

Development of Integrated Physics E-Module Earthquake Material Based on Inquiry-Based Learning to Improve Student Competence

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ABSTRACT

The Mentawai Islands were one of the areas on the island of Sumatra which are prone to earthquakes. An earthquake's main result was the destruction of buildings due to ground shaking. Presenting disaster knowledge in schools was one of the efforts to integrate disaster knowledge through the educational curriculum. Implementing disaster knowledge requires facilities that can present the disaster in real terms, namely in the form of non-printed teaching materials, one of which was e-modules. The type of research was Research and Development (R&D). Product development refers to the Plomp stage, namely the Preliminary Research, Development or Prototyping Phase and Assessment Phase. The data in this study were needs analysis data, validity, practicality, and effectiveness. The research instrument consisted of a questionnaire, analysis sheet, validation sheet, practicality sheet, self-assessment sheet, and objective questions. The data analysis technique was validity analyzed by Aiken's V formula, practicality was analyzed using a Likert scale, and effectiveness was analyzed using descriptive analysis. The result of the research was that the High School Physics e-module was integrated with inquiry learning-based earthquake materials to improve students' competence with valid, practical, and effective criteria.



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INTRODUCTION

Indonesia is prone to earthquakes because it is traversed by the meeting point of 3 tectonic plates: the Indo-Australian Plate, the Eurasian Plate, and the Pacific Plate (Harini, 2021). That is why earthquakes often occur on the islands around the meeting of the three plates. West Sumatra is one area with the highest frequency of earthquakes (Fauzi, 2014). Mentawai Islands Regency is one of the areas in West Sumatra Province which is prone to earthquakes. The main result of an earthquake is the destruction of buildings due to ground shaking. Casualties usually occur due to falling debris, landslides, and fires. To reduce the impact caused by earthquake disasters, earthquake disaster mitigation is needed.

Indonesia already has principles for implementing the curriculum, namely that the curriculum is implemented by utilizing natural, social and cultural conditions as well as regional assets for the success of education with optimal content of all study materials

(Permendiknas, 2007). Earthquake disaster material integrated with the curriculum is very helpful for increasing students' knowledge of earthquake disasters. Integrating earthquake disaster material is expected to increase students' awareness of earthquake disasters, so that they can take appropriate action when an earthquake occurs (Sopaheluwakan, 2006). Therefore, earthquake disaster material needs to be integrated into the subject matter, one of which is Physics

Physics is a branch of Natural Sciences (IPA) closely related to the environment and phenomena that occur in life (Asrizal, 2018). As a natural science, Physics teaches humans to live in harmony based on natural laws. One of the objectives of Physics is to develop reasoning abilities in inductive and deductive analytical thinking by using Physics concepts and principles to explain various natural events and solve problems both qualitatively and quantitatively (Suharto, 2015). Innovative Physics learning must keep up with the times. Technological advances are developing rapidly towards the Industrial Revolution 4.0 so that information can be accessed anytime and anywhere (Setiawan et al., 2017). Educators and students are challenged to be literate about the sophistication of information and communication technology, one of which is e-modules.

A good e-module has complete e-module components such as the opening, core, and closing sections (Henke, 2001). The opening section includes a cover, preface, table of contents, glossary, introduction such as KD and GPA, brief description, time, prerequisites, information maps and instructions for using the e-module. The core consists of objectives, material descriptions, summaries, assignments, skills worksheets, exercises and self-assessment. The closing section includes an evaluation, answer key and scoring guidelines, bibliography and attachments (Depdiknas, 2008). E-module is a learning tool that contains material, methods and ways of evaluating designed systematically, clearly and attractively to achieve the expected competencies (Priatna, 2017). E-modules can help increase knowledge and students' learning independence.

Based on the analysis of students' initial competencies, a learning model must be used to improve students' knowledge and skills. One model that can be used is Inquiry-Based learning. The Inquiry-Based learning model influences student understanding, development of knowledge of a topic, scientific process skills, attitudes towards science learning, motivation in learning and communication skills (Bayram, 2013). Simsek and Kabapinar (2010) also stated that the inquiry-based learning model improved students' understanding, process skills and attitudes toward learning. So, the development of Physics e-modules with the Inquiry-based learning model needs to be developed.

