Asian Journal of Science Education

Journal homepage: http://jurnal.unsyiah.ac.id/AJSE/

E-Module Development in Physics Lessons Based on Problem Based Learning

Ngadimin[1], Pratiwi Jasmine Suwardi[1*], Fitria Herliana[1],Samsul Rizal[2], Musdar[2],

[1]Department of Physics, Universitas Syiah Kuala, Banda Aceh – Indonesia
[2]Department of Physics, Serambi Mekkah University, Banda Aceh – Indonesia

*Corresponding email: suwardi15799@gmail.com

(Received: September 28, 2021; Accepted: October 04, 2021; Published: October 06, 2021)

ABSTRACT

The goal of this study is to develop problem-based learning e-modules that can be used in the teaching and learning process. Research is development research, or RnD (Research and Development), using a 4-D model as a development model (define, design, develop, and dessimate). Students in class X MIPA 2 at SMAN 1 Tangse, a total of 30 participants, were the subjects of this study. These research steps begin with learners receiving a posttest, followed by learners receiving a response questionnaire and posttest questions to determine their level of understanding. After receiving electronics modules, learners are given a response questionnaire and posttest questions to determine their level of understanding. Material and media specialists' validation results fall into the decent and very decent categories, respectively, with percentages of 84.85 and 78.4. The average reaction of learners and teachers is similarly high, indicating that the electronics module is appropriate for use in education. With an average N-Gain value of 0.6, there are 13 people in the high N-Gain category, 15 people in the medium N-Gain category, and 2 people in the low N-Gain category. The N-Gain understanding of learners experiencing an increase in material understanding of momentum and impulses by employing electronics module. Electronics module can be observed in the results.

Keywords: E Modules, PBL, Momentum and impulses, learners' understanding

INTRODUCTION

According to Law No. 20/2003 on the National Education System, education is a conscious and planned effort to create a learning environment and learning process in which students actively develop their potential in order to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills that students, society, nation, and state require. As of now, Indonesia is adopting the 2013 curriculum, which requires students to participate more actively in the teaching and learning process. Because the 2013 curriculum stresses character education of students who are helped by a scientific method, pupils are required to think critically during the learning process (scientific approach). Science Approach is a bridge to students attitudes, abilities, and knowledge (Hasanah, T. A. N., et al., 2017). Unlike the teaching and learning process using KTSP, learning at this point just requires teachers to guide.

Hamid, A., et. al (2020), "The development of curriculum 2013 is currently prioritizing learning by educators and direct experiences and processes of learners. The implementation of

curriculum 2013 is expected to encourage students to think more creative, innovative, fast, and responsive and prioritize the principle of religion in life, being a person who has contributions to the development of society and Nation". Physics is one of the ordered, graded, and continuous subjects. Understanding concepts in physics subjects is the first step in delivering concepts in other physics subjects; if students can grasp the concepts, they will be able to work on a wide range of physics topics and solve physics challenges in everyday life days without difficulty

Problem of Research

The problems that are frequently found in teaching and learning activities (KBM), especially physics subjects, are teachers who play an active role in delivering lessons, while students only receive lessons without any experience from the students themselves, students there is no encouragement or lack of encouragement to develop thinking skills (Soewarno, S. et al., 2020). Participants are pushed to remember and store varied knowledge without being obliged to understand the concept of information they recall according to their ability or cognitive capacity, so that understanding of the information they remember is possible.

PBL-based learning modules are well-suited to classroom learning, particularly in Physics courses. Students will have a better understanding of concepts rather than just memorizing formulas, and they will have more opportunities to apply concepts to solve problems. Physics disciplines are more than just materials and formulas; they also include concepts, laws, principles, and theories that apply to everyday life. As a result, teaching materials that complement the PBL paradigm are required. "Teaching materials include all sorts of materials used to aid teachers or instructors in carrying out teaching and learning activities, one of which is modules," (Hasanah, T. A. N. et al., 2017).

