Effectiveness of integrated science (IPA) textbook nested with landslide theme to improve preparedness of students

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Abstract. Landslide disaster is one of the disasters that often hit the hills one of them is the hills in West Sumatra. Education and preparedness on landslide disaster is very important, to reduce the impact and risk of landslide disaster. Preparedness of landslide disaster can be integrated into education through textbooks. A quality textbook is a textbook that can effectively increase learning activities that will impact on improving learners' learning outcomes. Effectiveness can be used as a means of measuring educational success. The purpose of this research is to test the effectiveness of integrated IPA textbook nested landslide theme in improving students preparedness. The research design uses quasi-experiments with One Group Pretest-Posttest Design. Data collection techniques use instruments from the assessment of preparedness aspects of attitudes and aspects of knowledge. Preparedness assessment sheet of attitude aspects through self-assessment, knowledge using written test and then analyzed using N-gain, t-Test, and effect size. The results show that (1) attitude preparedness is in the medium category. (2) the preparedness of the knowledge aspect is in the big category. This means that an integrated IPA textbook is nested with a landslide theme effectively improve the preparedness of students on attitude and knowledge aspects.

1. Introduction
Indonesia is a country that has high vulnerability to natural disasters. Almost all regions in Indonesia have the incidence of disasters. This is because the geographical location of Indonesia between the two oceans so that Indonesia has a tropical climate. Various natural disasters start earthquakes, tsunamis, volcanic eruptions, floods, landslides, droughts, and forest fires prone to occur in Indonesia. The diagram of the number of disaster events in Indonesia shows that landslide disaster is a natural disaster that threatens the Indonesian people with a percentage of 17% from various other disasters. The number of disasters and casualties up to October 2016 recorded 464 landslides, 160 deaths and disappearances, 35,625 suffered and displaced [1]. Although the losses incurred by landslide disaster are not comparable with other disaster loss records in Indonesia, the vigilance and risk reduction process must be kept in mind.

One of the areas with the potential for landslide disaster is West Sumatra. Local Regulation of West Sumatera No. 5 Year 2007 states that the geographical condition of West Sumatra is an area that has high vulnerability to landslides because West Sumatra is surrounded by hills and mountains. Analysis of the potential of West Sumatera region has the potential of disaster is quite high and complex especially in Padang area. Padang City has potential of potential disaster-prone areas of landslide / landslide movement, potential flood, potential earthquake ashore and sea with medium to
high category. Areas with medium to high category have medium to high potential for land movement, flooding, and landslides. Thus, there must be an effort to reduce the risk of landslide disaster in Padang [2].

Disaster risk reduction is the concept and practice of disaster risk reduction through systematic efforts to analyze and manage disaster-causing factors, reduce exposure to hazard threats, reduce vulnerability of people and property, to wise land and environment management, and to increase preparedness for adverse events [3]. Significant improvement of preparedness in mitigating landslide risk measures taking into consideration environmental, physical, social and economic conditions of the community. Efforts that can be done is the cultivation of preparedness in education. Disaster mitigation is organized by local governments in the form of formal, nonformal, and informal education [4]. Disaster mitigation in education aims to take preventive action to improve the ability of the community, especially learners in reducing the risk of disaster through preparedness. Education and preparedness on landslide disaster is very important, to reduce the impact and risk of landslide disaster. In addition to education, improvements to the curriculum have also been undertaken. The curriculum structure for the secondary education unit is the local content [5]. The Local Content Curriculum is an educational program whose content and delivery media is linked to the natural environment and cultural environment as well as regional needs [6]. The local content curriculum must be studied by learners in the area. Local content of landslide material is taught in learning.

Material of learning should be holistic or integrated to improve knowledge of learners. This is because the principle of the 2013 curriculum should be relevant to necessity of life or contextual. Natural Science (IPA) is a learning material that is holistic and integrated. Curriculum Development Guideline 2013 mentions that science lesson in junior high school level is implemented based on integrity. Science learning in junior high school is not as a discipline, but developed as an subject integrated science. Integrative science has the meaning of combining various aspects of the domain of attitude, knowledge, and skills. Integrated IPA learning has ten integrated models that can be applied in connecting IPA materials, the model is a integrated model nested. The advantage of the model nested is that teachers can combine concepts with multiple skills at once in a single subject lesson. The landslide material was raised to be a theme in science teaching with a model nested to be relevant to necessity of life or contextual, ie with the help of learning resources.

