



## DEVELOPMENT OF MODULE DISASTER MITIGATION BASED ON STEM FOR SECONDARY SCHOOLS

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### Abstract

This research is to develop and produce a valid, interesting and effective Covid-19 disaster mitigation module. The STEM-based disaster mitigation module on natural science learning that is developed is intended to educate students in disaster preparedness that can be done in a manner that is done. This research was conducted in March to June 2020 with research subjects as linguists, material experts, media experts and VII graders of SMP Negeri 1 Maduran. The development model carried out by this study uses the Borg & Gall development model which has 10 developments, but researchers only reach stage 9. The validation results show a disaster mitigation module involving 92.5%, 97.5%, and 97.5% with the average validation results of 95.75% are categorized as very valid, the percentage of attractiveness of 90% is included very interesting and student learning outcomes calculated using N-Gain obtained an average value of 0.6 in hopes of increasing moderately. The product of the disaster mitigation module developed can be said to be very valid, interesting and able to improve student learning outcomes so as to increase understanding and preparedness for the covid-19 disaster that is happening. Research on understanding and STEM-based covid-19 disaster preparedness has never been done before, so this is the first time researchers are researching this to increase awareness of the importance of understanding and disaster preparedness.

**Keywords:** Disaster Mitigation, Modules, Natural Sciences, STEM

## INTRODUCTION

A disaster is an event that occurs as a result of a natural and non-natural phenomenon with a certain time span (Afkar, 2017). Disasters that have occurred have various types of causes of disasters themselves, such as natural disasters, namely earthquakes and tsunamis, which have caused millions of human lives and lost ecosystems on land. Disasters in 2020 have also hit Indonesia, ranging from earthquakes, volcanic eruptions, forest fires and disease outbreaks that are spreading rapidly (Disaster, 2019). Therefore, in Indonesia, law number 24 of 2007 concerning Disaster Management has been passed which does everything in order to protect Indonesian citizens from the impact in the event of a disaster (Kemendikbud, 2018). It is not a disaster that is feared by humans because most disasters can be predicted and can be handled with disaster mitigation education that has potential in the surrounding environment.

Mitigation is a series of actions and efforts taken to reduce the impact of a disaster which includes preventive measures before a disaster, actions when a disaster occurs and actions taken after a disaster occurs (Hasanah, 2016). This disaster mitigation is a very important action in order to reduce human casualties, environmental / habitat damage and other property losses because Indonesia is a disaster-prone country based on data from the United Nations (UN) agency in the framework of the International Risk Reduction Strategy. Disaster (UN-ISDR) (Erianjoni, 2017). Therefore, the Indonesian government takes quick action in order to educate disaster mitigation, one of the policies is to include topics or discussion of disaster mitigation in educational curricula at all levels of education so that students at all levels of education can learn, socialize, and be prepared about disaster mitigation as early as possible. .

The addition of the topic of disaster mitigation to the education curriculum occurred at the time of the revision of the 2013 curriculum which applies to all levels of education including junior high schools (Meviana, 2019; Kemendikbud, 2018). Disaster mitigation is included in all subjects taught to students with their respective portions including science subjects, because science subjects are able to integrate disaster mitigation with natural phenomena that occur. Science learning is learning based on natural phenomena which is then analyzed using scientific methods to analyze scientific concepts of the observed phenomena (Septaria, 2019). Therefore, IPA learning is very suitable in teaching natural disasters to analyze from a natural disaster that has

occurred scientifically and educate how to reduce the impact of a disaster that occurs (Putri, 2019).