Research Focus

Due to a lack of teaching resources in schools to support teaching and learning activities, pupils are less able to comprehend current teaching materials, and teachers are sometimes unable to explain content that is in the classroom. When compared to those using only school-based teaching materials, the modules utilized as teaching materials are expected to help students better understand the notion of learning on momentum and impulse materials. Because the module will include an overview of content that is easier to comprehend and more entertaining, as well as examples of simple problems and practice questions. Efforts to create more engaging, inventive, and diverse modules. Modules will be more colorful, and they will be built according to the steps of the PBL learning model.

METHODOLOGY OF RESEARCH

General Background of Research

The technique or development research utilized in this study is a sort of research in which the researcher is required to generate a product or a product of the research conducted. Development research is a research approach used to generate certain items and test the performance of these products (Sugiyono, 2015). An electronics module, sometimes known as an e-Modul, was produced as part of the research.

There are numerous model development models in R&D research, this study will focus on the 4-D model development model. The research and development research model is the product of an adaption of Thiagarajan's 4-D model (four-D model) (Handayani, R.A. et. al., 2018). The process of define, design, develop, and disseminate, also known as definition, design, development, and dissemination, is included in the research stage.

Subject of Research

The participants in this study for the electronic product trial modules that have been produced are X MIPA class students at SMA Negeri 1 Tangse, PIDIE, with a total of 30 students.

Instrument and Procedures

Questionnaires and learning outcome exams were utilized as data gathering tools in this study. The questionnaire employed in this research is a closed one. Several data sets were collected utilizing questionnaires in this study, including the validation of e-modules and teacher and student answers.

The following are the research tools, (1) material expert and media expert validation sheets, (2) teacher and student answer questionnaires, and (3) pretest and posttest questions were employed as data collection instruments in this study. The following is a list of the research instruments that were employed, The validation sheet grid, as well as the response questionnaire, can be found here.

Table 1. Grid of Material Expert Validation Sheets

No	Assessment aspect	Assessment Items	Question/statement
1.	**Eligibility for Content**	Meteri's compatibility with SK and KD	1. Load all materials that meet KD and SK requirements.
			2. Presentation of learning activities in accordance with KD and SK
			3. The module contains all of the necessary materials.
		Materials Accuracy	4. Module concepts and definitions can assist in clarifying the topic.

			5. Modules with examples and cases that correspond to the study material
			6. Images/illustrations that correspond to the study material
			7. The terms employed can aid in the comprehension of the material.
			8. The module's symbols and icons relate to the content.
			9. Make sure you have a clear library source.
		Material Revisions	10. The module contains all of the relevant learning resources.
			11. Using real-life scenarios as examples
			12. The graphics used in the presentation aid in the comprehension of the material.
		Boosting Curiosity	13. The module contains all of the relevant learning resources.
			14. Using real-life scenarios as examples
2.	**Eligibility for the Presentation**	Techniques of presentation	15. The graphics used in the presentation aid in the comprehension of the material.
			16. The notion of learning materials is organized according to the sequence in which learning activities are completed.
		Support for Presentations	17. Every learning exercise has instances of problems.
			18. Every learning activity includes a question-training component.
			19. In the question practice, there is a critical answer.
			20. The modules include prefaces, glossaries, summaries, and bibliographies.
		learning presentation Run with a groove	21. Learners can readily comprehend the module's content on their own.
			22. A list of learning exercises organized into paragraphs.

