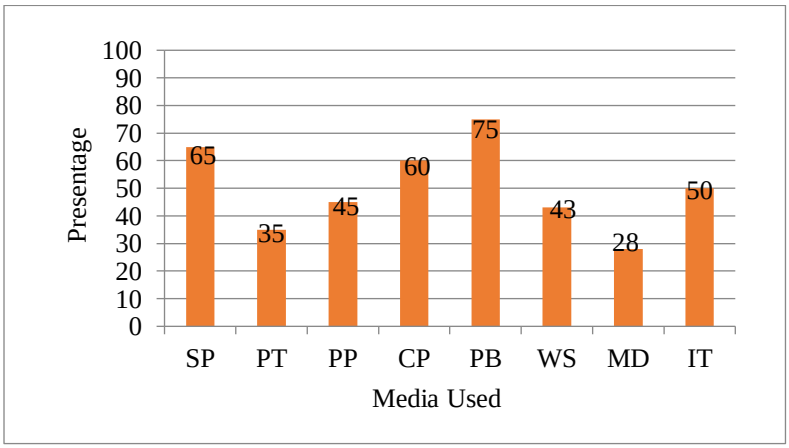

Figure 4. Analysis of Media Use on the Teacher's Static Electricity Meter

Based on Figure 4.0, the results of analysis of media use on teacher static electricity material in the four schools obtained the percentage for the use of smartphones 65%, Phet 35%, PPT 45%, computers 60%, printed books 75%, student worksheet 43%, modules 28% and internet 50%. Based on the analysis of the media used by theachers on static electricity material, it was found that the media used the most namely print books which reached 75%.

Based on the analysis of the media used by the teacher on static electricity material, it is known that the most widely used media, namely printed books, reaches 75%. Meanwhile, the media that the teacher uses the least amount of static electricity is a module that only uses 28%. This shows that the module is not often used as a teaching aid by teachers when teaching static electricity topics. This is due to the limited time teachers have in developing modules and the unavailability of modules that can be used by teachers on static electricity material.

Based on the results of media analysis on static electricity material in the four schools, it can be seen that the use of media in these materials is very low, therefore it is important to do research that will be used later as learning media used in this static electricity material and from the analysis it can be seen that the use of printed books is very dominant in learning while the use of other interactive media is very minimal. Based on the analysis of the material that has been carried out, it is found that the use of media on static electricity material is only a little, namely only 82% for students while only 83% for teachers, and this is dominated by the use of printed books while the use of media such as module only 20% for students and 28% for teachers. , Therefore the researchers focused on analyzing media on static electricity material so that the problem of using media in this material could find a solution. From the problems above, a solution is found that will later develop a e-module on static electricity material.

Discussion

Based on the findings of interviews conducted with physics teachers and class XII high school students, most of the teaching materials used in schools are packaged in the form of printed media in the form of textbooks which only contain writing and illustrations. Because abstract material in physics learning is difficult to concretize and because it is less attractive for students to learn, the learning media used does not increase student motivation. Students have difficulty understanding the meaning of static electricity because electricity appears to be the result of electrical events (Afriana, 2015). Therefore, teaching materials are needed that can be used in the classroom, especially physics-based teaching materials that can make abstract concepts concrete, keep students' attention, increase learning motivation, and reduce the teacher's tendency to lecture or tell stories.

To overcome the problems faced by educators in utilizing media during developing experiences, tasks from various parties, especially public authorities, are needed, in particular as follows: 1) Teachers must receive regular training to develop their pedagogical abilities in operationalizing learning media. It is beyond the possibility for students to be able to use media while considering the assumption that educators are also unable. It is hoped that teachers can incorporate media into the learning process after attending this training, so as to produce various media, learning resources, and teaching materials. Learning does not only use reading but also fluctuates with IT-based learning media such as the demands of 100 year learning 21 (Yusrizar, 2017), 2) Limiting the burden on educators at school. Currently, teachers are not only responsible for teaching and directing students in class but also for technical and structural responsibilities such as handling school documents. As a result, the teacher loses time preparing learning materials, and 3) acquiring facilities and infrastructure. The lack of infocus facilities is the main obstacle in presenting educational material. If the information is still incomplete, how can educators use the media to convey the content. According to Desnita (2020), the best course of action to overcome the challenges faced by teachers during the learning process is to follow these three steps.

