

Developing a Science Teaching Aid (KIT IPA) to Teach Earthquake of Junior High School Student

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ABSTRACT

The threat of disaster encourages everyone to make preparations that must be done. Knowledge about these actions can be obtained through various activities that study learning activities at school. The 2013 curriculum for seventh-grade junior high school discusses the topic of disaster, specifically earthquakes. To be able to attract students' interest and motivation, it needs help about earthquake preparedness, development media are needed that can facilitate learning activities. Earthquake KIT that is appropriate to use in learning. This Earthquake KIT presents 4 types of activities. This type of development research uses a 4-D model with stages of Define, Design, Develop, and Disseminate Subjects in the study were students of class VII SMP 5 Depok. The data collection technique used was a questionnaire with a Likert scale for media experts, materials, and responses while students used the Guttman scale. Data analysis uses quantitative and qualitative analysis. The results showed an average number of media experts of 88%, an average of 92.86%, and an average of 95.38% all in the excellent category compared to limited trials of 98.83% and trials field of 97.86 good categories. Then, the KIT IPA props can be approved suitable for use in learning.

Keywords: *KIT IPA 1, Earthquake 2, Disaster Preparednes 3.*

1. INTRODUCTION

Indonesia is located in the Pacific Ring of Fire where natural disasters often occur, so it is very important to reduce its impact [1]. No country is immune to disasters. Designing, implementing efficient disaster preparedness strategies and programs is essential to ensure disaster resilience [2]. Countries that are vulnerable to natural disasters, the consequences and effects of such events are anticipated, encouraging disaster risk management and reduction to reduce risks and facilitate recovery from hazards in the event of a disaster [3]. Disaster risk reduction is the responsibility of the government. However, as stated in the 2015-2030 Disaster Risk Reduction Framework, all stakeholders share responsibilities [3]. The community has the power to activate the capacity of internal resilience to cope with and recover from natural disasters [4]. Understanding how people interpret risk and choose actions based on interpretation is very important for each disaster reduction strategy [5]. Problems associated with increased losses due to disaster more lies in the interpretation and understanding of risk [6]. The

findings show that news related to earthquake preparedness only received limited coverage. The indication is that the information provided cannot have a direct role in communicating earthquake risk [7]. Providing information about preparedness needs to be done as early as possible. Preparedness can be started by giving knowledge to teenagers on the school bench about the importance of knowing the disasters around their homes, to prepare themselves for the impact that they cause. Therefore, schools can be involved as a means of channeling knowledge of disasters, especially earthquake disasters. The teacher can integrate several learning concepts with the topic of disaster and encourage students to be able to understand, and be able to act when disasters occur.

Frontline teachers strive to understand students and look for appropriate learning steps to create intelligent education [8]. The teacher has a big role in ensuring that the teaching and learning process takes place effectively. Teachers also need to be more creative and innovative in conveying learning [9]. Studying now

knows no bounds and is not limited to school. Learning can occur anytime, anywhere [10] [11].

The learning process will be effective every individual, who is involved in it, is approved to carry out their respective tasks. If students have direct experience with something to see, hold, accept, and carry out physical activities, then students will have certain experiences that build their knowledge. The teacher also needs to allow students to exploit themselves in learning so that they have a good learning experience. The teacher can provide learning media that conveys student curiosity, so students have a strong curiosity for the material delivered to them and become active in learning [12]. Cognitive and affective aspects in learning can be enhanced by the contribution of media which can contribute to fostering student interest [13].

Media that convey the ideology that has been approved. The media can familiarize students with real contexts. Media uses different dialects and styles that can appeal to students [14]. Learning media is an unimportant one that functions as a communication link between the teacher and students. the use of instructional media is expected to increase students' understanding of the material delivered by the teacher. Using the media to create a different atmosphere in the classroom, making students enthusiastic in participating in learning to encourage students to think creatively. Teachers can foster student interest through the media they use and create a pleasant learning atmosphere to make students able to utilize and utilize the material presented easily [12]. The teacher must use teaching aids that can attract students' attention. Meanwhile, the success of students also depends on the environment and facilities available at the school [9]. Using learning media seriously with learning thinking media that can describe something absurd becomes concrete. In learning science, students not only think about concepts but students must also be able to think creatively in solving problems and social issues that develop in the community. The development of science and technology in the world of education is increasing so that teachers and students are required to have broad insights related to problems in the environment related to problems that will be provided following class as learning material. For this reason, the media needs to be approved which is expected to contribute to the delivery of information on disaster and preparedness.