Based on the problems described, using an Inquiry-Based learning model, developing an e-module Physics for SMA/MA integrated with earthquake disaster material is necessary. The e-module is prepared by following the inquiry-based learning steps. It is hoped that integrating earthquake disaster material into the Physics e-module can increase student competency. Therefore, this study aims to produce an integrated High School Physics e-module with earthquake material using an Inquiry-Based Learning model to improve valid, practical, and effective student competencies.

METHODS

The research was carried out by researchers in development research (Research and Development/R&D). Research and development is a method used to produce and test specific products (Sugiyono, 2012). The product produced and tested in this research is an integrated physics e-module for volcanic eruption disasters based on inquiry-based learning to increase students' preparedness. Development stages of an integrated physics e-module for earthquake disasters based on inquiry-based learning using the Plomp development model. The Plomp

model consists of three phases, namely: 1) initial investigation (preliminary research), 2) development or prototyping phase (development or prototyping phase), and 3) assessment phase (Plomp, 2013). The starting point for development research is the identification of educational problems. Educational problems can be obtained through previous research information and literature reviews. Additionally, analysis, design, evaluation and revision activities are repeated until a balance between objectives and realization is achieved.

The first phase of research is Preliminary Research. The criteria are an emphasis mainly on content validity, less on consistency and practicality. This stage is needed to obtain information about problems in the field of education. The preliminary phase aims to obtain information about existing problems (the gap between the existing situation and the expected one) (Plomp, 2013). In developing e-modules, a deeper analysis of the e-module design process, material suitability, and socio-cultural life (students, teachers and the environment) is needed to gain a deeper understanding of e-module development (Binss, 2015). Important activities that will be carried out at this stage include curriculum analysis and student analysis. Curriculum analysis refers to SKL, learning activities, assessments, and materials. Student analysis refers to initial competencies, interests, motivation, learning styles, and independence. Material analysis refers to the suitability of physical materials for earthquake disaster materials.

The second phase of research is the Prototyping Phase. The criteria are the initial stage: consistency (construct validity) and practicality, then prioritizing practicality and gradually moving towards effectiveness. This stage is carried out after the initial investigation stage. The prototype is developed, evaluated, and revised repeatedly (cycles) at this stage. The design results at this stage produce a prototype. Then, a formative evaluation of the prototype is carried out. Formative evaluation is an evaluation aimed at improvement, present in all phases and repeated cycles of design research.

The third phase of the research is the Assessment Phase. The criteria are practicality and effectiveness. A trial was conducted at this stage to develop the SMA/MA Physics e-module integrated with earthquake disaster material based on the inquiry-based learning model to improve valid and practical student competencies. This stage aims to determine the effectiveness of the e-module being developed. Product effectiveness means a measure that states whether or not there is an effect or influence of the product being developed on users, namely on students. Effectiveness was observed in the learning process using the Physics e-module.

This research uses instruments for analyzing learning activities, SKL, assessments and students through questionnaires. Material analysis uses material analysis sheets and validation sheets to obtain data about validating the e-module being developed. This validation sheet contains four components: appropriateness of content, presentation, language and graphics. This study's validation sheets were e-module development and practicality validation instrument assessment sheets (teacher response questionnaires and student responses) and expert and practitioner validation sheets. The practicality instrument collects information regarding the practicality of the Physics e-module being developed. The practicality instrument consists of teacher and student response questionnaires. Effectiveness instruments are used to collect data on the effectiveness of the developed e-modules. Data collection instruments for the effectiveness test were self-assessment for attitude competence, tests with multiple choice questions for knowledge competence, and performance assessment for skills competence.