Learning resources are mandatory reference for use in primary and secondary education units or colleges that contain instructional materials compiled based on national education standards [7]. The main learning resource in the 2013 curriculum is textbooks. Textbooks have an important role in learning. Textbooks can facilitate learners to learn independently. Textbooks are the main learning resource for achieving basic competencies and core competencies and are declared appropriate by the Ministry of Education and Culture for use in educational units [8]. The ideal textbook should be written according to structure and theory. Textbooks at least include title and identity, competence in the form of KI, KD, Indicator, and learning objectives, concept maps, material coverage, material content exposure (in which there are supporting information and sample questions), the activities of learners in the form of activity sheets, exercises, summary, evaluation and assessment [9]. The fact that there is based on observations made in SMP Negeri 6 Padang shows that the textbooks used in the learning not yet in accordance with the structure of the ideal textbook, has been integrated but not yet thematic adhere to local content. The observed IPA text book is the textbook of SMP / MTS grade 7. Thus, it is necessary to develop a textbook in accordance with the structure of the ideal textbook, with the theme of landslide as a local content learning material with natural environment phenomenon that is close to the learners and become regional needs. The development of textbooks is essential to produce quality textbooks. A quality textbook is a textbook that can effectively increase learning activities that will impact on improving learners' learning outcomes.

Effectiveness can be used as a means of measuring educational success. Etymologically (language) effectiveness comes from the word effective which means there is influence, consequence and so on [10]. Effectiveness is related to the realization of all the essential tasks, the achievement of objectives, timeliness, and the active participation of the members [11]. Factors that affect the effectiveness of
learning include the ability of teachers in using methods. Methods are part of the learning strategy that in the learning process is influenced by factors, learners, situations, facilities, learning media and teachers themselves. The better and more appropriate a method and media used, the more effective the achievement of the objectives that have been set so that the learners learn to be better. In this case textbooks become the media used by learners. There has been a lot of research on the effectiveness of teaching materials, or textbooks, that effectively improve the learning outcomes of learners, but there are still textbooks that have not been in accordance with the needs of learners, and not according to the natural environment and cultural environment and the needs of the area where the learners live. Based on the above, a study on the effectiveness of integrated IPA textbooks nested with landslide themes to improve the preparedness of students.

Preparedness of learners to disaster is seen in attitude and knowledge aspect. To find out whether the textbooks developed can improve the preparedness of students, then conducted a research development of integrated IPA textbook nested with landslide theme to improve the preparedness of learners.

2. Method
This research type is quasi-experimental researchers with one group pretest-postest design [12]. The trial was conducted at SMPN 6 Padang. The subjects of the experiment were VII-2 class lessons 2017/2018. The number of students of class VII-2 is 30 people. Data type in this research is primary data, that is effectiveness data taken from result of pretest and postest learners. Before the data obtained effectiveness, firstly done preliminary analysis of needs and context analysis. Respondents were given a questionnaire containing statements regarding needs analysis such as analysis of learning activities, media analysis, learner analysis, material analysis and context analysis. The result of the preliminary analysis is that an integrated IPA textbook theme of landslide with a model is required nested. Furthermore, the textbook design is done, then the textbook validated by the validator and tested the practicality of the use of textbooks to learners and teachers. After that done effectiveness to textbook.

The effectiveness of the use of integrated IPA text books landslide themes with models is nested done to increase the students preparedness of knowledge competence, and attitudes. Analysis of preparedness effectiveness is processed through the following steps.
1) Scoring of student answers on the test sheet, so obtained the score of pre-test and post-test.
2) Create as cores pre-test and post-test of learners
3) Calculate the increase in preparedness occurring before and after learning using the gain formula [13] and the effetivity categories of N-Gain [14] in Table 1.

\[
\text{Gain (g)} = \frac{(\text{posttest score}-\text{pretes score})}{(\text{ideal score}-\text{pretest score})}
\] (1)

| Table 1. Category of N-Gain |
|----------------------------|
| Persentase $\bar{g}$ (%) | Category |
| $g > 0.7$ | High |
| $0.3 < g < 0.7$ | Medium |
| $g < 0.3$ | Low |

4) Then if the results show that there are differences in the effectiveness of pretest and posttest preparedness, then the difference sizes (effect size). Effect size is a measure of the magnitude of the effect of a variable on another variable, the magnitude of the difference or the relationship, independent of the effect of the sample size. Calculate the effect size using the t-test. Value t-test based on the average value of pretest and posttest and variance pretest and posttest, with the formula [15] as follows:
\[ \mu^2 = \frac{t^2}{t^2 + df} \]  

(2)

Description:
\( \mu \) : effect size
\( t \) : calculate of t-Test
\( df \) : the degree of freedom

Category value of effect size can be seen in Table 2.

| \( \mu \) (effect size) | Interpretation               |
|-------------------------|------------------------------|
| \( \mu < 0.15 \)       | effect is negligible (very small) |
| \( 0.15 \leq \mu < 0.40 \) | Small Effect                |
| \( 0.40 \leq \mu < 0.75 \) | Medium Effect               |
| \( 0.75 \leq \mu < 1.10 \) | Great Effect                |
| \( \mu \geq 1.10 \)    | Very Large Effect            |

Source: [16]

The product is said to be effective when N-gain is in medium category, and effect size with medium effect category.

