P-ISSN 2746-9034 || E-ISSN 2774-5066
Indonesian Physics Education Research
Volume 4, No. 1, June 2023, pp. 35-50

THE DEVELOPMENT OF E-MODULE BASEDON SCIENTIFIC APPROACH TO IMPROVE STUDENT LEARNING OUTCOMES IN WORK AND ENERGY MATERIALS

Luni Karlina Manik[1], Dewi Wulandari[2]

[2]Universitas Negeri Medan, Medan 20113,
IndonesiaEmail:
lunikarlinamanik@mhs.unimed.ac.id

Abstract

This research aims to; (1) What is the level of validation of the development of physics e-module based on the scientific approach that was developed on the Work and Energy material. (2) How did the students respond to the electronic module (e-module) based on a scientific approach on the subject matter of Work and Energy for class X SMA/MA students. (3) How is the effectiveness of physics e-module teaching materials based on scientific approach on Work and Energy materials to improve student learning outcomes. This study uses research and development (R & D) methods. The development model in this study uses a 4D model learning tool development method that is limited to the 3D stage with Define, Design, and Development Steps. The data collection instruments used in this study consisted of: material expert and media expert validation questionnaires, teacher responses to questionnaires, student response questionnaires and test instruments. The type of data obtained from the research results is qualitative data which is analyzed using quantitative data in the form of numeric data and interpreted with guidelines for assessment category criteria to determine product quality. The results of this study are, (1) the scientific approach-based physics learning e-module assisted by work and energy materials, the results obtained get very valid criteria with an average validation score of 93% material experts, and 90% media experts, (2) Physics learning e-module based on a scientific approach on Work materials and energy the results obtained are very practical criteria with the average score for small group trials 92%, for large group trials 94% and for teacher response tests 90%. (3) physics e-learning module based on a scientific approach to material, Workand energy, the results obtained have a moderate level of effectiveness with an average N- gain score of 0.70.

Keywords: Development, E-module, Work and Energy, Scientific Approach, Learning Outcomes.

Teaching materials are designed as media that can help educators and students in the learning process so that learning is more effective (Festiyed, 2018). Teaching materials that can be used according to the demands of the industrial revolution 4.0 are non-printed teaching materials.Non-printed teaching materials are all materials used to assist educators in carrying out learning activities as outlined in non-printed technology. One of the non-printed teaching materials that are in line with the development of industry 4.0 is an electronic module (e-module). A module isa learning tool that contains materials, methods,

and ways of evaluating that are designed in a systematic and interesting way (Syafitri & Festiyed, et al., 2019), Electronic modules are non- printed modules. Modules are printed teaching materials that are able to help students understandlessons with educators in the classroom or without an educator. According to the Ministry of Education and Culture (2008) a module is a book written with the aim that students can learn independently without or with the guidance of an educator. The module is interpreted as a set of teaching materials that are presented systematically, so that users can learn with or without an educator (Prastowo, 2011). The module must be arranged systematically, meaning that the module must be in accordance with the learning objectives to be achieved, the characteristics and needs so that students can learn independently (Asrizal, 2013). E-modules are non-printed teaching materials or modules that are digital in their use using computer devices. So it can be interpreted that the e-module is a set of non-printed teaching materials used for independent learning by students.

According to Nursiddieq 2022, currently the facts on the ground show that there are still symptoms that mark the ineffectiveness of learning in schools. One of them is that there are still many learning systems in schools that run traditionally which prevent students from actively learning. He stated that the limitations of the learning process in the current pandemic have resulted in teachers having difficulty developing learning tools and guiding students so that it has an impact on students' interest in learning Physics and difficulties in understanding subject matter. He also said that students had difficulty understanding the subject matter because the teacher was not able to control the learning process optimally.

Learning in the classroom will be more focused if assisted through teaching materials that are able to make students more enthusiastic in learning. By using teaching materials, students will think about the material regularly and precisely. So, that they are able to master all competencies in a complete and coordinated manner. In terms of utilization, the module can be used adaptively. Modules can encourage students to learn independently. Modules can also be used anywhere without being bound by time, we can use it alone or in collaboration with other media. From the linear shape of this module, this module has quite a lot or thick sheet of contents so that the cost of making the module is more expensive than the electronic module. With the development of today's digital era, the module which was still cracked is expected to be developed into a digital format or more modernly known as an electronic module.