Source : Faishal, A (2015)

Table 2. Grid of Media Expert Validation Sheets

No	Assessment aspect	Assessment Items	Question/statement
1.	**Self Insructional**	Objectives for learning	1. Competency achievement indicators are developed based on fundamental competencies.
			2. Learning objectives are created in accordance with supplement achievement metrics.
			3. Learning objectives are organized according to the subject and learners' progress.
		Learning materials specifications	4. Materials for learning in accordance with SK
			5. Materials for learning in accordance with KD
			6. Learning resources that follow the PBL Model syntax of student problem orientation
			7. Learning resources that follow the syntax of the PBL Model arrange learners to learn.
			8. Individual and group investigations are guided by learning resources that follow the PBL Model syntax.
			9. Create and present the work 4. Examine and assess the troubleshooting procedure
			10. All resources are loaded in accordance with fundamental skills.
2.	**Self Contained**	All resources in compliance with KD, GPA, and SK are All resources in compliance with KD, GPA, and SK are contained in this module.	11. KD-specific load material
			12. Learning resources that follow the syntax of the PBL Model arrange learners to learn.
			13. The module's resources on momentum and impulse learning
3.	**Stand Alone**	Other educational materials aren't used	14. E-modules can be studied without the use of printed materials.
			15. E-modules can be studied without the need of audio materials.
			16. E-modules do not require the use of video media to be learnt.
4.	**Adaptive**		17. E-modules grouped according to scientific and technological progress

		Modules that have been tailored to the advancement of knowledge and technology.	18. E-learning modules based on the type of PDF software used in the research
5.	**User Friendly**	The use of instructions and exposures is beneficial.	19. Any instructions or information that appears to be beneficial
			20. The terminology employed are simple to comprehend and are of a generic character.
6.	**Display**	Design of an E-Module	21. Cover design in accordance with module content 4. Design compatibility with subjects
			22. Learning activities are presented in a consistent manner.
			23. Module contents must match the table of contents.
			24. Any instructions or information that appears to be beneficial
		E-Module Background Selection	25. In E-Module, there is a background.
			26. E-Module background color
		In E-Module Pictures and Placements, the letter size is used.	27. The writing color scheme does not contrast with the background.
			28. Choosing colors for artwork, tables, and other items.
		In the E-Module Layout, the letter size is employed (layout)	29. Font size selection
			30. Fotn employed in E-Module selection
			31. Spaces between sentences and paragraphs must be consistent.
		In E-Module Pictures and Placements, the letter size is used.	32. Image size suitability
			33. Image positioning on E-Module suitability
			34. Look at the image
			35. Font size selection
		In the E-Module Layout, the letter size is employed (layout)	36. Using E-Module to create a layout
			37. Supporting component layout on E-modules
			38. The layout of the E-Module as a whole.

Source: Daryanto (2013)

Table 3. Grid of teacher responses to the questionnaire

No	Assessment aspect	Assessment Items	Question/statement
3.	**Material**	Module Material Suitability	23. This module covers the concepts of momentum and surplus material.
			24. The material in the module has been made intriguing.
			25. Fill the module with material that corresponds to the learning objectives that have been specified.
			26. The instructions and explanations for the information in the module are simple enough for me to comprehend.
		The Language That Is Employed In The Conveying Of Information	27. The language or sentence utilized in the program is easy for me to understand.
			28. I'm not a fan of vague words or sentences.
			29. I comprehend the foreign term in the module completely.
		Tasks And Training	30. I can readily comprehend the training that has been provided to me.
			31. The module's training questions cover all of the content covered in the module.
			32. I'm interested in answering the training questions in the module.
4.	**Media**	Modules Slide Design	33. Create a display on modules based on the material.
			34. The layout of the layout on the module does not confuse me.
			35. I believe the size of the module's components is appropriate.
		The Module Contains Text.	36. I can read the text in the module without difficulty.
			37. For foreign terms on the module, I can easily read italic, underlining, or bold text.
			38. The size of the letters and the placement of capital letters on the module do not confuse me.
		Color Palettes, Illustrations, And Images	39. I can easily understand the material in the module because of the image/illustration.
			40. I find the images/illustrations in the module to be fascinating.
			41. I am not perplexed by pictures/ilustaris.
			42. The madul contains colored writings/images.