Given the requirements exams that have been completed, the difficulties of class XII students in learning physics indicate that it is very important to encourage performance

material as electronic modules (e-modules), especially friction-based electricity materials. Masek & Yamin (2010) confirmed that this e-module is PBL-based, especially e-modules that use PBL syntax. By making PBL-based electronic modules (e-modules), it is hoped that students can understand physics lessons, especially static fluid material, and become more independent. According to (Imaningtyas, 2016), the purpose of the E-module is for students to learn on their own, either with the help of an instructor, considering that this module basically contains the basic parts of the performance. previous reference material. PBL-based static electricity charge in the form of an electronic learning module (e-module) is needed considering this needs analysis. The Flip PDF Professional application is available for making this learning module.

This research has found the need for the development of physics e-modules on the topic of static electricity. However, the limitations of this study include the small sample size used and the lack of testing in different learning environments. Therefore, further research can be conducted using a larger sample size and testing in diverse learning environments to obtain more valid results and broader generalization. By addressing these limitations and conducting further research, a more comprehensive understanding of the impact and applicability of the physics e-modules can be achieved. This would contribute to the development of effective and versatile learning resources for teaching static electricity in physics education.

CONCLUSION

The use of E-modules should be used by teachers in deepening students' physics concepts. Based on the results of media analysis on static electricity material in the four schools it can be seen that the use of media in these materials is very low, therefore it is important to do research that will later be used as learning media used in this material. static electricity materials and from the results of the analysis it appears that the use of printed books is very dominant in learning while the use of other interactive media is very minimal. Based on the material analysis that has been carried out, it is known that the use of media on static electricity material is only a little, namely only 82% for students while only 83% for teachers, and this is dominated by the use of printed books while the use of media such as modules is only 20% for students and 28% for teachers. Therefore the researchers focused on media analysis on static electricity material so that the problem of using media in this material could find a solution. From the problems above, a solution is obtained which will later develop an e-module on static electricity material.

REFERENCES

Afriana, Jaka. 2015. Penggunaan Alat Peraga Sederhana SISIMISTIS dalam Pembelajaran Listrik Statis. (Online).

Afriana, Jaka. (2015). Project Based Learning, Makalah Untuk Memenuhi Tugas Mata Kuliah Pembelajaran IPA Terpadu. Bandung: Pendidikan IPA Sekolah Pascasarjana UPI Bandung.

Ambarsari, D. (2016). Implementasi Pendekatan Saintifik Untuk Meningkatkan Keterampilan Mengkomunikasikan dan Prestasi Belajar IPA Siswa Kelas IV SD. Jurnal Pendidikan Guru Sekolah Dasar, V(12): 1.112-1.121.

Amin, M., Muslim, S., & Wirasti, M. K. (2020). Modul Pembelajaran Hypercontent Pengenalan Perangkat Jaringan Komputer Untuk Mahasiswa Asal Daerah 3T Di Stkip Surya. Jurnal Nasional Pendidikan Teknik Informatika : JANAPATI, Vol 9(1), 1–15.

Andani, Dika T., & Yulian, M. (2018). Pengembangan Bahan Ajar Electronic Book Menggunakan Software Kvisoft Flipbook Pada Materi Hukum Dasar Kimia di SMA Negeri 1 Panton Reu Aceh Barat. Jurnal IPA dan Pembelajaran IPA, 2(1): 1-6.

Ardiyanti, N., & Dewi, N. R. (2019). Development of Android-Based Interactive Learning Media on Rectilinear Motion. Journal of Physics: Conference Series, 1280(1), 012042.

Arfani, Laili. (2016). Mengurai Hakikat Pendidikan Belajar dan Pembelajaran. Jurnal PPKn dan Hukum. 2(11): halaman 81-97

Arikunto, S., Suharjono dan Supriadi. 2015. Penelitian Tindakan Kelas. Jakarta : PT Bumi Aksara.

Arsyad, Azhar. 2017. Media Pembelajaran. Jakarta : Rajagrafindo Persada.