The electronic module is a printed teaching material that is made into electronic form, where this module can be studied by students anywhere without bringing a printed book. An electronic module is a learning tool or facility that contains materials, methods, limitations, and evaluation methods. The materials, methods, limitations, and evaluation methods were developed in a structured and inventively designed manner in order to achieve the planned capabilities. (Wijayanto and Zuhri, 2014) suggested that the electronic module is a picture of information written in a book, and displayed in digital form in the form of a hard disk, floppy disk, CD or flash disk, where a computer or e-book reader is used as a means to read the electronic module. Previous research has shown that the developed electronic module is suitable for school textbooks. However, the electronic module still looks interesting, because this electronic module does not inspire students to be more creative and active in the learning process. To develop student potential, students must participate actively in the learning process. This activity can be achieved through the use of innovative, diverse, interesting, contextual textbooks that meet the needs of students. It is hoped that through the use of these teaching materials, a fun learning process can be created and can trigger an efficient learning activity. With this, it is necessary to maintain a learning device that is able to make students motivated or enthusiastic in learning.

Sirait, J V,. et al (2016), the research results show that scientific inquiry-based teaching materials developed can improve student responses, activities and student learning outcomes at each meeting. This is in line with other research conducted by Swaji C Y (2019) which clearly shows that electronic teaching materials can improve student learning outcomes. Research by Pajr N., et al (2016) learning media in the form of scientific-based physics-based electronic modules that were developed can be categorized as good and suitable for use as learning media. Research results Luvia R N and M. Nasir (2016) Scientific-based worksheets taught using cooperative learning models are effective for improving students' cognitive learning outcomes.

The development of e-modules using a scientific approach has been carried out by Nur P, et al (2016) but has not researched the effectiveness of improving student learning outcomes, also in research by Resy A, et al (2017) there is no simulation in every learning activity, it cannot be connected with internet, and can not be used on smartphones. Research by Putri, I T., et al (2020) on the development of e-modules based on a scientific approach has also not examined the effectiveness of improving student learning outcomes. In Sari D A P., et al's research (2019) on the development of e-modules based on a scientific approach, it is suggested to test the effect of its use on student learning outcomes and add simulations to activities 1 and 2 and add scientific activities

for each sub-material. Then in the research of Rahmawati K M., et al (2019) there is no guide to the use and learning method using scientific-based teaching materials before students study independently.

Besides the use of smartphones as a medium for learning physics using e-modules, this has never been done before. Then, the teaching materials currently available have not made students think scientifically and have not been able to solve problems. For the development of e-modules, it should be adapted to today's millennial children by paying attention to contemporary aspects in the form of features, animations, and images, and videos are included. Given the importance of this, the researcher intends to develop a scientific-based module. The guiding stages in the module are based on scientific steps (observing, asking, trying, associating, and communicating). So far, the learning models recommended by the 2013 Curriculum Development Team are problem-based learning, discovery learning, project-based learning, and inquiry learning. Through the syntax of the learning model it is possible to carry out scientific steps. The difference between the development of this e-module with existing e-modules is that there is a scientific stage where, in this e-module, the emphasis is on the scientific stage, namely the trying stage, also in previous research on researching for effectiveness on student learning outcomes, and can be accessed to the internet on a smartphone

Based on the results of questionnaire analysis to several X grade students at SMAN 1 Dolok Masihul through questionnaires, it was found that 90% of students needed online-based physics teaching materials that were arranged according to school material in order to be able to understand the material presented, 97% of students needed alternative teaching materials that could be used. During the physics lesson, 98% of students need physics enrichment teaching materials in the form of e-modules. In addition, the use of smartphones as a medium for learning physics using e-modules has never been done before then the teaching materials currently available have not made students think scientifically and have not been able to solve problems so that student learning outcomes are very low. For the development of e-modules, it should be adapted to today's millennial children by paying attention to contemporary aspects in the form of features, animations, and images, and videos are included.

Based on the explanation above, it is necessary to find a solution to this problem immediately. One of them is by developing electronic-based learning media modules that are packaged creatively,interactively and also using a learning approach that can improve student learning outcomes. One approach is a scientific approach in accordance with the 2013 curriculum

which makes it easier for students to solve existing problems through scientific activities. With the development of the electronic-based module, students will be more active in learning in the hope that it will increase their interest in learning outcomes of students in physics.