			43. The colors on the modules do not make me dizzy, and they are easy to read.
		Electronic Modules In Action	44. I find it simple to navigate and use modules.
			45. Electronic modules were delivered in accordance with my requirements.
5.	**Learning in Modules**	The Compatibility Of The Media Utilized With The Teacher's Expectations Interest In Modules	46. Compared to the print module / regular, the electronic module given is intriguing.
			47. I'm interested in pursuing a degree in electronics.
			48. When I use electronics modules to learn momentum and impulse materials, my learning spirit soars.
		Electronic Modules Interest In Modules Operation	49. The existence of this electronics module has aided me.
			50. I find learning through e-modules to be more engaging.
		Module Of Study Teacher Expectations Are Met Through The Usage Of Conformity Media.	51. The challenges assigned to the module are simple to comprehend.
			52. My group and I were delighted to overcome an issue offered in the momentum and impulse material module.
6.	***Problem Based Learning***	Problem-Based Learning Comes In A Variety Of Forms.	53. This module covers the concepts of momentum and surplus material.
		Problem-Based Learning's Effectiveness	54. The material in the module has been made intriguing.

Source: Faishal, A (2015)

Table 4. Grid of learner's responses to the questionnaire

No	Assessment aspect	Assessment Items	Question/statement
1.	**Material**	Module Material Suitability	1. Modules delineate the concepts of momentum and surplus material.
			2. Material that is in line with KD and GPA
			3. Materials for modules that are aligned with learning objectives
			4. The material in the module is explained in an easy-to-understand manner.

		The Language That Is Employed In The Conveying Of Information	5. The phrase or statement is simple to comprehend.
			6. Include sentences that elicit a desire to learn.
			7. Modules delineate the concepts of motion and excess material.
		Tasks And Training	8. KD and GPA-compliant materials
			9. Materials for modules that are aligned with the learning objectives
			10. The module's material is explained in a straightforward manner.
2.	**Media**	Modules Slide Design	11. The words or sentences utilized are simple to comprehend.
			12. Include statements that encourage a learning mindset.
			13. The module's component sizes are acceptable.
		The Module Contains Text.	14. The text used is simple to read.
			15. Foreign terms are italicized, underlined, or bolded.
			16. The font sizes and capital letter placement on the module are adequate and appropriate.
		Color Palettes, Illustrations, And Images	17. There are images/illustrations that can help you grasp the topic better.
			18. The images/illustrations that already exist are clear and fascinating.
			19. The module's components are of sufficient size.
			20. The text that has been used is simple to understand.
			21. Foreign terms are italicized, underlined, or bold.
		In Modules Operation	22. The font sizes and capital letter placement on the module are adequate.
3.	**Learning in Modules**	The Compatibility Of The Media Utilized With The Teacher's Expectations Interest In Modules	23. There are images/illustrations that can help with comprehension.
			24. The images/illustrations that are now available are clear and engaging.
		Electronic Modules Interest In Modules Operation	25. Students are more enthusiastic about learning with electronic modules.
			26. Learners' desire in learning momentum and impulse content grows.

		Module Of Study Teacher Expectations Are Met Through The Usage Of Conformity Media.	27. The electronics module has aided the teacher.
			28. Learning is more fascinating when it is done in a fun way.
4.	**Problem Based Learning**	Problem-Based Learning Comes In A Variety Of Forms.	29. Variations in problems pique learners' interest in addressing them.
		Problem-Based Learning's Effectiveness	30. The problems in the module can assist learners in comprehending the idea.

Source : Faishal, A (2015)

Data Analysis

The data used in this study came from an analysis of the results of material and media experts' validation of the e module to determine whether it is suitable for use in the teaching and learning process. The eligibility criteria are measured by a percentage calculated using the formula percentage of eligibility

$$score = \frac{\text{Total score obtained}}{overall\ score}\ 100\%$$

Then, using the calc, the data was acquired from the questionnaire response analysis of students and teachers. According to table 5, the range of the percentage value of the questionnaire data is divided into four parts using this equation.