RESULTS AND DISCUSSION

Results

Validation Test Results

Products that have been developed need to be validated by a team of experts first. The validation sheet was filled in by three experts (lecturers) and two practitioners (teachers). The results of the e-module validation showed that the e-module was in the valid category. The e-module validation includes four assessment components, including the feasibility of content, presentation, language, and graphics. The results of the validity of the e-module can be seen in Table 1.

Table 1. E-module Validity Value from the Validator

No	Validation Component	Expert Validator		User (Teacher)	
		Aiken's V value	Criteria	Aiken's V value	Criteria
1	Content Eligibility	0,89	Valid	0,93	Valid
2	Presentation	0,90	Valid	0,92	Valid
3	Language	0,91	Valid	1,00	Valid
4	graphic	0,83	Valid	1,00	Valid
Average		0,89	Valid	0,96	Valid

Content validation by expert validators obtained an Aiken's V value with a score of 0.93 in the valid category, and content validation by users (teachers) obtained an Aiken's V value with a score of 0.93 in the valid category. Product development consists of 3 materials: the characteristics of mechanical waves, physical quantities of travelling waves and stationary waves. The aspects assessed in the concept of mechanical wave characteristics are the definition of mechanical waves and the Mentawai Islands Regency earthquake phenomenon, an example of mechanical waves. Two aspects of the material of physical wave quantities are assessed based on the earthquake phenomenon in the Mentawai Islands Regency. In comparison, in the material of stationary waves, three aspects show the phenomenon of earthquakes. The analysis results of validating the contents of the student e-module from the expert team are valid. So, e-modules with Inquiry-Based learning are feasible for students to use in learning physics on the quality and breadth of content components.

Construct validation by expert validators of the Aiken's V score obtained a score of 0.90 in the valid category, and construct validation by users (teachers) of the Aiken's V score obtained a score of 0.92 in the valid category. The results of this validation are based on three teams of experts in e-module constructs and two practitioners. Overall, construct validation focuses on the structure of the writing and the suitability of the e-module with the curriculum. Graphical validation was also assessed by three teams of experts and two practitioners. Graphic validation by expert validators of the Aiken's V score obtained a score of 0.83 in the valid category, and graphic validation by users (teachers) of the Aiken's V score obtained a score of 1.00 in the valid category. The aspects assessed in the graphical component are very important to attract students' interest in learning physics. Apart from that, language validation by expert validators of Aiken's V scores obtained a score of 0.91 in the valid category and language validation by teachers of Aiken's V scores obtained a score of 1.00 in the valid category. This shows that the e-modules that have been developed can be understood by students in language. Overall, the average value of validation results by expert validators for Aiken's V scores was 0.98, and the average value of validation by teachers of Aiken's V scores was 0.95, with the category of e-module validation results being very valid.

Practicality Test Results

The practicality test is carried out in the same phase as the validity test. However, the Practicality test uses a practicality instrument consisting of teacher and student response questionnaires. The teacher response questionnaire was used to obtain teacher responses to the Physics e-module being developed. The student response questionnaire was used to obtain student responses to the Physics e-module being developed. This research has two practicality tests, namely practicality in small groups and field tests. The practicality test in small groups is given to students with low, medium and high abilities divided into three groups. In contrast, the field test is given to students in the same school but in different classes. The practical results of the small group evaluation are very practical, as shown in Table 2.

Table 2. Response of Small Group Students to E-module

No	Statement	Score	Category
1	Ease of use	84,6%	Very practical
2	Interesting	83,3%	Very practical
3	Efficient	87,5%	Very practical
4	Beneficial	86,6%	Very Practical
Average		86,00%	Very Practical

Based on Table 2, it can be seen that the highest level of practicality of the e-module is in the efficient statement, with a value of 87.5% in the very practical category, and the lowest is in the attractive statement with an attractive value of 83.3% in the very practical category. After carrying out practicality tests through one-on-one and small group evaluations, it was found that the e-module developed was very practical. This practical SMA/MA Physics E-module is called prototype 3. Then, prototype three is subjected to a field test (field trial).