Based on the results of observations in science subjects at SMP Negeri 1 Maduran on April 3, 2020 on the topic of mitigation, it was found that (1) the analysis of the curriculum on disaster mitigation was in Basic Competency 3.10 Class VII regarding Explaining the layers of the earth, volcanoes, earthquakes, and actions. risk reduction before, during, and after a disaster according to the threat of disasters in the area, (2) science learning about disaster mitigation is still in the form of showing videos to students and teacher explanations, (3) there is no science learning module on disaster mitigation. The results of the observations on science learning at SMP Negeri 1 Maduran are sufficient to indicate that disaster mitigation education for students is limited to video viewing and teacher-centered explanations which are in contrast to science learning which should focus on students (student centered) assisted by devices. learning in the form of modules to guide students in systematically analyzing and looking for concepts from disaster mitigation that are learned. The Learning Module is one of the print-based teaching materials used by students for independent study with certain instructions to help students learn more effectively in achieving certain goals (Wati, 2019). Modules are said to be good when they are arranged systematically, interestingly and clearly, can be used anytime and anywhere according to student needs (Yasa, 2018). The completeness and attractiveness of a module will greatly affect the learning interest of students as learning subjects. The importance of the science learning module on the topic of disaster mitigation is something that educators need to fulfill immediately, this is because students will find it difficult to learn systematically using scientific methods in analyzing the concept of natural phenomena about disasters.

The relevant research results regarding the importance of the disaster mitigation module in science learning were delivered by Zainuddin (2019) entitled "Development of Science Module Based on Disaster Mitigation Based on Disaster Mitigation Using Eruption Software" explains that modules are very important in improving student learning outcomes and preparedness attitudes. students in mitigating a disaster. In addition, Hasanah's research (2016) entitled "Development of a Disaster Mitigation Module Based on Local Potentials Integrated in Natural Science Lessons at SMP" explains that the learning module is able to understand students about potential disasters on a local scale or in the surrounding environment and is able to develop environmental awareness

and minimize the impact of disasters. caused by humans. The results of Firaina's research (2019) with the title "Ipa Class Ix Junior High School E-Book Analysis Based on Disaster Literacy Aspects" explains that disaster mitigation e-books can increase disaster literacy in students.

The results of research on the importance of STEM-based learning were delivered by Ahmuharomah (2019) with the title "Development of Integrated STEM Physics Module Local Wisdom" Beduk "to Improve Creative Thinking Ability of Junior High School Students" explained that the STEM-based module developed was able to improve creative thinking and was suitable for use as a book. textbook companion at school. The results of research from Sugianto (2018) with the title "Development of STEM Integrated Project-Based Science Module on Pressure Material" explains that the STEM-based module developed is valid, effective and suitable for use in science learning. Therefore, if students get limited learning resources it will result in students having difficulty learning and not being independent in learning. Therefore, the researcher proposes a solution, namely developing a STEM-based module on the topic of disaster mitigation to students of SMP Negeri 1 Maduran which will hopefully be able to learn independently by teachers on the topic of disaster mitigation and learning can be trusted to students so that learning can be meaningful for students. The disaster that was studied in the developed module was a Covid-19 disaster.

**METHOD**

**Research Design**

The model for developing a STEM-based science module for disaster mitigation uses the Borg & Gall (1983) Model. This development model is a process of developing and validating the product of an education with the Borg & Gall model flow which consists of 10 stages, namely (1) Research and Information collecting, (2) planning, (3) develop preliminary from product, (4) preliminary field testing, (5) main product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision and (10) dissemination and implementation. However, in this study, the development procedure stage was carried out only up to the 9th stage, namely carrying out revisions of the formative test results. In the 10th stage (summative evaluation) is not carried out, because it is outside the learning system.

**Research Objectives**

This research was conducted in March - July 2020 with the test subjects of this research were

material experts, media experts, language experts, grade VII students of SMP Negeri 1 Maduran. At the trial stage, the target trials were carried out on 30 class VII students with a gender percentage of 60% female and 40% male. The age range for grade VII students of SMP Negeri 1 Maduran is 12-14 years with an average age of 13.2 years.