Table 5. Table Scores On The Teacher And Student Response Questionnaire

No	Category	Level
1	Very Good	Quartil 3 $< x <$ Score Maksimum
2	Good	Median $< x <$ Quartil 3
3	Poor	Quartil 1 $< x <$ Median
4	Not Good	Score Minimum $< x <$ Quartil 1

Source : Yusrizal (2016)

In order to develop student participation in the research process, more data was acquired from the examination of pretest and posttest students' test questions in this study. Syaifudin (2011), a moderate increase in the outcomes of the study of students' scores before and after teaching and learning activities is a sign of research and development effectiveness. The analysis' conclusions are derived by doing the following calculations using the N-Gain formula:

$$Theory\ N - Gain = \frac{Posttets\ Value - Pretest\ Value}{Maximum\ Value - Prestets\ Value}$$

Based on the above equation, the N-Gain criteria will be shown in accordance with the following table:

Table 6. Table of N-Gain Criteria

No	N-Gain Value	Level
1	≥ 0,7	High
2	0,7 ≥ N-Gain ≥ 0,3	Medium
3	≤ 0,3	Low

Source : Farah (2017)

RESULTS AND DISCUSSION

The model employed in this PBL-based e-module development study is based on an adaption of Thiagarajan's (1974) 4D model, which comprises the following processes:

1. *Define*

Previous researchers have found flaws that are deemed to be a difficulty in the teaching and learning process of students, particularly in physics learning materials, at this stage of definition. The researchers then looked at instructor, student, and learning material requirements.

The researchers analyzed the textbooks that had been delivered to the school, and they also conducted a few interviews with teachers and students at this point. The findings of the textbook analysis show that textbooks quickly bore students and reduce their interest in learning, particularly in physics textbooks, that writing is not too tight and monotonous, and that pictures that are sometimes difficult for students to understand make textbooks less appealing. The researcher conducted an analysis of the old LKPD and also analyzed the need to obtain information on how the willingness of LKPD was in accordance with the 2013 curriculum (Rahmah, S., 2020).

According to the findings of the study, teachers and students require instructional material companions who are willing to engage students' enthusiasm in learning. Researchers decided to create an electronics module because they believe it will make it easier for students to access the module from anywhere by simply carrying a smartphone and an E-book. This problem-based module will also engage students in the learning process because they will be expected to solve the issues in the module whether they are solved at school or at home.