The field test was conducted on class XI MIPA students at SMA Negeri 2 Sikakap. Learning activities are carried out in 3 meetings. The practicality of the e-module in the field test is seen based on the teacher's and student's responses. The results of the practicality of the e-module from the teacher's response were 97% in the very practical category. The practicality test results for the e-module for each statement are presented in Table 3.

Table 3. Practical Results of the Teacher Response E-module

No	Statement	Score	Category
1	Ease of use	100%	Very Practical
2	Interesting	100%	Very Practical
3	Efficient	88%	Very Practical
4	Beneficial	100%	Very Practical
Average		97%	Very Practical

Based on Table 3, it can be seen that the level of practicality of the e-module is in the very practical category. The highest average score is for the ease of use, interesting and useful indicators, namely 100%. Meanwhile, the lowest value is in the efficient indicator, namely 88%. The practical results of the e-module from student responses of 87% were in the very practical category. Test the practicality of the e-module from student responses using a student response questionnaire. The results of the practicality test of students' responses in the field test (large group) of each statement are presented in Table 4.

Table 4. Field Test Student Responses to E-modules

No	Statement	Score	Category
1	Ease of use	92%	Very Practical
2	Interesting	82%	Very Practical

3	Efficient	81%	Very Practical
4	Beneficial	94%	Very Practical
Average		87%	Very Practical

Based on Table 4, it can be seen that the highest value is in the useful statement, namely 87%. Meanwhile, the lowest value is in the efficient category, namely 81%. Based on the teacher's and student responses, it was found that the SMA/MA Physics e-module integrated inquiry-based learning earthquake disaster material was very practical.

Effectiveness Test Results

The effectiveness test in the assessment phase is very important to determine the effect of the SMA/MA physics e-module integrated with earthquake disaster material based on the Inquiry-Based Learning model. The instrument used was multiple choice questions given before treatment (pre-test) and after treatment (post-test). The material tested in both tests is Physics questions related to natural phenomena. The results of the pre-test and post-test analysis in the form of lowest value, highest value, average and N-Gain are shown in Table 5.

Table 5. N-gain Score Results After Using E-module

Test	Highest Score	Lowest Score	Average	<g>	Criteria
Initial Test	64,0	31,0	42,20	0,82	High
Final Test	96,0	84,0	89,60		

Table 5 shows that the SMA/MA Physics E-module is integrated with inquiry-based learning earthquake material, which is used effectively in increasing the knowledge competence of students. This is evident from the increase in knowledge competence, as seen from the pre-test and post-test results. The average pre-test score of the students was 42.20, while the average post-test score was 89.60. The N-gain score of 0.83 is in the high category. This shows that using the SMA/MA Physics e-module integrated with inquiry-based learning earthquake material effectively increases students' knowledge competence.

Discussion

This research develops a product as an e-module Physics integrated with Inquiry-Based learning earthquake material. This development research uses the Plomp model. The Plomp model consists of 3 phases: preliminary research, development or prototype phase, and assessment phase (Plomp and Nieveen, 2013). This development aims to produce valid and practical products for physics learning, especially natural phenomena material. The validation results were determined by a team of three experts and two practitioners. In contrast, the product's practicality was determined from the responses of teachers and students from both small and large groups. In addition, the effect of product use is also measured by comparing the pre-test and post-test results and displayed in the form of an N-Gain value.

The validity test was carried out to determine whether the integrated Physics e-module of Inquiry-Based learning based on earthquake material is valid according to the applicable system or not yet valid. Experts carry out the validity test. Sugiyono (2011) states, "Several experienced experts can carry out product validity to assess the weaknesses and strengths of the products produced". This is by Akbar (2013). Sugiyono (2011) states, "Several experienced experts can carry out product validity to assess the weaknesses and strengths of the products produced". The experts in question are people who are considered to understand the intent and substance of providing e-modules. They can also be professionals in their fields, such as lecturers.

Components of validity, according to the Ministry of National Education (2008), include components of content feasibility, presentation, language, and graphics. Each section is further broken down into indicators that can assess the product more fully. The content feasibility component test tests the validity of content or material from an e-module. The components of eligibility for content/material, according to the Ministry of National Education (2008), are conformity with KD, suitability for child development, conformity with the needs of teaching materials, correctness of the substance of the subject matter, benefits for adding insight, conformity with moral values and social values.