Earthquake disaster preparedness material is one of the materials needed by the media to support learning so that it does not look abstract. Earthquake preparedness can be done through formal and non-formal education policies and strategies. The characteristics of science are very strategic as a vehicle for learning mitigation. Earthquakes are one of the natural phenomena that have an impact on life. Earthquakes cause death, property

losses, and impacts on education, this effect because some people do not yet understand about preparedness [15]. Earth and space science for junior high school is given to science subjects with a portion of 6.94%, the total portion of the earth and space is relatively small, so learning must be well prepared to create a society that switches to emergencies. The proportion of Earth and space material which is still relatively less alarming compared to those in schools [16] According to the 2017 BNPB 2017 the death toll from the earthquake was 86,247,258 people ([17] because of the victims according to data from the Ministry of Education and Culture (2017) a total of around 497,576 total Indonesian schools are included in 34 provinces, consisting of 229,533 kindergartens / RA / KB / TPA / SPS, 174,249 SD / MI, 57,499 SMP / MTS, 22,439 SMA / MA 22,439 and SMK 13,856. The data for the year 2013 was juxtaposed with the risk index in Indonesia by BNPB [17] Recorded thousands of casualties after the earthquake that occurred in Indonesia, the high number of fatalities and property losses is a sign of low preparedness [18] within the parameters of the emergency response plan and mobilization of Resources fall into the low category [19] The next step should be to encourage teachers and students to update the information to increase the level of assessment to increase awareness and to increase the level of good and safe preparedness at home [21].

The teachers learn about how to use learning media will give positive opinions to the learning process that only some teachers use the media to explain abstract things in learning so that most students voluntarily understand the material presented. Learning media in the classroom is one way to achieve learning objectives. Appropriate media selection will greatly affect student learning outcomes [22]

One of the learning media used is the KIT IPA earthquake props. The Natural Science KIT can be used in the learning process so that it can help develop science concepts and can also help in learning to make it look more interesting in delivering novelty material so that the material delivered does not satisfy students with a variety of topics available in the environment. Through teaching aids, the Natural Science KIT is expected to create enjoyable learning that can help students so that students in learning activities can find ideas related to problems in their environment. To achieve these objectives there needs to be habituation in learning activities to foster creative thinking of junior high school students. Schools must always be oriented towards practicum activities. Practicum activities, observations, and experiments are activities that must be carried out [23.] KIT IPA earthquake can be used in the delivery of earthquake material so that it can be prepared preparedness among students.

2. LITERATURE REVIEW

Education is an important aspect of knowledge acquisition. The teacher was very successful in the progress of education. The teacher uses various methods used to teach the material to students. In addition to learning methods and techniques, teachers also use various types of tools to support learning to be more effective. Educate and help teachers to make it easier to explain concepts [24]. The main concept of learning is to provide motivation, guidance, and good examples. Learning does not only pay attention to the curriculum and final results but also must pay attention to the teaching and learning process which is a very important influence to obtain maximum student achievement [24]. Providing information through simulation exercises is greater than providing information through brochures or other traditional methods. Simulation exercises for people to have more detailed disaster experiences to imagine negative people that increase individual preparedness [25]. Disaster preparedness is often referred to as action is taken before an event that can help overcome and restore the severity of a disaster with the community or people through the development of contingency plans for hazard response and recovery [3].

Media that convey the ideology that has been approved. The media can familiarize students with real contests. The media uses different dialects and styles that can be attractive to students [14]. Learning media is an unimportant one that functions as a communication link between the teacher and students. the use of instructional media is expected to increase students' understanding of the material delivered by the teacher. Using the media to create a different atmosphere in the classroom, making students enthusiastic in participating in learning to encourage students to think creatively.