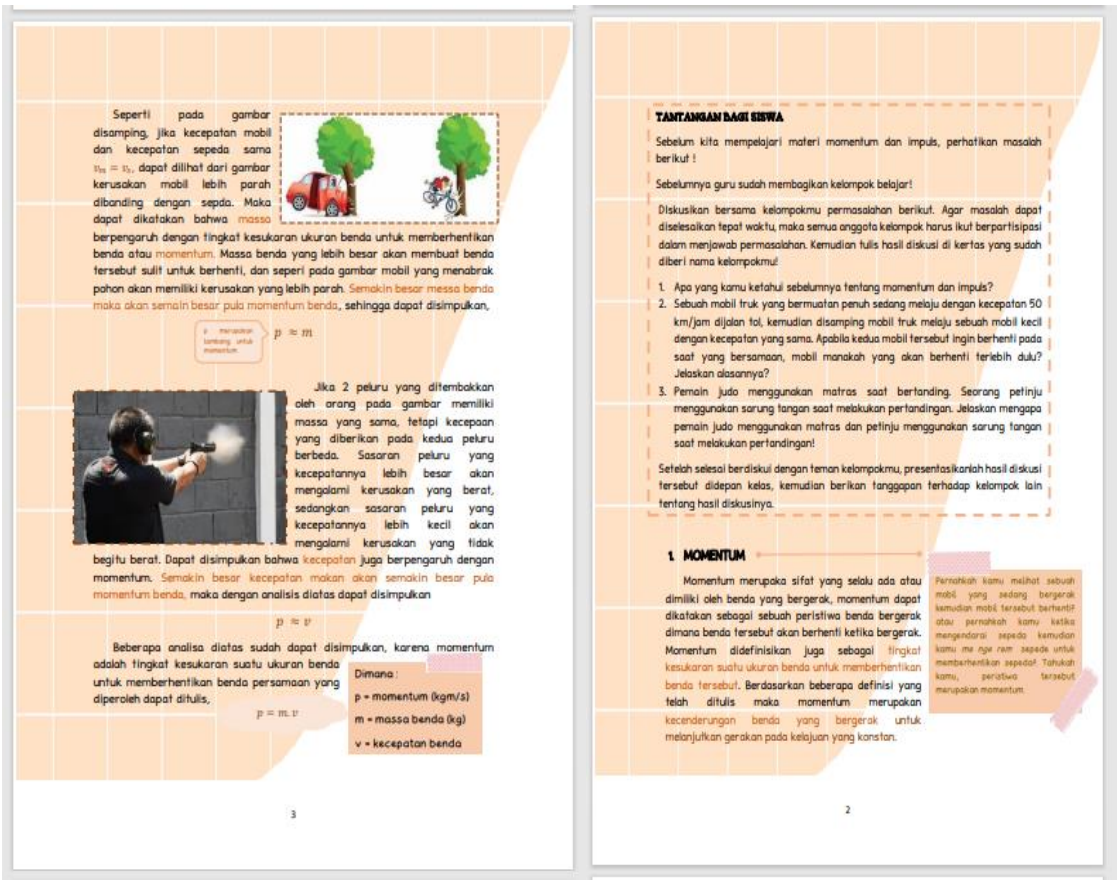
The foundation for creating a product in the form of a module. Teachers require instructional materials. Like a colored module with interesting images/illustrations. I also need modules for the teacher that can properly explain the content and complete it in simple language that students can understand, as well as representations that are unique (Handayani, R.A. et. al., 2018).

2. *Design*

Herry Setyawan, a physics instructor from SMA Negeri 2 Sarolangun, built a module for the researcher. S. Pd, M. Si. The modules were designed to be more engaging and colorful, and the researchers also used PBL-based learning methodologies to create them. On the website

www.bosspedia.com, you can find the developed module. The module's initial design was less appealing and colorful for students, therefore researchers altered the background, then the lettering, and finally the colors to make it more appealing to students. Developing products in accordance with the conditions and needs of students. The first step in development starts with determining the media and approach to be used. The choice of approach is done by analyzing the results of the first stage. After that, designing the product design, namely video (Serevina, V., et. al., 2021).

The researcher updated the design of the module after it was created in order to pique students' interest in reading it, not just in terms of color and background design, but also in terms of the electronic design of the module itself. The researcher also altered the writing style so that students would not become bored while reading the electronics module. The choice of colors and text is carefully tailored to the eyes so that reading does not cause discomfort. The attractiveness of the module, one of which is the contrasting color and background with the text, is also necessary to make the content simpler to read (Paulinan, H., 2001). As shown in the illustration below:



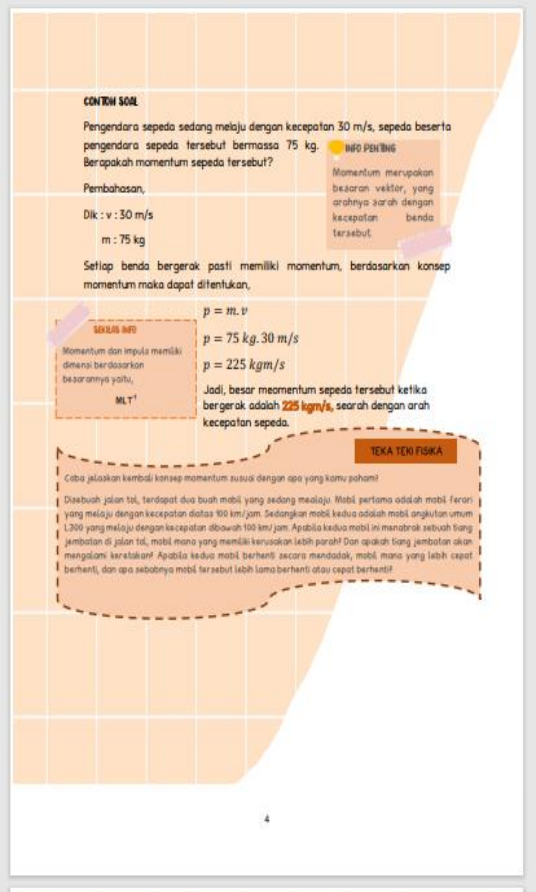


Figure 1. shows the developed E Module.

3. *Develop*

The researchers not only developed the module's color, writing, and electronic background during the development stage, but they also developed a module based on a problem-based learning method, also known as a problem-based learning method, because Herry's module was not based on any learning method. This problem-based development is thought to be very exciting for students' learning interests because students would feel challenged before they understand the notion of learning and the concept of the learning material will be easy to understand.

At this stage the researcher is assisted by a team of experts consisting of 1 lecturer and 1 teacher to assess the developed LKPD. Before the LKPD based on the scientific approach using the group investigation model on the collision material was validated by a team of experts, the expert team first assessed and provided suggestions so as to produce LKPD that could be used in learning (Rahmah, S., 2020).

Researchers create puzzles based on real-life scenarios and involving the concepts of momentum and impulse material. The placement of the problems is in accordance with the learning activities in the electronics module, ensuring that the concept of the material received is sequential and that students are not confused when studying independently using the researchers' electronics module.

Students are expected to study hard and answer every problem in the module after the group is formed and the modules are distributed. After learning how to use the electronic module that

was provided, students will be given response questionnaires and posttest sheets to complete after learning how to use the electronic module.

4. *Disseminate*

This is the stage in which the researcher's electronics module is handed to students and teachers in the schools where it will be distributed, one of which being SMA Negeri 1 Tangse. The distribution of electronic modules created by researchers is done using WhatsApp, a popular chat tool among students and teachers. The platform where the video is uploaded (YouTube) can be accessed anywhere and anytime with a smartphone or laptop. YouTube also has a facility to speed up/slow down videos, so students can take part in lessons according to their learning abilities (Serevina, V., et. al., 2021).

Students are expected to study hard and answer every problem in the module after the group is formed and the modules are distributed. After learning how to utilize the electronic module that has been delivered, students will be given response questionnaires and posttest papers to fill out. The purpose of providing questionnaires and test papers at this stage is to assess students' interest in the module as well as their level of understanding after learning how to utilize the electronics module.

With percentages of 84.85 and 78.4, the validation of material experts and media experts yields a solid and extremely realistic category. The findings of the student and teacher questionnaire response analysis also yielded a high average answer, indicating that the electronics module is appropriate for use in the teaching and learning process. The findings of the examination of the test questions given to the students revealed that 13 individuals received high N-Gain scores, 15 people received medium N-Gain scores, and two people had low N-Gain scores, with the average N-Gain scores. The N-Gain table below has the gain of 0.6.

Table 7. The N-Gain results

No	N-Gain Value	Category	Students
1	≥0,7	High	13
2	≥0,7 N-Gain≥0.3	Medium	15
3	≤0,3	Low	2

As a result, it can be concluded that e-Module based on PBL on the physics learning of momentum and impulse material physics is capable of increasing understanding in class learners X MIPA SMAN 1 Tangse and e-Module based on PBL modules on the physics learning of momentum and impulse materials developed are worthy of use as one of the learning media in the classroom. Problem-based learning is an innovation in learning because with problem-based learning, students' thinking abilities are actually maximized to hammer the prose of group work so that learners can sharpen, test, and build their thinking skills continually (Rusman, 2011). The results of the N-Gain table show that students' grasp of momentum and impulse material has improved as a result of employing module electronics.