METHOD

The research was carried out at SMA Negeri 1 Dolok Masihul which is located at Jl. Mutiara No.1,Dolok Masihul, Serdang Bedagai, North Sumatra for students of class X Science in 2022 The subjects of this study were students of class X IPA SMAN Dolok Masihul. The object of this research is the eligibility of an e-module based on a scientific approach. Research is developed using the type of research development or Research and Development (R&D). This research is intended to develop a product, namely the physics e-module for Work and Energy. The steps taken in each phase of development research can be described as follows: (1) Analysis phase, which includes job analysis, selecting work functions to be trained, constructing work measurement methods, analyzing existing work activities, and selecting arrangements. learning.; (2) the design phase, which includes developing objectives, describing initial behavior, and selecting the structure and stages of learning; (3) The development phase includes determining learning activities, determining learning management plans, and delivery systems, selecting and reviewing existing teaching materials, developing lesson plans, and validating learning designs. (Thiagrajan, et al., 1974)

The population in this study were as follows: a physics lecturer at the State University of Medan, a physics teacher at SMAN 1 Dolok Masihul, and class X science students at SMAN 1 Dolok Masihul. The research sample is a group of individuals who represent a certain group or are some members with characteristics that represent the population. Samples taken from the population must truly represent the population (Ridwan, et al., 2018). The samples from this research are as follows:

1. Several physics subject lecturers with minimum criteria for master's education, teaching experience, are actively learning and are experts in analyzing physics material and are experts in learning media.
2. One of the physics teachers who is actively teaching in class X SMAN 1 Dolok Masihul
3. Class X IPA SMAN 1 Dolok Masihul.

This research belongs to the type of research and development (Research and Development) which will produce a product. Research R&D as the process of making and consolidating the

product to be used. The development model used refers to a 4-D model that has been modified and adapted. This model was suggested by Thiagarajan et al (1974). However, this research is limited to 3 stages (Define, Design, Development) which have been modified by researchers adapted from Thiagarajan (Akhlish, 2014). Procedures are steps to do work that must be done in stages to achieve a predetermined goal or complete a product. This e-module development procedure refers to the 4-D development model which can be explained as follows:

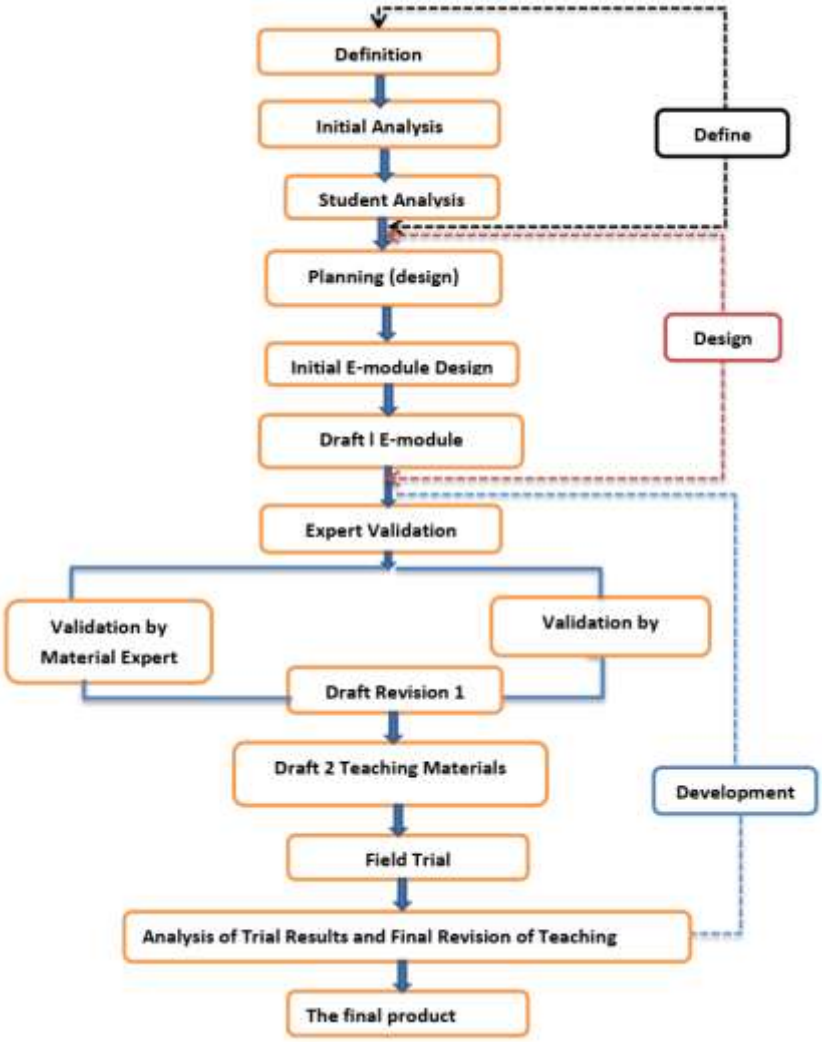

Figure 3. 1 Research Procedures for Development of Teaching Materials Modules Based on a Scientific Approach on Work and Energy Materials.

RESULT AND DISCUSSION

Define Stage

The define stage is carried out as an initial stage to determine and define the learning

requirements in the preparation of the e-module which is carried out by analyzing the objectives of the material limits developed by the product. The material raised in the development of the emodule is work and energy. At this stage, several analyzes were carried out on students at SMA Negeri 1 Dolok Masihul, namely:

(a) Early-late analysis

At the initial stage, identification of problems faced by students and teachers in learning is carried out. This stage was carried out by interviewing teachers in the field of physics studies and observations at SMA Negeri 1 Dolok Masihul. Based on the questionnaires that were given to students and interviews with teachers, it was found that crucial problems in learning Based on these data on the result analysis, it is known that students' interest in physics material is still relatively low, this is because students rarely ask questions and are less active in the learning process. The student's low interest in physics material can have a negative impact on students, and making the students more difficult to understand work and energy material. If viewed from the student learning experience, it is known that the student learning experience is still relatively low, this is because the modules provided by the teacher are not in accordance with the needs of students and are not equipped with stages that can be used by students as instructions for solving work and energy problems. So, it can be seen the needs students in terms of module development is very high.

Based on the result analysis the problems in the early-late analysis are obtained, namely the teacher conveys the material to students by using conventional method in learning. Students just silently listen to what is conveyed by the teacher resulting in students not getting used to exploring and elaborating the material being studied. Teachers have limited time in learning so that teachers tend to immediately provide materials and assignments in the learning process. The teaching materials used by students in learning are only in the form of textbooks. The available printed teaching materials are limited and only consisting of a summary of the material, and some practice questions. In line with the research (Nihayah & Yuli, 2019) students who do not have learning source for studying at home and books are only used at school make the learning process less effective and efficient. This results in a lack of ability and experience of students to play an active role in the process of observing, asking, trying, associating and communicating so that they cannot lead students to improve student learning outcomes.

Design Stage

The design stage is carried out to design the developed e-module in order to obtain a learning device prototype. The steps that must be taken at this stage are:

1. Media Formatti

In this part of designing module have started to design module covers, making module frameworks (opener, module content and closing), planning the placement of module contents, learning videos, pictures and readings used. The modules developed are designed according to the needs and packaged in an attractive form and can make it easier for students and educators in the learning process.

2. Material Preparation

In this part attribute to the series topic collection with accordance with the core competencies and basic competencies from various accurate sources to enrich the information in the E-module. The material contained in the Work and Energy E-Module consists of the concepts of work and energy and the relationship between work and energy.

3. Format Selection

The E-Module format chosen as a reference in the product preparation process starts from the type of paper, typeface, and font size. The font size used in making the E-Module on Work and Energy based on the Scientific Approach is letter 21.59 x 27.94 cm. The typeface used for the title and content is "Times New Roman" with a varied font of 12-26. All of the learning tools are adapted to the scientific approach in order to become a single unit that has an impact on improving student learning outcomes at SMA Negeri 1 Dolok Masihul.