Components of language appropriateness. Assess whether the information conveyed in the e-module reaches students as readers well. According to the Ministry of National Education (2008), the components of language suitability are readability, clarity of information, conformity with good and correct Indonesian language rules, and effective and efficient (clear and concise) use of language. The feasibility component of presentation is how an e-module presents material to readers. The components of the appropriateness of presentation, according to the Ministry of National Education (2008), are clarity of objectives (indicators) to be achieved, sequence of presentation, motivation, attractiveness, interaction (providing stimulation and response), and completeness of information. The component of graphic feasibility is how the e-module looks and is designed. According to the Ministry of National Education (2008), the components of graphic appropriateness are the use of letters (fonts), type and size, layout or layout, illustrations, pictures, photos and learning design.

The product development phase also needs to know student responses before it is widely used. In this phase, practicality testing was carried out in two stages: small groups and field tests (Plomp and Nieveen, 2013). The Practicality Test uses a practicality instrument consisting of teacher and student response questionnaires. The teacher response questionnaire was used to obtain teacher responses to the Physics e-module being developed. The student response questionnaire was used to obtain student responses to the Physics e-module being developed. The practicality test in small groups is given to students with low, medium and high abilities divided into three groups.

In contrast, the field test is given to students in the same school but in different classes. In general, four components are assessed: interest, usability, ease of use, and efficiency. The four components received positive responses from students. They realize that the phenomena around them are nothing more than physics concepts taught by teachers at school.

Effectiveness testing is the final stage in the assessment phase (Plomp and Nieveen, 2013). The analysis results show that the SMA/MA Physics e-module integrated with earthquake disaster material based on the Inquiry-based learning model can significantly improve student learning outcomes. This increase is very significant because it is in the high category. The material tested is the concept of mechanical waves. Questions to test the improvement in student learning outcomes by the basic competency of analyzing the characteristics of mechanical waves and analyzing the physical quantities of travelling waves and stationary waves in various real cases. This research is the same as research by Sinem and Ayhan Yilmaz (2017), explaining that Inquiry-Based Learning is an approach that can be used to develop students' talents. Guided inquiry learning activities designed and implemented can increase student learning motivation and influence the student environment, such as students' understanding, motivation and attitudes. Moreover, Fitria Wahyu Pinilih's research (2016) states that the mailing-temas-based physics electronic module is stated to be able to improve student learning outcomes; this was shown in the n-gain of the large group trial, which was 0.59, which was included in the medium category, as well as the achievement of KKM by all students.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the High School Physics e-module integrates inquiry-based learning-based earthquake material with valid categories for all aspects, including appropriateness of content, appropriateness of presentation, appropriateness of language, and appropriateness of graphics. E-module development is also very practical. This means that the e-module developed is easy to use, useful, efficient and interesting. The development of e-modules has an effective category for increasing student competence, including attitude, knowledge and skill competence.