**Data collection technique**

The data obtained are qualitative data, namely the results of input and suggestions for module improvement, and quantitative data in the form of validity, practicality, attractiveness measured using a Likert scale and the effectiveness of the STEM-based learning module on the topic of disaster mitigation. The data collection instruments were validation sheets, questionnaires, and student learning outcomes tests

The data analysis technique of validity, practicality, and attractiveness of the validation questionnaire, attractiveness and practicality of experts were analyzed by percentage, the formula for processing data from the validation of experts was as follows:

$$Vm = \frac{Tse}{TSh} \times 100\% \quad Vd = \frac{Tse}{TSh} \times 100\%$$

$$Vt = \frac{Vm+Vd}{2} = \dots\%$$

**Figure 1.** (Validation data processing formula) adapted from Yasa (2018).

Information:

Vm = Validity of material / content expert

Vd = Expert design validity

TSe = Total Empirical Score achieved (based on expert judgment)

TSh = Total expected score

Vt = Total / combined validation

100% = constant

Furthermore, where the value of the validation results is interpreted into several criteria or categories based on the percentage level as follows:

**Table 1.** Interpretation of the validation results

Percentage	Interest Rate	Criteria	
		The level of practicality	Level of Validity
86% - 100%	Very interesting, no need for revision	Keprak is very good, no need for revision	Very Valid (can be used without revision)
70% - 85%	interesting enough, no need for revision	Good practicality, no need for	Fairly valid (can be used with

Percentage	Interest Rate	Criteria	
		The level of practicality	Level of Validity
60%	- less attractive, needs small revisions.	Practicality is sufficient, needs small revisions	Invalid (cannot be used)
0%	- unattractive, total revision	Less practicality, total revision	very invalid

The data analysis technique for the effectiveness was obtained from the average test given to students after using the module and process observation sheets. After conducting descriptive analysis, the researcher looked for the average score of student learning outcomes. The effectiveness data is processed from the test given and the resulting total student score is divided by the number of students. The effectiveness criteria used as interpretation guidelines were adapted from Yamasari (2010).

## RESULTS AND DISCUSSION

The results of the initial study through interviews with science teachers at Secondary school 1 Maduran obtained several problems such as science learning about disaster mitigation, still in the form of video viewing to students and teacher explanations, the absence of a science learning module on disaster mitigation, teacher-centered learning, and no education. about potential disasters that have the potential to occur in the school environment or the student's school environment. Based on the results of this preliminary study, the researcher offers a solution by developing a stem-based disaster mitigation module for students which is expected to make students active and find out about potential disasters in the surrounding environment and increase disaster preparedness at any time if they occur.

After developing a draft disaster mitigation module, the researcher validated the material, language, and media experts as follows:

**Table 2.** Validation Results

Aspect	Expert validation results			Mean validation score	Category
	Theory	Language	Media		
Depth of material	4.00	4.00	4.00	4.00	Very Valid
Accuracy of facts	4.00	4.00	4.00	4.00	Very Valid
Truth of concept	4.00	4.00	3.00	3.67	Very Valid
Recency	3.00	4.00	4.00	3.67	Very Valid
Current reference	4.00	4.00	4.00	4.00	Very Valid
Cultivate curiosity	3.00	4.00	4.00	3.67	Very Valid
Develop academic skills	4.00	3.00	4.00	3.67	Very Valid
Develop social skills	3.00	4.00	4.00	3.67	Very Valid
Provide concrete examples	4.00	4.00	4.00	4.00	Very Valid
Message clarity	4.00	4.00	4.00	4.00	Very Valid
Total	3.70	3.90	3.90	3.83	Very Valid
Percentage	92.5%	97.5%	97.5%	95.75%	Very Valid

In addition to the validation results, the validators also provide input or suggestions on the

developed disaster mitigation module, suggestions or input can be seen in the following table:

**Table 3.** Input Results and Validator suggestions

Validator	Part	Before the Revision	After the Revision
Materi	Module	There is a need for additional concept maps.	Concept maps have been added
		Need to add more discussion activities	A discussion section has been added
Media	Module	It is necessary to include the module composer and editor	Added (revised)
		Need to add references to journals or books in the module	Added (revised)