Learning media is one of the important elements that serve as a communication link between the teacher and students. The use of instructional media is expected to increase students' understanding of the material delivered by the teacher. The use of media aims to provide a different atmosphere in the classroom, making students enthusiastic in participating in learning to encourage students to think creatively. Teachers can foster student interest through the media they use and create a pleasant learning atmosphere to make students able to understand and absorb the material presented easily [12] Teachers must be familiar with the use of teaching aids that can attract students' attention. Meanwhile, the success of students also depends on the environment and facilities available at school [9] The use of learning media is closely related to the stages of thinking because learning media can describe something that is concrete. In learning science, students don't just understand concepts but students must also be able to think creatively in solving problems and social issues that develop in the community. The development of

science and technology in the world of education is increasingly rapid so that teachers and students are required to have broad insights [26]. Practicum activities, observations, and experiments are activities that must be carried out [23]. Media is a means of communication and categorizing media in various forms [27] namely text, audio, visual, video, engineer, people who are very important for learning. Students learn from teachers, other students, and adults. The role of educational media in learning are factors that influence learning [26]. One example of learning media is the KIT IPA props.

The Integrated Instrument Component (KIT) of Natural Sciences is equipment that is packaged and produced in the form of a teaching unit box, shaped like a series of process skills trials in the field of Natural Sciences and is equipped with a user manual. The Natural Science KIT is a box containing Natural Science tools. This set of Natural Science equipment is used for continuous and sustainable activities, the Natural Science KIT resembles a set of process skills testing equipment and is equipped with a user manual. The Natural Science KIT is a teaching science aid that will help science teachers to be able to prepare learning more easily and more precisely and be able to implement it optimally so as to create an active, creative, effective, and fun science learning situation [28] "science kits contain all (or nearly all) of the equipment, supplies, and curricular materials needed to study a particular science topic [29] Through the equipment that is in a series of KIT, students are expected to be able to combine the concepts they learn with everyday life events The Natural Science KIT can be used in the learning process so that it can help develop science concepts and can also provide tangible teaching so that learning looks more interesting The optimal way to utilize the Natural Science KIT is to ask students to demonstrate and explain all the objects and events contained in the KIT that students try without using guidance questions The use of KIT students can understand the lesson well because students can directly assemble, observe and analyze the tools used [30]

The Natural Science KIT is a tool that is packaged and produced in the form of a box in which there is equipment that can be used as a teaching aid that is equipped with user manuals aimed at investigating science topics so that it can help teachers in the teaching process and can make learning more interesting so make students more active and creative in the learning process.

3. METHODOLOGY

This development research aims to produce Earthquake Natural Sciences KIT products. The basis for developing product development on the 4D development model. The 4D development model

consists of four sides namely defining, designing, developing, and disseminating that was developed by Thiagarajan [31].

The first stage is defining the goal to understand the needs and information of development by the characteristics of students, learning environment, material, and applicable curriculum. Things done at this time are discussing problems in science learning, interviews with teachers, classroom observations, and literature studies can be obtained alternative solutions to problems in science learning through the tools developed. The second stage is the design. The design phase provides activities to design products that have been designed for this research, products that are designed to display the earthquake science KIT. The Natural Sciences KIT (Developmental Testing) is a test for experts on natural science materials. Testing student responses is done with a limited test first, then a broad test. The assessment was conducted to study the quality and feasibility of the KIT IPA earthquake props. The validator and students provide input or suggestions on the earthquake science KIT which is then made as a reference to improve the product to finally produce a product that contains an earthquake science instrument.

Earthquake KIT KIT consists of several parts of the KIT box, tools, and book guidance material. The explanation is as follows:

3.1 KIT Box earthquake science

The IPA KIT box is made of plastic material that has several bulkheads that have been designed. This KIT box supports the addition of several dividers divided according to the placement of materials to be used. Each code barrier serves to determine the location of each material and makes it easier for students as well as teachers when searching for or restoring tools into the KIT. See figure 1.



Figure 1 Bulkhead in the Earthquake Science KIT box

Also, the KIT box is given an attractive sticker at the top. Close KIT that highlights the characteristics of an earthquake KIT. See figure 2.