REFERENCES

- Amri, Sofan. (2013). *Pengembangan dan Model Pembelajaran dalam Kurikulum 2013*. Jakarta: PT Prestasi Pustakaraya
- Anggraini, Septian D dkk. (2017). Pengembangan Modul Fisika Materi Gelombang Berbasis Kebencanaan Alam di SMA. *Jurnal Edukasi, IV* (1), 20-23.
- Anggraini, Septian Dwi. (2017). Pengembangan Modul Fisika Materi Gelombang Berbasis Anik, K. S., Nyoman, I.S.D., & Setyosari, P. (2019). The Effects of Electronic Modules in Constructivist Blended Learning Approaches to Improve Learning Independence. *International Journal of Innovation, Creativity and Change, 9*(10).
- Arfiana, Ma'rufi N dan Euis Ismayati. (2017). Pengembangan Bahan Ajar Menerapkan Rangkaian Digital Kombinasi Berbasis Mobile Learning di SMK Negeri 3 Surabaya. *Jurnal Pendidikan Teknik Elektro, 06*(03), 233- 239.
- Arikunto, Suharsimi. (2008). *Prosedur Penelitian Suatu Pendekatan Praktek*. Jakarta: PT. Rineka Cipta.
- Asrizal, Amran, A., Ananda, A., & Festiyed. (2018). Development of Adaptive Contextual Teaching Model of Integrated Science to Improve Digital Age Literacy on Grade VIII Students. *Journal of Physics: Conference Series, 1116*, 1-9.
- Ayu, Fitriah dan Ahmad Fauzi. (2021). The Validity of the E-Book on Integrated Physics for Earthquake Disaster Mitigation Materials. *International Journal of Progressive Sciences and Technologies (IJPSAT), 25*(1),35-42.
- BNPB. (2012). *Buku Saku Tanggap Tangkas Tangguh Menghadapi Bencana*. Jakarta: BNPB.
- Depdiknas. (2006). *Kurikulum Tingkat Satuan Pendidikan (KTSP) Mata Pelajaran IPA SMP & MTs Fisika SMA & MA*. Jakarta: Dirjen Dikdamen.
- Depdiknas. (2008). *Penulisan Modul*. Jakarta: Direktorat Tenaga Kependidikan.
- Derlina. (2015). Implementasi Model Pembelajaran Inquiry Training dalam Pembelajaran Fisika untuk Meningkatkan Kemampuan Berpikir Formal Siswa. *Jurnal Pendidikan*.
- Fairuzabadi, Afrizal. (2017). Penerapan Model Pembelajaran Inkuiri Terbimbing dengan Video Berbasis Kontekstual dalam Pembelajaran IPA pada Materi Suhu dan Pengukurannya di SMP. *Jurnal Pembelajaran Fisika, 6*(1), 100-106.
- Fauzi, A. (2014). *Fisika Bencana Alam*. Padang: UNP Press.
- Fransisca, Monica. (2017). Pengujian Validitas, Praktikalitas, dan Efektivitas Media E-Learning di Sekolah Menengah Kejuruan. *Jurnal Ilmiah Pendidikan Teknik Elektro, 2*(1), 17-22.
- Ghaliyah, Sitti dkk. (2015). Pengembangan Modul Elektronik Berbasis Model Learning Cycle 7E pada Pokok Bahasan Fluida Dinamik Untuk Siswa SMA Kelas XI. *Prosiding Seminar Nasional Fisika, IV*, 149-154.
- Guskey, TR. (2000). *Evaluating Profesional Development*. California: Corwin Press.
- Haliday, David dan Robert Renick. (1985). *Fisika*. Jakarta: Erlangga.