4. Initial E-Module Design

The E-Module is prepared based on a predetermined format and is based on the 2013 curriculum. The designed E-Module that is divided into 2 parts, namely e-module cover and material content. Integrated the scientific-based approach which consists of: a) Observing is used to train students' accuracy and sincerity through reading, listening, listening and seeing; b) Questioning is used to develop students' curiosity by asking questions about things that are not understood from what is observed; c) Experiments are used to explore and collect information from various sources through various means; d) associate is used to explore and collect information from various sources through various means;

5. Cover E-Module

The lay cut of cover E-Modul is designed with several images of work and energy applications in daily life using the Canva Application with a dominating white-blue background, and the typeface used is Shrikhand.

6. Contents

The content of the material in the E-Module is equipped with a preface, table of contents, instructions for using the E-Module, content standards containing core competencies and basic competencies, learning indicators objectives along with, concept maps and stages of the process of scientific approach activities that have been processed in the form of questions or related images. work and energy. The format of the Work and Energy E-Module is made in colorful to attract students' interest and motivation to learn.

7. Preparation of Research Instruments

The research instrument in the form of a questionnaire was compiled and designed by researchers and thesis supervisor to obtain information that can be used as a basis to determine the eligibility of the product from the validator and student responses.

8.Draft 1

At this stage, all responses and suggestions of e-modul given by the supervisor have been updated and are ready to be validated by expert validators.

Development Stage

In development stage, researcher analysis validation by material and media experts and take teacher and students responses to the use of e-modules. The questionnaire validation of the material and media expert referred to the scoring description adapted by BNSP. The results of the validation by material expert cover two aspect as shown in table 1.

Table 1. Validation by material expert result

No	Assessment Aspect	Category Percentage	Percentage Classification
1	Content eligibility	91%	Very valid
2	Eligibility of Presentation Approach scientific	95%	Very valid
Average Overall Score	93%	Very valid	

Based on the results of the material expert's assessment, the E-Module that has been developed is expressed in the form of a percentage, the content eligibility gets a percentage of

91% consisting of 11 indicators and the presentation eligibility gets 95% consisting of 5 indicators. Then the average percentage is 93%. If it is adjusted to the table of eligibility criteria, then this score is classified as very feasible. From these two aspects, it was found that the E-module that had been developed was stated in the learning of Physics in class X IPA at SMA Negeri 1 Dolok Masihul that it could be continued at the trial stage. The results of the validation by learning expert cover two aspect as shown in Table 2

Table 2. Learning Expert Validation Results

No.	Aspect	Category presentation	Classification
1.	Content Eligibility	91%	Very valid
2.	Eligibility of Presentation of Learning Based on Scientific Approach	91%	Very valid
Average Overall Score		91%	Very valid

Based on the results of the assessment of learning experts, the e-module that has been developed by the researcher is expressed in the form of a percentage, then the eligibility of the content gets a percentage of 91% consisting of 6 indicators and the eligibility of the presentation gets 91% consisting of 6 indicators. So the average percentage is 91%. If it is adjusted to the table of eligibility criteria, then this score is classified as very feasible. From these four aspects, it was found that the e-module that had been developed was stated in the learning of Physics in class X IPA B SMA Negeri 1 Dolok Masihul can be continued at the trial stage.

The results of the validation by media expert cover two aspect as shown in Table 3.

Table 3 Media Expert Validation Results

No.	Aspect	Category presentation	Classification
1.	Graphic Eligibility	97%	Very Valid
2.	Language Eligibility Aspect	95%	Very Valid
Average Overall Score		96%	Very Valid

The E-Module that has been developed is expressed in the form of a percentage, the percentage of graphic eligibility is 97% and the language eligibility aspect is 95%. Then the average percentage is 96%. If it is adjusted to the table of eligibility criteria, then this score is classified as very feasible. From these two aspects, it was found that the E-module that had been developed was stated in the learning of Physics in class X IPA at SMA Negeri 1 Dolok Masihul that it could be

continued at the trial stage. The teacher's response to e-module is carried out offline (at school). The instrument used to obtain responses was in the form of a questionnaire using a Likert scale of one to four cover four aspect as shown in table 4.