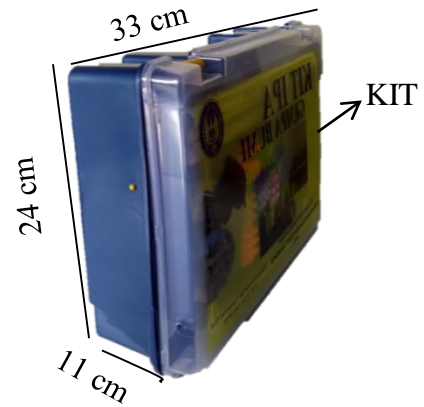


Figure 2 Earthquake KIT Box Size

The KIT box has strong and strong quality and is easy to move because its size is adjusted to the condition of the students.

3.2 Tools and Materials

The tools and materials in the Natural Sciences KIT are 29 types, namely 1 manual, 2 impraboard, 1 P3K (scissors, gauze, cotton, betadine, hands plus, and revanol), 1 glue gun, 2 contents of a glue gun, 4 pieces of sponge, 4 types of plants, each consisting of 4 trees, 1 lego seat, 1 whistle, 1 set of the vibrator (2 batteries, on/of a button, dynamo, and connecting cable), 1 seat evacuation route, 1 double tip, 12 adhesive pieces, 1 curter, 1 plastic box, 10 rubber bands, 1 paper receipt, 1 earthquake risk index map in Indonesia, 1 DIY earthquake risk index map, 1 evacuation route sheet, 4 preparedness brochure sheets, 7 different color plasticine, and 2 paper clips.

3.3 Guidebook

The Natural Sciences KIT handbook contains Core Competencies, Basic Competencies, and Indicators, as well as learning guides, lists of tools and materials, tools and materials functions, instructions for using earthquake Natural Sciences KIT, How to use earthquake Natural Sciences KIT, Instructions for use of tools and materials, and work connectors learners (LKPD) meetings 1 to 4. LKPD meetings 1 learner do several activities, part 1 arranging plasticine to make layers of the earth, part 2 using sponges to adjust the movement of earth plates. LKPD 2 activities are arranging simple seismographs, in LKPD 3 students lend shelter and are given the ease of completing earthquakes and for LKPD 4 which is doing earthquake preparedness exercises.

The test subjects in this study were students of grade VII of SMP Negeri 5 Depok. Limited trials were conducted by 9 students and extensive trials of up to 32 students. The type of data used is qualitative and quantitative data. Quantitative data is data consisting of scores of media experts, material experts, approvals, and students while qualitative data consists of suggestions

and input from media experts, material experts, and science teachers.

The technique of collecting data uses a questionnaire with the method of collecting data using a Likert scale checklist questionnaire for media expert questionnaires, material experts, while the trial questionnaire is used to use the Guttman scale. Earthquake KIT teaching aid is approved to have good quality if the percentage value is in the very good category or good is the percentage value \geq for assessment materials of experts, media experts and science teachers for students in good categories [32].

4. RESULT AND DISCUSSION

4.1 Result

KIT IPA earthquake which has 4 types of activities added in the guidebook. These activities can be seen in figures 3,4,5 and 6.



Figure 3. Creating a layer of the Earth

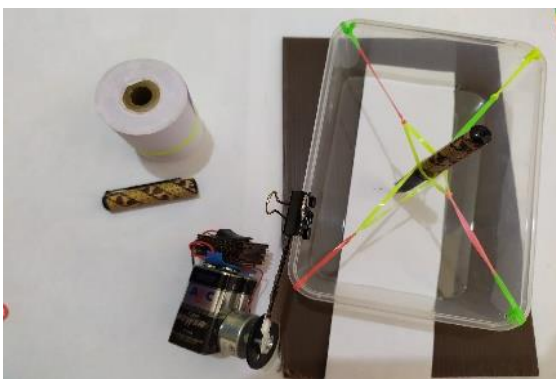


Figure 4 Simple Seismograph Design



Figure 5 Residential Design



Figure 6 Evacuation route

The first activity can be seen in Figure 3 namely through this activity students complete the earth's layer through the plasticine that has formed the earth's layer. The formed plasticine represents the 3 main layers of the earth. After that students participate in the movement of plates using sponsors, through this activity students liken sponsors are earth plates, through these plates students are taught to get help moving plates through the media of sponsors. After experimenting with activity 1, students answered several questions at LKPD meeting 1.