- Harini, S., Mulyanto, A. D., Fahmi, H., & Abtokhi, A. (2021). Factors Affecting the Response of Bali's Society to Earthquake Information Using Structural Partial Least Square Equations. *Journal of Hunan University Natural Sciences*, 47 (11).
- Hashim, Mohamad Hisyam Mohd. (2015). Using Technology and Instructional Material among Technical Teacher and Student into Teaching and Learning: A Qualitative Case Study. *International Education Studies*, 8(3), 175-180.
- Hidayat, S. (2013). Pengembangan Kurikulum Baru. Bandung: PT. Remaja Rosdakarya
- Kemendikbud. (2016). *Materi Pelatihan Guru Implementasi Kurikulum 2013-Materi Pelatihan 6. Analisis Buku Guru dan Buku Siswa*. Jakarta: Kementerian Pendidikan dan Kebudayaan.
- Kemendikbud. (2017). *Panduan Praktis Penyusunan E-modul Tahun 2017*. Jakarta: Direktorat Pembinaan SMA. Ditjen Pendidikan Dasar dan Menengah
- Pedaste, Margus, dkk. (2015). Phases of Inquiry-Based Learning: Definition and the Inquiry Cycle. *Educational Research Review*, 14(2015), 47-61.
- Permendikbud No. 21 Tahun 2016 tentang *Standar Isi*. Jakarta: Depdikbud
- Permendikbud No. 22 Tahun 2016 tentang *Standar Proses*. Jakarta: Depdikbud
- Permendikbud No. 23 Tahun 2016 tentang *Standar Penilaian*. Jakarta: Depdikbud
- Permendikbud No. 54 Tahun 2015 tentang *Panduan Penilaian Untuk Sekolah Menengah Pertama (SMP)*. Jakarta: Depdikbud
- Plomp, T. (2013). *Educational Design Research: An Introduction* dalam Tjeerd Plomp dan Nienke Nieveen (Eds.) *Educational Design Research* (hlm. 10- 51). Enschede: SLO.
- Prastowo, Andi. (2014). *Pengembangan Bahan Ajar Tematik*. Jakarta: Kencana Media Group.
- Prastyaningrum, I & Handhika, J. (2017). Development of Smartphone e-Modul by Problem-Solving Method for Biot-Savart Theory. *International Conference on Science and Applied Science 2017*. 909.
- Purwanto, M. Ngalim. (2000). *Psikologi Pendidikan*. Bandung: Remaja Rosdakarya.
- Sarwono, dkk. (2009). *Fisika untuk SMA dan MA Kelas XI*. Depdiknas: Jakarta.
- Setiawan, A., Kaniawati, I., & Suhandi, A. (2017). Learning Outcome dalam Pembelajaran Fisika Berbasis Virtual Lab. Seminar Nasional Sains Dan Entrepreneurship IV Tahun 2017, 194-203.
- Setyosari, Punaji. (2013). *Metode Penelitian Pendidikan Dan Pengembangan*. Jakarta: Kencana.
- Siahaan, Andri. (2021). Pengaruh Model Pembelajaran Inkuiri Terbimbing dengan Multi Representasi terhadap Keterampilan Proses Sains dan Penguasaan Konsep IPA. *Jurnal Basicedu*, 5(1), 195-205.
- Sopaheluwakan, Deny Hidayati, Haryadi Permana, Krisna Pribadi, Febrin Ismail, Koen Mayers, Widayatun, Titik Handayani, Del Alfriadi Bustami, Daliyo. (2006). *Kajian Kesiapsiagaan Masyarakat dalam Mengantisipasi Bencana Gempa Bumi & Tsunami*. Jakarta: LIPI UNESCO.
- Sugiyono. (2013). *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Bandung: Alfabeta.
- Sukardi. (2010). *Evaluasi Pendidikan Prinsip dan Operasionalnya*. Yogyakarta: Bumi Aksara.
- Sukmadinata, Sy Nana dan Erliany Syaodih. (2012). *Kurikulum Dan Pembelajaran*. PT Bandung: Refika Aditama.
- Thalheimer, A. & Samantha, C. (2002). *How to Calculate Effect Sizes from Published Research: A Simplified Methodology*. WorkLearning Research. [Online].
- Tim Pengembang MKDP Kurikulum dan Pembelajaran. 2013. *Kurikulum dan Pembelajaran*.
- Trianto. (2010). *Model Pembelajaran Terpadu*. Jakarta: PT Bumi Aksara.
- Uno, Hamzah.B. 2009. *Model Pembelajaran*. Jakarta: PT Bumi Aksara.
- Wahyu, F. P., Masykuri, M., & Suparmi. (2016). Pengembangan Modul Elketronik Fisika Berbasis SalingTemas Materi Pemanasan Global Untuk Siswa SMA/MA Kelas XI. *Jurnal Inkuiri FKIP UNS*, 5(2):143-155.
- Yamin, Martinis. (2012). *Desain Baru Pembelajaran Konstruktivistik*. Jakarta: Ciputat Mega Mall.

Yani, Ahmad. (2014). *Mindset Kurikulum 2013*. Bandung: Alfabeta.

Yaumi, Muhammad. (2013). *Prinsip-Prinsip Desain Pembelajaran Disesuaikan dengan Kurikulum 2013*. Jakarta: Kencana.