3. Results and Discussion

The result of this research is the effectiveness of textbook use. The effectiveness of the use of integrated IPA text books landslide themes with models is nested done to increase the student preparedness.

3.1 Preparedness Aspects of Attitudes and knowledge

The parameters used in the attitude preparedness variables consist of various levels, namely receiving, responding, appreciating, and being responsible. While knowledge of disaster is the main reason someone to conduct protection activities or preparedness efforts. Knowledge covered in the cognitive domain is know, comprehension, analysis, synthesis, and application and evaluation. Assessment of preparedness attitude aspect is done with self assessment instrument while knowledge is done by written test. Assessment of preparedness of learners is done before (pretest) and after (posttest) textbook is given. The results of pretest and posttest preparedness of learners can be seen in Table 3.

| No. | Rata-Rata | Aspect of Attitude | Aspect of Knowledge |
|-----|-----------|-------------------|--------------------|
| 1   | Pretest   | 81.33             | 45.6               |
| 2   | Posttest  | 87.32             | 81.33              |

Table 3 demonstrate the preparedness of attitude and knowledge aspects for the pretest and posttest of students. Next, to see the magnitude of the increase in preparedness that occurs before and after learning, is calculated using the N-Gain formula. Based on the calculation, the N-Gain value of preparedness of attitude aspect is 0.47 while in the knowledge aspect is 0.66. Both are in the medium category. These results indicate that there are differences in the effectiveness of pretest and posttest enhancement, then the difference sizes will be determined (effect size). Calculating the effect size using the t-test, before computing the t-test first, the data pretest and posttest are normally distributed.
By using IBM SPSS application obtained normal distributed data then t-test calculation. The result of calculation of t-test value using SPSS which can be seen in Table 4.

Table 4. Results of T-test pretest and posttest value of preparedness attitude and knowledge aspects

| Paired Samples Test | Paired Differences | T      | df | Sig. (2-tailed) |
|---------------------|--------------------|--------|----|----------------|
|                     | Mean               | Std. Error Mean | 95% Confidence Interval of the Difference | Lower | Upper |
| skill               | -8.83333           | 8.85061 | 1.61589 | -12.13821 | -5.52846 | -5.467 | 29         | 0.000 |
| knowledge           | -35.73333          | 12.57237 | 2.29539 | -40.42793 | -31.03873 | -15.567 | 29         | 0.000 |

Table 4 shows the value of the attitude that is -5.467 while knowledge -15.567 and df value of 29. This value of t and df is used for calculation effect size. Calculation of effect size for attitude is 0.51 with the medium category, while calculation the value of effect size for knowledge is 0.89 with a large category. The product is said to be effective if N-Gain is in medium category and effect size with medium category. This means that an integrated IPA textbook theme of landslide with an nested model effective improves students preparedness in attitude and knowledge aspects.

Improvement of preparedness of students attitude aspect indicate that students become more know and alert in responding to landslide disaster after using textbook of SMP / MTs of landslide theme with nested model. As for the preparedness of students knowledge aspect shows that students initially do not have knowledge about disaster, but after given IPA text book integrated theme of landslide with nested model students become aware of landslide disaster and mitigation effort. This indicates that textbook development can improve the preparedness of students on attitude and knowledge aspects. The criterion of the textbook is effective if after using the textbook there is a positive impact on the learners in the students process, especially the improvement of preparedness of students in attitude and knowledge aspects.

Preparedness is a condition of anticipating and reacting quickly and appropriately to stimuli faced both cognitively, affectively and psychomotorically [17]. Knowledge is the result of knowing, and this occurs after a person senses a particular object [18]. Much of human knowledge is obtained through the eyes and ears. Knowledge or cognitive is a very important domain the formation of one's actions. Their knowledge influences the attitude and care of learners to be ready to anticipate disaster, especially for those who live in disaster-prone areas. If a person has knowledge of disaster preparedness then that person will also have an attitude of preparedness for disaster as well.

4. Conclusion

The results showed that textbooks that have been developed effectively improve the students preparedness on the attitude aspects with the medium category and textbooks that have been developed effectively improve the preparedness of students on the knowledge aspect with a large category.

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