The second activity, in figure 4 illustrates and explains earthquake theory for students and introduces tools used to measure earthquake strength. Through the introduction of an earthquake measuring devices, students are invited to make a simple seismograph. Activity 3, namely students compile simple dwelling as shown in figure 5 after that vibrate the dwelling as if an earthquake occurred and students improve what happens to the dwelling. Activity Four, namely preparedness training activities. The purpose of this exercise is for students to take action to be taken when facing an earthquake.

Table 1. Average percentage of calculation results per KIT of natural sciences of an earthquake

No	Validator/Subject	Feasibility Level (%)	Category
1	Media Expert	88	Very good
2	Material Expert	92,86	Very good
3	Science teacher	95,38	Very good
4	Unlimited Test Student	98,83	Good
5	Broad trial	97,86	Good

Based on research conducted at SMP Negeri 5 Depok, quantitative and qualitative data were obtained as research data. Assessment by media experts, material experts, science teachers and student response tests to the earthquake science KIT props that have been implemented are obtained in table 1.

Based on the average percentage of results for props KIT IPA earthquake included in the category of very good/good and in the statement is very feasible to be used as a learning media on earthquake material for seventh-grade junior high school. The effect of the media used for learning motivation of a medium on learning [33]

4.2 Discussion

Preliminary data collection in this study carried out a needs analysis, namely by conducting interviews with science teachers in SMP Negeri 5 Depok, Yogyakarta Public Middle School, and SMP Negeri 1 Cepogo. Based on the results of the interviews that contained several indicators about the use of curriculum in schools, learning tools, models/learning, teaching materials, learning media, problems and difficulties in learning, and disaster preparedness in schools. The results of learning discussions for earthquake material are carried out with discussion activities with the help of PowerPoint media. Even preparedness learning is only done by reading student handbooks and there is no other media that facilitates teaching and learning activities specifically for earthquake materials.

Then proceed with producing earthquake KIT IPA tools. The first stage is the design carried out to produce product development guidelines and a research instrument grid. Complete product development guidelines for development objectives, earthquake material based on the 2013 curriculum for VII grade of SMP with Basic Competencies 3.10 and 4.10, specifications and eligibility criteria, and making KIT design. The steps to design an earthquake KIT IPA tool are 1) media selection, media selection adapted to "earthquake" material on basic competencies 3.10 and 4.10, task analysis and concept analysis and students' expertise 2) Format, Format of visual aid KIT IPA earthquake adjusted to the indicators to be achieved; and 3) protocol materials, specifications for the use of materials used in the manufacture of earthquake IPA KIT both from the KIT box and the guidebook.

Earthquake KIT teaching aids have several components that are divided into 4 activities in the student worksheet (LKPD) contained in the KIT IPA manual. Activity 1 invites students to discuss the structure of the earth's layer by making earth shapes and discuss the movements of the earth's plates, activity 2 is the design of a simple seismograph to describe the resulting seismogram, activity 3 is a residential design which is then vibrated using an amplifier that is watched by the earth and students remember the event that occurred, activity 4 that is conducting a simulation of preparedness with the guidance contained in the KIT IPA earthquake component.

Earthquake KIT teaching aids that have been approved by media experts, material experts, and science teachers. Then tested on students of class VII. Natural Sciences KIT Earthquake Testing to determine student responses, this trial was conducted at SMP Negeri 5 Depok. The limited test uses 9 students of class VII and in the extensive test uses 32 students of class VII. Then experts and teachers provide input on the Natural Science KIT and subsequently the Natural Science KIT is corrected with approval of the suggestions given. Assessments from experts, science teachers, and students become data to find out the quality and feasibility of the earthquake science KIT. Qualitative data obtained in the study carried out consisted of input from media experts, material experts, and science teachers. Validation by material experts is carried out to see the material aspects including the aspects of the content suitability, the feasibility of presentation, and aspects of the characteristics of the earthquake KIT. The material expert will assess the material discussed through the Natural Science KIT is following the Basic Competencies in the curriculum, whether the material delivered through the Natural Science KIT is accurate, and whether this Natural Science KIT can be used as a means of learning earthquake material for students and whether the Natural Science KIT developed following the learning objectives. The material expert who became the media validator was Dr. Insih Wilujeng, M.Pd, lecturer in Science Education at Yogyakarta State University. Material expert validation was carried out on November 13, 2019, at the UNY Postgraduate Building. Advice from material experts, namely:

1. Improve some work steps in the manual
2. Enlarge manual font letters.
3. Accuracy in terms of use
4. The use of words must be consistent

Some suggestions for improvement are the basis of research to improve the earthquake science KIT tool. Based on the ratings from the material experts, the level of feasibility of the Natural Sciences KIT earthquake reached 92.86% with a very good category. Validation by media experts includes aspects typical of the earthquake KIT, construction aspects, graphic aspects, and practical aspects of use. The media expert lecturer who received the KIT IPA earthquake was Dr. Pujianto, M.Pd who is a lecturer in Natural Sciences at UNY. The assessment was carried out on November 13, 2019, at the UNY Physics laboratory. Based on the results of media experts that the KIT IPA earthquake has an 88% feasibility rate with a very good category and there are some revisions and suggestions from media experts namely







1. Correct some typo words in the manual,
2. Clarify how to store KIT IPA,
3. Member stickers on KIT

4. Designing a vibrator that uses simple technology
5. Avoiding tools and materials that are harmful to students.
6. Using tools and materials that are easily obtained

Assessments and suggestions are used by researchers as a basis for the improvement of earthquake science KIT props. The teacher as a practitioner helps researchers to fill in the questionnaire responses to the use of the earthquake science KIT. Aspects that are assessed by practitioners are the aspects of the feasibility of presentation and aspects of the unique characteristics of the earthquake KIT. The teacher response questionnaire was conducted at SMP Negeri 5 Depok with science teacher Mr. Suhadi, S.Pd. The activity was held on January 7, 2020, at the Library of SMP Negeri 5 Depok. In addition to completing the questionnaire the Natural Sciences teacher tries all the activities contained in the Natural Science KIT and he gives some suggestions, i.e.,

1. Giving the code in each bulkhead laying tools,
2. Prepare a tutorial for each step of the work in the KIT in the video CD.