Table 4. Teacher's response result

No.	Aspect	Category Percentage	Percentage Classification
1	E-module display	100%	Very practical
2	Content Eligibility	100%	Very practical
3	Serving Eligibility	96%	Very practical
4	Graphics	96%	Very practical
Overall Average Rating Score		87%	Very practical

The teacher's response in the field of study to e-modules based on a scientific approach on work and energy materials from 16 indicators gave an assessment in the very good category with a percentage of 87%. The display module gets an average result of 100%, the eligibility of the content gets 100%, the eligibility of presenting 96% and the graphic 96%. Teachers feel very helpful with the e-module. This shows that the e-module that has been developed can help teachers as facilitators with scientific activities.

In in a small group of 10 students and a large group test of 35 students of class X. Student response collection carried out using student response questionnaire consisting of three aspects, that are the aspects of interest, material, and language. However, in large group trial provides 35 students response to the product with same aspect as shown in table 4.

Table 4. Large group trial response

No.	Aspect	Category Percentage
1	Interest in e-modules	94%
2	Presentation of e-modules	91%
3	Component Based Learning	
Scientific Approach	91%	Very attractive

Based on the table students give a positive response to the product being developed. This is evidenced by the high percentage of their response and there is an increase in satisfaction with the use of e-modules by students.

Discussion

This research was conducted using the stages of the Thiagarajan (4D) model which was modified and adapted to the needs of e-module products. However, the development stage in this

research is limited to a 3-D model, namely definition, design and development, due to time constraints.

The development of e-modules is adapted to a scientific approach whith goal is that students can learn through the activity steps (observing, questioning, experimenting, associating and communicating). Observing Step, teacher invites to observe an illustration image and make a perception. The teacher directs students' answers to what will be done. Questioning Steps, at this stage the teacher directs students to formulate problems and hypotheses based on the illustrated images that have been observed. In the experimental stage, the teacher guides students in reading the instructions from the e-module and the teacher directs students to experiment according to the steps listed in the e-module and directs students to collect the data needed for discussion. Associating/reasoning stage, the learning activities provided by the teacher are processing diverse information, deepening and expanding information and making it mutually supportive even though they are different or contradictory. And at the communicating stage, at this stage the student representatives from the group present the results of their group work. The preparation of this e-module uses a format adopted from the National Education Office (Prastowo, 2015) which consists of three parts, namely: the introduction, content and closing pages. The introductory page consists of a cover, preface, table of contents, instructions for use, competency review, the second part (content) consists of a description of the work and energy material, learning steps according to a scientific approach, evaluation questions, a glossary and the third attribute to bibliography.

The eligibility assessment of the e-module was carried out by three experts validators, namely material expert media expert and learning expert. Data from the results of the e-module assessment includes data in the form of scores and then converted into four categories, namely very valid, valid, less valid, and very invalid. Each score obtained is processed into a percentage for the validity criteria. If the criteria according to the e-module are appropriate, then the emodule is effectively used to study the competence of learning objectives, so that the e-module is said to be valid. However, if the validation results are invalid, it is necessary to make improvements until the product has a valid category.Validation results by material expert with average percentage of 93% in very valid category, media expert with average percentage of 96% in very valid category, media expert with average percentage of 92% in very valid category ,teacher response rate of 87%% in very good criteria and students in large group trial with average percentage of 87%% in very good criteria.

According to (Puspitasari,. (2019) the effectiveness of the e-module that has been developed can be seen from the achievement of learning outcomes and student responses. The results of the achievement of learning outcomes are obtained from the pretest-posttest results. The results of the pretest-posttest scores are a benchmark for an e-module to be said to be effective This test consists of 20 multiple choice questions pretest and 20 multiple choice questions posttest it shows at Appendix 17, that there are 15 students or 43% of the number of students whose n-gain is at a score of 0.3 g 0.7, meaning that the increase in student learning outcomes is in the medium category, 20 students or 57% of the number of students whose n-gain is at a score of g 0.7, meaning that the increase in student learning outcomes is in the high category. If referring to the pretest-posttest scores, the scores obtained for the pretest get an average of 32 and the score for the posttest get an average of 80. Thus, the results of the normalized gain or the average normalized gain of students after being given learning using emodule based scientific approach that is equal to 0.70. These results indicate that there is an increase in the moderate category according to the Hake criteria, This means that the scientific approach-based e-module which is applied in learning work and energy materials can significantly improve student learning outcomes. The increase in the n-gain score was due to the large range of pretest and posttest scores. This can happen because the use of appropriate emodules can improve student learning outcomes (Puspitasari. 2019).