Validator	Part	Before the Revision	After the Revision
Bahasa	Module	It needs to include some missing image sources.	Image sources have been added

The module was then revised according to suggestions and input from the validator which were then tested by small-scale groups to find out the attractiveness score of the developed stem-based disaster mitigation module. The results of the attractiveness test obtained a percentage of 90% which was categorized as very attractive module from students. In addition, students provide input and comments or responses to the disaster mitigation module in the form of (1) pictures need to be improved because they are not clear, (2) disaster mitigation material is now easy to understand because it uses the phenomena of surrounding life and (3) the language used in the module is easy to understand.

Furthermore, the researcher made revisions after getting suggestions or responses from students regarding the stem-based disaster mitigation module being developed. The results of the revision were then tried out in a whole class and the implementation of stem-based learning was observed by two observers who were assigned to observe the implementation of stem-based learning using the disaster mitigation module during three learning meetings. The results of stem-based learning can be seen in the following table:

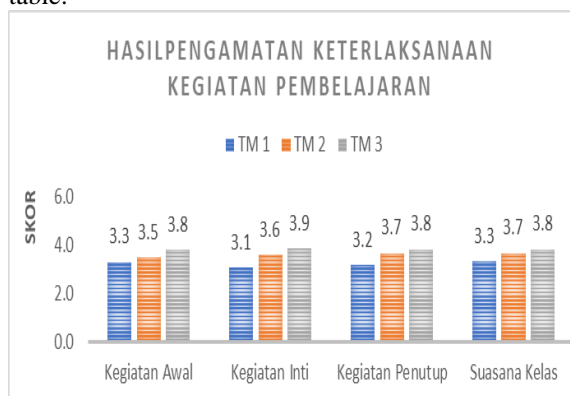


Figure 2. Implementation of Learning using the disaster mitigation module

Based on the chart above, the implementation of learning gets a score ranging from 3 to 4 which is in the Good category, while the percentage of reliability of stem-based learning implementation is 99% which explains that the stem-based learning implementation instrument is reliable (Borich, 1994).

The learning outcomes data of 30 students before and after carrying out stem-based learning activities using the disaster mitigation module can be seen in the following table:

Table 4. Student learning outcomes

Student	Score		N-Gain	Category
	Pretest	Posttest		
S1	45	75	0.55	Moderate
S2	55	90	0.78	High
S3	35	95	0.92	High
S4	45	90	0.82	High
S5	40	90	0.83	High
S6	75	90	0.60	Moderate
S7	60	90	0.75	High
S8	55	90	0.78	High
S9	65	80	0.43	Moderate
S10	60	80	0.50	Moderate
S11	60	95	0.88	High
S12	70	95	0.83	High
S13	35	70	0.54	Moderate
S14	55	90	0.78	High
S15	60	85	0.63	Moderate
S16	30	55	0.36	Moderate
S17	50	95	0.90	High
S18	55	95	0.89	High
S19	45	95	0.91	High
S20	40	100	1.00	High
S21	55	85	0.67	Moderate
S22	60	95	0.88	High
S23	70	90	0.67	Moderate
S24	45	80	0.64	Moderate
S25	75	80	0.20	Low
S26	90	95	0.50	Moderate
S27	55	95	0.89	High
S28	50	95	0.90	High
S29	70	100	1.00	High
S30	50	90	0.80	High
Mean		0,6		Moderate

Discussion

Natural and non-natural disasters are difficult to predict when they will occur, but disasters will definitely occur (Wedyawati, 2017). Therefore, humans need to be educated as early as possible to reduce the negative impact of disasters that occasionally occur. Increasing awareness and attitude of disaster preparedness in the community needs to be improved in various ways, including education on natural disasters at the school level (Kurniawan, 2017). Disaster mitigation learning can be taught through science learning in junior high schools, so that science learning will be systematically analyzed scientific concepts in a disaster. Science, Technology, Engineering and Mathematics-based science learning needs to be tried in disaster mitigation learning at the junior

high school level to educate and students carry out their own analysis of disaster events encountered so that learning can be meaningful by students.