Asrizal, Arnel, Hidayati, dan Festiyed. (2018).Penerapan Model Pembelajaran Penemuan Mengintegrasikan Laboratorium Virtual dan Hots untuk Meningkatkan Hasil Pembelajaran Siswa SMA Kelas XI. Prosiding Seminar Nasional Hibah Program Penugasan Dosen ke Sekolah (PDS) Universitas Negeri Padang.

Asrizal, A., Festiyed, F., & Sumarmin, R. (2017). Analisis Kebutuhan Pengembangan Bahan Ajar Ipa Terpadu Bermuatan Literasi Era Digital Untuk Pembelajaran Siswa Smp Kelas Viii. *Jurnal Eksakta Pendidikan (JEP)*, *1*(1), 1.

Divayana, D.G.H., Suyasa, P.W.A., & Sugihartini, N. (2016). Pengembangan Media Pembelajaran Berbasis Web Untuk Matakuliah Kurikulum dan Pengajaran di Jurusan Pendidikan Teknik Informatika Universitas Pendidikan Ganesha. Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI), 5(3), 149-157.

Fitriani, N., Gunawan, G., & Sutrio, S. (2017). Berpikir Kreatif dalam Fisika dengan Pembelajaran Conceptual Understanding Procedures (CUPs) berbantuan LKPD. Jurnal Pendidikan Fisika dan Teknologi, 3(1), 24-33.

Hartini, T. I., dan Martin. 2020. Pengembangan Instrumen Soal HOTS (High Order Thinking Skill) Pada Mata Kuliah Fisika Dasar 1. Jurnal Pendidikan Fisika 8(1): 18–21.

Hasanah, Lukman Nulhakim Umrotul. (2015). Pengembangan Media Pembelajaran Film Animasi sebagai Media Pembela jaran Konsep Fotosintesis. Jurnal Penelitian dan Pembelajaran IPA, 1(1), 91-106.

Imaningtyas, C. D., Karyanto, P., Nurmiyati, N., & Asriani, L. (2016). Penerapan e-module berbasis problem based learning untuk meningkatkan literasi sains dan mengurangi miskonsepsi pada materi ekologi siswa kelas x mia 6 sman 1 karanganom tahun pelajaran 2014/2015. Bioedukasi: Jurnal Pendidikan Biologi, 9(1), 4-10.

Jaelani, A., Fauzi, H., Aisah, H., & Zaqiyah, Q. Y. (2020). Penggunaan media online dalam proses kegiatan belajar mengajar pai dimasa pandemi covid-19 (Studi Pustaka dan Observasi Online). Jurnal IKA PGSD (Ikatan Alumni PGSD) UNARS, 8(1), 12.

Marsa, P. B., & Desnita, D. (2020). Analisis Media, Sumber Belajar, dan Bahan Ajar Yang Digunakan Guru Fisika SMA Materi Gelombang Di Sumatera Barat Ditinjau Dari Kebutuhan Belajar Abad 21. Jurnal Eksakta Pendidikan (Jep), 4(1), 81-88.

Asrizal, Asrizal, Festiyed Festiyed, and Ramadhan Sumarmin. (2017). Analisis Kebutuhan Pengembangan Bahan Ajar Ipa Terpadu Bermuatan Literasi Era Digital Untuk Pembelajaran Siswa SMP Kelas VIII. *Jurnal Eksakta Pendidikan (JEP)* 1(1):1.

Purwoko, Riawan Yudi, Puji Nugraheni, Syafarina Nadhilah, Universitas Muhammadiyah

Purworejo, and Kabupaten Purworejo. 2020. "Analisis Kebutuhan Pengembangan E - Modul Berbasis Etnomatematika Produk Budaya Jawa Tengah." 5(1):1–8.

Rahman, Aditya, Lucya Mega Heryanti, and Bambang Ekanara. (2019). Pengembangan Modul Berbasis Education for Sustainable Development Pada Konsep Ekologi Untuk Siswa Kelas X SMA. *Jurnal Eksakta Pendidikan (JEP)* 3(1), 1-8.

Setyani, nita depit. 2017. "Inkuiri Bebas Termodifikasi Pada Materi Listrik Dinamis Untuk Meningkatkan Kemampuan Multipel Representasi."