Retnonigrum in (Ilmiwan et al., 2019) states that the scientific approach is believed to be a golden tool for the development of students' attitudes, knowledge, and skills. Thus, learning using e-modules based on a scientific approach can be a solution for educational actors to encourage students to become competent and capable human resources in solving every competitive and sophisticated life problem in this era of globalization.

CONCLUSION

Based on the results of research and discussion of making a scientific-based physics module on the subject of Work and Energy in class X students of SMAN 1 Dolok Masihul, it can be concluded that the level of validation of the development of physics e-modules based on scientific approach in work and energy material is very valid category. It is concluded that they are suitable for use in the learning process. Based on the validation results of material expert namely 93%, based on media expert validation of 86% and based on learning expert of 92%. The response from teacher and students of the e-module based on a scientific approach in Work and Energy material is very practice category. Based on the the teacher's response, which has very practice criteria and

a success rate of 87%. Student's response with an average percentage of 92%. The effectiveness of the e-module based on the Scientific Approach to improve student learning outcomes in Work and Energy material that has been developed is in the high category. This is based on the average N-gain score of 0.70.

ACKNOWLEDGMENTS

I would like to express my special thanks of gratitude to my supervisor, Dr. Dewi Wulandari, M.Si. who has provided guidance and input to the author so that this research can be carried out. I also would like to thank Prof. Dr. Makmur Sirait, M. Si., Deo Demonta Panggabean, S.Pd., M.Pd. and Jubaidah, S.Pd., M.Pd. as my examiner that given suggestions to improve my writing be better. Last but no least, thanks to my family and friends for financial, moral and motivation support until the completion of this research.

REFERENCES

Aflaha, Dwi S. I. (2017) Pengembangan Modul Berbasis Problem Solving Pada Mata Kuliah Elektronika, Vol.2 No.1, Tecnoscienza

Aprillia.,Dkk.,(2021)"Pengembangan E-Book Fisika Dasar Berbasis Pendekatan Saintifik Pada Materi Usaha, Energi, Impuls Dan Momentum, Jurnal Pendidikan,5 (1)

Anthon, Dkk. (1997).Pelajaran Fisika SMU Jilid 1.Jakarta:Erlangga

Asmiyunda, A., Guspatni, G. And Azra, F. (2018) 'Pengembangan E-Modul Kesetimbangan Kimia Berbasis Pendekatan Saintifik Untuk Kelas XI SMA/ MA', Jurnal Eksakta Pendidikan (Jep), 2(2), P. 155. Doi: 10.24036/Jep/Vol2-Iss2/202.

Halliday, David, Robert Resnick. (1996). Fisika Jilid1 Edisi7.Jakarta:Erlangga. Handayani, R.D., 2014. Pengembangan Bahan Ajar Elektronik Berbasis Mobile-Learning Pada Mata Kuliah Optik Di FKIP Universitas Jember. Ta'dibJurnal Ilmu Pendidikan.Vol 17(1) : hal 81-85.

Julianti, Dwi Putri & Ramadhan, S. (2018). The Development of Student Worksheet Based on Scientific Approach on Environmental Pollution Topic For Junior High School Student Grade VII. International Journal of Progressive Sciences and Technologies, 10(1): 11-18.

Kurniawan, D., Suyatna, A. And Suana, W. (2015) 'Pengembangan Modul Interaktif Menggunakan Learning Content Development System Pada Materi Listrik Dinamis', Jurnal Pembelajaran Fisika Universitas Lampung, 3(6), P. 120296.

Latifah, N., Ashari And Kurniawan, E. S. (2020) 'Pengembangan E-Modul Fisika Untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik', Jurnal Inovasi Pendidikan Sains, 01(01), Pp. 1–7. Available At: Http://Jurnal.Umpwr.Ac.Id/Index.Php/Jips/Article/View/570.

Luvia Ranggi Nastiti And Muhammad Nasir.(2016). Pengembangan Lks Berbasis Saintifik Pada Materi Alatalat Optik Dan Efektivitasnya Terhadap Hasil Belajar Kognitif Fisika Siswa. Edusains Volume 4 Nomor 1

Mahdalena & Musnar, I.D. (2020). Pengembangan Pembelajaran Fisika Berbasis Saintifik Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Komunikasi Verbal Siswa SMA. Journal On Teacher Education. 2(1): 39– 48.