Therefore, researchers developed a disaster mitigation module, the Learning module is one of the print-based teaching materials used by students for independent learning with certain instructions to help students learn more effectively in achieving certain goals (Wati, 2019). The disaster mitigation module that has been developed is validated by 3 experts and the validation results from material, media and language experts are 92.5%, 97.5%, and 97.5%, respectively with an average validation result of 95.75%, these results indicate that the disaster mitigation module STEM-based is very valid to be used to educate students about disaster mitigation. In addition, the modules that have been developed have been arranged systematically, interestingly and clearly so that students can use them anytime, anywhere independently (Chrisyarani, 2018).

The results of the material expert validation explained that the disaster mitigation material in the module was in accordance with the basic competencies with the accuracy of the latest material, using effective and efficient and adaptive learning media (Ismail, 2016). Technological development is very important in learning to train students to learn and practice hard skills and soft skills that are used by students in the future (Suwaryo, 2017). The selection of material that is complete, in-depth and the depth of the material according to the level of student education is able to make a module enter into the self-contained category, which means that the module used already has characteristics that are suitable for use, because students will learn a complete concept that is contained in a learning module. . The STEM-based disaster mitigation module will help students learn independently and systematically about disaster mitigation (Meviana, 2019). This is because the module material that has been arranged in a demanding manner will make it easy for students to read, analyze and increase student knowledge. In addition, stem-based disaster mitigation material makes students care about their environment and improves disaster preparedness attitude with potential disasters around them (Siswanto, 2018). The increase in student learning outcomes also indicates that students understand and have been educated on the attitude of disaster preparedness in their surroundings because humans and the surrounding environment have natural reciprocal relationships and are interdependent in mutual care activities to preserve life (Sugianto, 2018; Sarnita, 2019). Students' understanding of disaster mitigation is a very important activity for the community to

minimize large negative impacts, especially casualties when a disaster strikes in an area.

In terms of media, the disaster mitigation module developed is a learning medium that will make students active and effective in learning so that students feel happy and interested in teaching and learning activities (Taslim, 2017; Zainudin, 2019). The disaster mitigation module developed is categorized as a user friendly learning module, where every activity is given complete instructions to help solve the problems faced (Zakwandi, 2018; Farida, 2019). If students feel interested and happy in a lesson it will have an impact on learning outcomes that will be obtained by students. When students carry out STEM-based activities, students will be given the opportunity to study science, mathematics, technology and techniques used in integrated learning with the aim of overcoming problems that occur in everyday life (Siswanto, 2018). Learning using stem-based modules makes students carry out fun and meaningful activities in finding constructivist concepts so that students don't experience boredom in learning, because students do not only think but use all the senses in their bodies to analyze and find solutions to problems (Rifai, 2018 ). Stem-based activities also train students in analyzing phenomena and solving problems that occur so that they can directly increase student interest in learning because they are designed to attract and use appropriate illustrations to attract students' attention in learning.

The results of the validation in terms of the resulting language indicate that the use of language in the STEM-based disaster mitigation module is in accordance with good and correct Indonesian and provides information that helps readers understand the content of the module. The disaster mitigation module requires a grammar that is as concise as possible but still prioritizes the completeness of the material and the objectives of the Natural Science learning on Disaster Mitigation (Putri, 2019; Meviana, 2019). The use of good and correct Indonesian is very important because it makes it easier for readers, uses general terms and uses simple language in realizing user friendly learning modules (Hasanah, 2016; Yasa, 2018). Excessive use of certain symbols or images will make students less concentrated in reading because students' attention will be diverted to pictures or symbols (Sudirman, 2018). Therefore, the disaster mitigation module is considered to have used sufficient symbols and does not interfere with students' concentration in reading or understanding the context of learning mitigation that is being learned.