Table 2. Different of before and after revision KIT

Before Revision	After Revision
	
Figure 7 KIT gave a sticker as a typical KIT of earthquake science	
	
Figure 8 Addition of insulation at the bottom	
	
Figure 9 Addition of encoding the location of tools and materials in KIT	

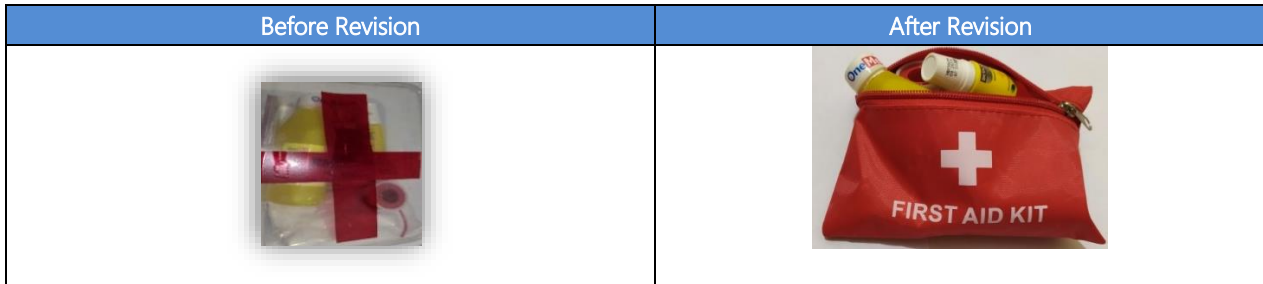


Figure 10 Using first aid according to standard

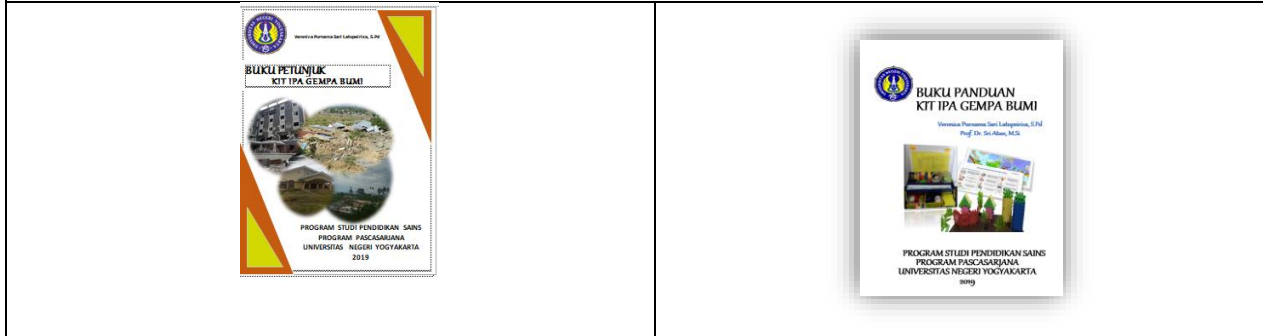


Figure 11 Color of the cover of the manual is simplified

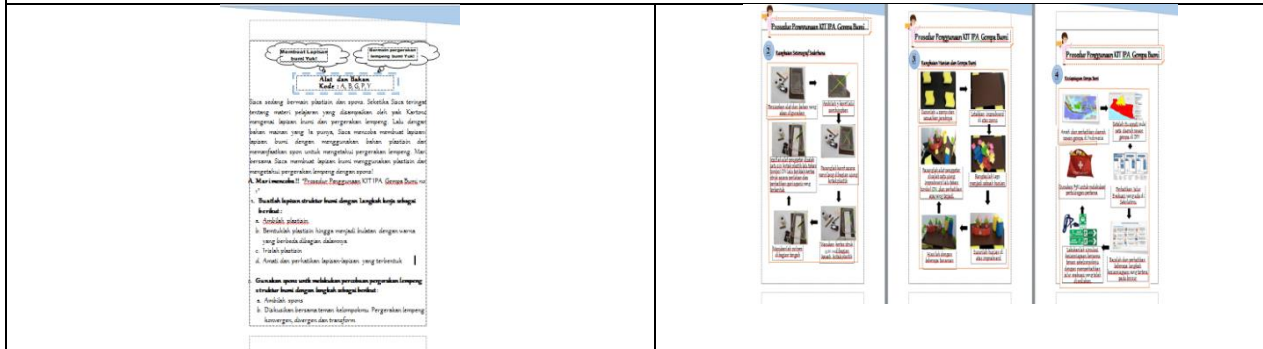


Figure 12 The steps for using the tool are made more interesting and the picture is included

Based on the science teacher response questionnaire, the level of feasibility of the Natural Sciences KIT earthquake was 95.38% with an excellent category.

The learning process needs to be supported by learning media. Learning something without being interested in the topic or object being studied will not give the best results. To encourage and increase student interest in learning can be implemented by giving a different touch in the learning process. Through media, learning activities in junior high schools can run more effectively [12]. Earthquake KIT visual aids have advantages and disadvantages. The advantages of this Earthquake Science KIT can be used as a fun learning medium for students. Because it involves several activities that facilitate the achievement of learning goals, it is easy to bring to the class because the box size is not too large, making students do not need to learn about earthquake disasters, can foster creativity and cooperation of students because the activities are carried out in groups. While the shortage of earthquake science KIT props is, production costs are limited to one type of

disaster and the activities cannot be carried out by individuals. Kits as learning media can foster motivation of students in the teaching and learning process, especially in conducting experiments and observations [34]. In addition, the Science Kit can have a positive effect on learning outcomes [35]. There is an increase in science process skills with the use of KIT [30]

Revision of earthquake science KIT teaching aid products based on advice from science experts and teachers. The following product revisions are listed in Figure 7,8,9,10,11,12.

Suggestions from media experts, material experts and agreed and then made a benchmark by researchers to improve the earthquake science KIT props.

5. CONCLUSION

Based on the research that has been done, it can be concluded that the Natural Science KIT earthquake has a very good quality based on the results of the assessment conducted by media experts, material

experts, practitioners with an average rating obtained in a very good category, as well as student responses included in the category well so that it can be stated that the earthquake props IPA KIT is very feasible to be used as a medium of learning science on earthquake material for grade VII students of junior high school

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