Mahdalena, M. And Daulay, M. I. (2020) 'Pengembangan Pembelajaran Fisika Berbasis Saintifik Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Komunikasi Verbal Siswa Sma', Journal On Teacher Education, 2(1), Pp. 39–48. Doi: 10.31004/Jote.V2i1.903.

Maryani, Ika & Laila. (2015). Pendekatan Scientific Dalam Pembelajaran Di Sekolah Dasar (Teori Dan Praktek). Yogyakarta: Depublish.

Nasution, S. (2005). Berbagai Pendekatan Dalam Proses Belajar Dan Mengajar. PT. Bina Aksara.

Nihayah, Rifqiyatun & Yuli, P. (2019). Pengembangan Lembar Kegiatan Peserta Didik IPA Berbasis Pendekatan Saintifik Untuk Siswa Kelas V SD Negeri Poncowarno Kabupaten Kebumen, Jurnal Pendidikan Ke-SD-an. 5(3): 674- 683.

Pajr, N,. dkk(2019) Pengembangan E-Modul Fisika Berbasis Pendekatan Saintifik Pada Materi Rangkaian Listrik Untuk Siswa SMP Kelas IX https://repository.unja.ac.id/3625/1/A1C313036-ARTIKEL%20SKRIPSI.pdf

Prastowo, A. (2015). Pengembangan Bahan Ajar Tematik, Jakarta: Kencana Predana Group.

Punaji, Setyosari. (2015). Metode Penelitian Pendidikan & Pengembangan, Jakarta: Prenadamedia Group.

Putri, I T., Dkk (2020) 'Pengembangan E-Modul Fisika Berbasis Pendekatan Saintifik Pada Materi Teori Kinetik Gas', Jurnal Pendidikan Fisika, P-ISSN: 2477-7935, Vol. 5 No. 1.

Rahmawati, K M., dkk (2019) 'Pengembangan Bahan Ajar Fisika Berbasis Scientific Approach Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Pada Materi Medan Magnet Di Sma', Jurnal Pembelajaran Fisika https://jurnal.unej.ac.id/index.php/JPF/article/view/11663

Resy Anggraini,. Dkk. (2017). Pengembangan E-Modul Fisika Berbasis Pendekatan Saintifik Pada Materi Gerak Melingkar Untuk Sma/Ma Kelas X. Https://Repository.Unja.Ac.Id/2145/1/Artikel Ilmiah.Pdf

Setyandaru, A. T., Dkk. (2017). Pengembangan Modul Pembelajaran Berbasis Multirepresentasi Pada Pembelajaran Fisika Di Sma/Ma. Jurnal Pembelajaran Fisika, Vol 6 No. 3.

Sirait, J.V,. Dkk. (2016). Pengembangan Bahan Ajar Fisika Pada Materi Fluida Dinamis Berbasis Scientific Inquiry Untuk Meningkatkan Hasil Belajar. Jurnal Pendidikan Fisika

Sudjana Dan Ibrahim. (2007). Penelitian Dan Penilaian Pendidikan. Bandung: Sinar Baru

Algesindo. Sugiyono. (2018). Metode Penelitian Kuantitatif, Kualitatif Dan R&, Bandung : Alfabeta Bandung.

Syafitri, et, all. (2019). "Desain Modul Interaktif menggunakan Aplikasi Course Lab berbasis Pendekatan Saintifik Pada Materi Usaha, Energi, dan Momentum". Pillar of Physics Education, 12(3), 433-440.

Thiagrajan, S., D.S, S., & M, S. (1974). Instructional Development For Training Teachers Of Exceptional Children. Minneapolis Minnesota: University Of Minnesota. Widodo, S.C., & Jasmadi, S. T. P. (2008). Panduan Menyusun Bahan Ajar Berbasis Kompetensi. Jakarta: Elex Media Komputindo.

Yenti, Retna & Hardeli. (2020). Development of Electrolyte and Nonelectrolyte solution Module Based on Science Approach to Science Prompting Probing Technology Class X SMA / MA. International Journal of Progressive Sciences and Technologies, 18(2): 187-193