## CONCLUSIONS AND SUGGESTIONS

### Conclusion

Based on the results of research and discussion, it can be concluded that the stem-based disaster mitigation module in science subjects developed is very valid, interesting and effective for use in science learning at the junior high school level so that it can improve students' understanding and disaster preparedness.

### Suggestion

Future research is expected to have broader research subjects to better educate the wider community according to the level of education taken.

## REFERENCES

- Afkar. (2017). Pengembangan Lembar Kegiatan Peserta Didik dengan Model Pengembangan 4-D pada Materi Mitigasi Bencana Dan Adaptasi Bencana Kelas X SMA. *Jurnal Pendidikan Geografi*, 135-147.
- Almuharomah, F. A. (2019). Pengembangan Modul Fisika STEM Terintegrasi Kearifan Lokal "Beduk" untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa SMP. *Berkala Ilmiah Pendidikan Fisika*, 1-10 Vol 7 No 1.
- Bencana, B. N. (2019, Juni Monday). Data Informasi Bencana Indonesia. Retrieved from Badan Nasional Penanggulangan Bencana: diunduh pada tanggal 20 September 2020 dari <http://bnpb.cloud/dibi/tabel1a>
- Chrisyarani, D. D. (2018). Validasi modul pembelajaran: Materi dan desain tematik berbasis PPK. *Premiere Educandum: Jurnal Pendidikan Dasar dan Pembelajaran*, 206-212.
- Erianjoni. (2017). Pengembangan Materi Ajar Sosiologi Tentang Mitigasi Bencana Berbasis Kearifan Lokal Di Kota Padang. *Jurnal Socius: Journal of Sociology Research and Education*, 96-107.
- Farida, M. (2019). Sosialisasi Bencana Geologi dan Mitigasinya di Sekolah Dasar Islam Terpadu (SDIT) Ar-Rahmah Makassar. *TEPAT Jurnal Teknologi Terapan untuk Pengabdian Masyarakat*, 66-73.
- Gall, B. d. (1983). *Educational Research, An Introduction*. New York and London: Longman Inc.
- Hasanah, I. (2016). Pengembangan Modul Mitigasi Bencana Berbasis Potensi Lokal Yang Terintegrasi Dalam Pelajaran IPA di SMP. *Jurnal Pembelajaran Fisika*, 226-234.
- Ismail, I. (2016). Efektivitas Virtual Lab Berbasis STEM dalam Meningkatkan Literasi Sains Siswa dengan Perbedaan Gender. *Jurnal Inovasi Pendidikan IPA*, 190-201.
- Jauhariyyah. (2018). *Science, Technology, Engineering and Mathematics Project Based Learning (STEM-PjBL) pada Pembelajaran Sains*. Pros. Seminar Pend. IPA Pascasarjana UM (pp. 423-436). Malang: Pendidikan IPA Pascasarjana UM.
- Kemendikbud. (2018). *Materi Bimbingan Teknis Pembelajaran Berbasis STEM dalam Kurikulum 2013*. Jakarta: Kemendikbud.
- Kurniawan, R. (2017). *GEMPA: Game Edukasi sebagai Media Sosialisasi Mitigasi Bencana Gempa Bumi bagi Anak Autis*. , Vol. 6, No. 2, Mei 2017, 174-183.
- Meviana, I. (2019). Pengembangan Buku Teks Mitigasi Bencana Pada Materi Erupsi Gunung Api di SDN Penataran 01 Kabupaten Blitar. *JPIPS : Jurnal Pendidikan Ilmu Pengetahuan Sosial*, 114-126.
- Parmin. (2012). Pengembangan Modul Mata Kuliah Strategi Belajar Mengajar Ipa Berbasis Hasil Penelitian Pembelajaran. *Jurnal Pendidikan IPA Indonesia*, 8-15.
- Putri, N. A. (2019). Pendidikan Mitigasi Bencana Tsunami dengan Menggunakan Media Pembelajaran Buku Saku Pada Masyarakat Pesisir Desa Karanggadung Kecamatan Petanahan Kabupaten Kebumen. *Edu Geography*, 72-79.
- Rifai, M. H. (2018). Pengaruh Penggunaan Media Audio Visual Terhadap Pemahaman Konsep Mitigasi Bencana Pada Mahasiswa Pendidikan Geografi. *Edu dikara: Jurnal Pendidikan dan Pembelajaran*, 62-69.
- Sarnita, F. (2019). Pengembangan Perangkat Pembelajaran Model PBL Berbasis STEM untuk Melatih Keterampilan Berfikir Kreatif Siswa Tuna Netra. *Jurnal Pendidikan MIPA*, 38-44.
- Septaria, K. (2019). implementasi Metode Pembelajaran Spot Capturing Pada Materi Pemanasan Global untuk Meningkatkan Keterampilan Proses Sains. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, 7(1), 27-37.
- Septaria, K. (2019). Mengeksplorasi Argumentasi dan Pengetahuan Pendidik Ilmu Pengetahuan Alam (IPA) Tentang Pemanasan Global [Exploring the Arguments and Knowledge of Natural Sciences (IPA) Educators on Global Warming]. *PEDAGOGIA: Jurnal Pendidikan*, 8(2), 247-256.