Solihudin JH, Taufik. 2018. "Pengembangan E-Modul Berbasis Web Untuk Meningkatkan Pencapaian Kompetensi Pengetahuan Fisika Pada Materi Listrik Statis Dan Dinamis Sma." *WaPFi (Wahana Pendidikan Fisika)* 3(2):51. doi: 10.17509/wapfi.v3i2.13731.

Taqwa, Muhammad Reyza Arief, Muhammad Adhe Febriyanto, and Achmad Misbakhussuduri. 2022. "Pengembangan Modul Elektronik Berbasis Multimedia Dengan Asesmen Formatif Pada Materi Fluida Statis." *Jurnal Inovasi Pendidikan Sains Dan Terapan* 1(2):48–63.

Yolanda, Yaspin. 2021. "Pengembangan E-Modul Listrik Statis Berbasis Kontekstual Sebagai Sumber Belajar Fisika." *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika* 2(1):40. doi: 10.31851/luminous.v2i1.5235.

Sasmita, P. R., Sakdiah, H., & Hartoyo, Z. (2020). Pengaruh Penerapan Model Pembelajaran Interactive Lecture Demonstrations (ILDs) Terhadap Kemampuan Pemahaman Konsep Fisika Siswa. Silampari Jurnal Pendidikan Ilmu Fisika, 2.

Santoso, B. (2013). Skema dan Mekanisme Pelatihan: Panduan Penyelenggaraan Pelatihan. Jakarta: Yayasan Terumbu Karang.

Sari, N. P., Irawati, S., & Hadi, S. (2018). Development of Interactive Learning Media Based on Animation on Rectilinear Motion Material. Journal of Physics: Conference Series, 1097(1), 012064.

Setyani, Nita Depit. (2017). *Inkuiri Bebas Termodifikasi Pada Materi Listrik Dinamis Untuk Meningkatkan Kemampuan Multipel Representasi*.

Solihudin JH, T. (2018). Pengembangan E-Modul Berbasis Web Untuk Meningkatkan Pencapaian Kompetensi Pengetahuan Fisika Pada Materi Listrik Statis dan Dinamis SMA. *WaPFi (Wahana Pendidikan Fisika)*, *3*(2), 51-61.

Sugiharni, G.A.D. (2018). Pengembangan Modul Matematika Diskrit Berbentuk Digital Dengan Pola Pendistribusian Asyn chrnous Menggunakan Teknologi Open Source. Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI), 7(1), 58-72.

Sukiminiandari, Y. P., Budi, A. S., & Supriyati, Y. (2015). Pengembangan Modul Pembelajaran Fisika. In Prosiding Seminar Nasional Fisika, IV (pp. 161-164).

Taqwa, Muhammad Reyza Arief, Muhammad Adhe Febriyanto, and Achmad Misbakhussuduri. 2022. "Pengembangan Modul Elektronik Berbasis Multimedia Dengan Asesmen Formatif Pada Materi Fluida Statis." *Jurnal Inovasi Pendidikan Sains Dan Terapan* 1(2):48–63.

Usmeldi.(2017). Efektivitas Penerapan Media Pembelajaran Interaktif Dengan Software Autorun Untuk Meningkatkan Kompetensi Fisika Siswa SMK Negeri 1 Padang. JEP. Volume 1 | Nomor 1 | Mei 2017 e-ISSN 2579-860X.

Wijayanto., & Zuhri, M. S. (2014). Pengembangan E-modul Berbasis Flip Book Maker dengan

Model Project Based Learning Untuk Mengembangkan Kemampuan Pemecahan Masalah Matematika. *Prosiding Mathematics and Sciences Forum*, 625-628.

Yolanda, Yaspin. (2021). Pengembangan E-Modul Listrik Statis Berbasis Kontekstual Sebagai Sumber Belajar Fisika. *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika*. 2(1), 40-56.

Yusrizal, Yusrizal, et al. (2017). Kompetensi Guru dalam Memanfaatkan Media Pembelajaran Berbasis Teknologi Informasi dan Komunikasi (TIK) di SD Negeri 16 Banda Aceh. *Jurnal Ilmiah Mahasiswa Pendidikan Guru Sekolah Dasar Unsyiah*, 2(2), 126-134.