CONCLUSIONS

Based on the data and analysis, the following conclusions can be drawn, The produced module is suitable for distribution and use in teaching and learning activities, as evidenced by the validation results, teacher and student reactions, and pre- and post-test results.

According to the findings of the N-Gain study, the e-Module based on PBL in the physics learning of momentum and impulse material can help students grasp the material's concept more easily. PBL (problem-based learning) is a learning style that focuses on guiding students to think critically about learning materials by posing problems.

Acknowledgements

Thank you to the guiding lecturer, all staff and physics lecturers, as well as comrades-in-arms who have provided support and inspiration so that we can complete all lecture issues.

References

Daryanto, D. (2013). Menyusun modul bahan ajar untuk persiapan guru dalam mengajar. *Yogyakarta: Gava Media*.

Faishal, A. (2015). Pengembangan E-Modul Pembelajaran Pneumatik Pada Mata Pelajaran Proses Dasar Kejuruan Mesin Di Smk N 3 Yogyakarta. *Jurnal Pendidikan Teknik Mekatronika*, *5*(5).

Hamid, A., Ngadimin, N., & Azwi, N. (2020). The Development of Student Worksheet to Support ICARE Learning Model on Optical Equipment Material. *Asian Journal of Science Education*, *2*(1), 56-63.

Handayani, R. A. (2016). *Pengembangan Modul Fisika Multirepresentasi Berbasis Problem Based Learning pada Materi Dinamika Rotasi dan Kesetimbangan Benda Tegar untuk Meningkatkan Keterampilan Berpikir Kritis Siswa SMA Kelas XI* (Doctoral dissertation, UNS (Sebelas Maret University)).

Hasanah, T. A. N., Huda, C., & Kurniawati, M. (2017). Pengembangan modul pembelajaran fisika berbasis problem based learning (PBL) pada materi gelombang bunyi untuk siswa SMA kelas XII. *Momentum: Physics Education Journal*, 56-65.

Paulinan, H. (2001). *Penulisan Bahan Ajar.* Jakarta: Pusat Antar Universitas dan Pengembangan Aktifitas Intruksional: Direktotorat Jeeral Pendidikan Tinggi, Depdiknas.

Rahmah, S., Ngadimin, N., & Halim, A. (2020). Development of Student Worksheets Based on a Scientific Approach using the Group Investigation Model. *Asian Journal of Science Education*, *2*(2), 128-142.

Rusman. (2011). *Model-model pembelajaran: Mengembangkan profesionalisme guru*. Rajawali Pers/PT Raja Grafindo Persada.

Serevina, V., Astra, I. M., & Danoza, F. V. (2021). Development of E-Learning Video Using a Contextual Approach to Distance Learning Static Fluid Discussion. *Asian Journal of Science Education, 3*(1), 70-80.

Soewarno, S., Herliana, F., & Musdar, M. (2020). Effectiveness of Problem Posing Model on Ability of High School Physics Teacher's to Solve HOTS-Based Problems. *Asian Journal of Science Education, 2*(1), 71-77.

Sugiyono. (2015). Metodologi Penelitian Pendidikan kuantitatif, kualitatif dan R & D . Bandung:Alfabeta

Syaifudin, A. (2011). Pengembangan Media Pembelajaran Berbasis Video Handphone Format 3gp Untuk Materi Pelajaran Fisika Kelas X Pokok Bahasan Perpindahan Kalor. *Skripsi Tidak Dipublikasikan, Universitas Sebelas Maret, Surakarta*.

Yusrizal. 2016. Pengukuran dan Evaluasi Hasil dan Proses Belajar. Banda Aceh: Penerbit Pale Media Prima