- Siswanto, J. (2018). Keefektifan Pembelajaran Fisika dengan Pendekatan STEM untuk Meningkatkan Kreativitas Mahasiswa. *Jurnal Penelitian Pembelajaran Fisika*, 133-137.
- Sudirman. (2018). Pengembangan Modul Mata Kuliah Gelombang Berbasis STEM (Science Technology Engineering And Mathematics) Pada Program Studi Pendidikan Fisika . *Jurnal inovasi dan pembelajaran Fisika (JIPF)*, 134-140.
- Sugianto, S. D. (2018). Pengembangan Modul Ipa Berbasis Proyek Terintegrasi STEM Pada Materi Tekanan . *Journal of Natural Science Education Reseach*, 28-39.
- Suwaryo, P. A. (2017). Faktor-Faktor Yang Mempengaruhi Tingkat Pengetahuan Masyarakat dalam Mitigasi Bencana Alam Tanah Longsor. *The 6th University Research Colloquium 2017* (pp. 305-314). Magelang: Universitas Muhammadiyah Magelang.
- Taslim, R. K. (2017). Pengembangan Buku Teks Pelajaran Ipa Terintegrasi Mitigasi Bencana Pada Pokok Bahasan Getaran Dan Gelombang. *Seminar Nasional Pendidikan Fisika 2017* (pp. 1-7). Jember: Universitas Jember.
- W, K. A. (2018). Pengembangan Modul Pembelajaran Kimia Terintegrasi Kewirausahaan, Pendekatan STEM dan PBL. *Jurnal Penelitian Pendidikan Kimia* , 56-64.
- Wedyawati, N. (2017). Pengaruh Model Pembelajaran IPA Terintegrasi Mitigasi Bencana Terhadap Hasil Belajar . *Jurnal Edukasi*, 261-273.
- Yasa, A. D. (2018). Pengembangan Modul Tematik Berbasis STM (Sains, Teknologi Dan Masyarakat) . *Jurnal Pemikiran dan Pengembangan SD* , 21-26.
- Zainudin. (2019). Development of Science Module Based on Disaster Mitigation Based on Disaster Mitigation Using Eruption Software . *Kasuari: Physics Education Journal*, 49-61.
- Zakwandi, R. (2018). Profil Literasi Fisika Siswa Madrasah Terhadap Mitigasi Bencana Erosi Batang Sinamar . *BELAJEA: Jurnal Pendidikan Islam* , 47-57.