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Student's disaster literation in 'SETS' (science environment technology and society) disaster learning

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Abstract: The purpose of this study was to analyze student disaster literacy based on mitigation, adaptation and responsibility profiles in SETS-based disaster learning. The subjects of this study were students at Piyungan State Elementary School, Tulung Pundong State Elementary School and Karanggayam Pleret State Elementary School Bantul Yogyakarta Indonesia. Three schools were randomly selected from the entire school population in earthquake prone areas. In this study the subject was chosen because it is located in an earthquake-prone area in Bantul, Yogyakarta, Indonesia. Data collection techniques using observations, instruments in the form of observation sheets mitigation, adaptation and responsibility of elementary school students. The data analysis technique used descriptive percentage technique. The results showed that after participating in the overall SETS-based disaster learning, student disaster literacy was based on an average mastery of 92.01 mitigation skills, which were included in the very high category, adaptation skills 85.20 were in the high category, and responsibility 84 , 04 which is included in the high category.

Keywords: Disaster Literacy, Disaster learning, SETS

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INTRODUCTION

The position of the Unitary State of the Republic of Indonesia which is above the three continental plates meeting and surrounded by the Pacific Ring of Fire is very prone to various disasters. However, although prone to various disasters, disaster literacy in Indonesia is still cause for concern. In Indonesia, disasters that occurred in the past are often forgotten. Though the disasters of the past must be used as lessons to build community literacy. Literacy is not just reading, but how to overcome learning difficulties itself. Because community disaster literacy is not at a good level, a variety of misguided information is rampant in Indonesia. The Government of Indonesia appears to be lacking in preparing Disaster Risk Reduction (DRR) policies. Though it has been agreed that there is a Sendai Framework Disaster Risk Reduction (SFDRR 2015-2030) by the world. Based on the Sendai Disaster Risk Reduction Framework, it can be seen that efforts to reduce disaster risks can be carried out through activities in education, social and natural sciences, culture and communication and information. This implementation is supported by the United Nations and harmonized with the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. In addition to the matter of the seriousness of the government (political will) in building a disaster risk reduction system, what is equally important is the community's disaster literacy that needs to be improved. Many institutions began to provide Standart Operation Procedures (SOP) when an earthquake occurs, for example, showing awareness of the urgency of preparing DRR tools and systems began to emerge. Next, disaster literacy should be an integral part of the lessons learned in schools. Basically the structure of the 2013 curriculum developed by the government seems to have been based on awareness so that our children are aware of the potential disasters around us. This is especially true for Natural Sciences (IPA) subjects for Junior High Schools / Madrasah Tsanawiyah (MTs). In the Minister of Education and Culture Regulation (Permendikbud) Number, Appendix 24 of 2016, namely in the elaboration of the basic competencies of natural science subjects, it is stated that students of grade VII (seven) SMP / MTs must be able to "Explain the layers of the earth,

mountains, earthquakes, and risk reduction measures before, during, and post disaster according to the threat of disaster in the area ".

One of the disaster-prone areas in Indonesia is Yogyakarta. Based on a study of various literature sources it is known that the severe damage caused by the earthquake in Yogyakarta was concentrated in the Bantul area. Historical records show that the vibrations felt in the city of Yogyakarta are very powerful reaching the intensity scale VIII to IX MMI. At that time, the damage did not only affect the settlements of Yogyakarta residents, but also several parts of the Yogyakarta Palace building that suffered quite severe damage. Geologists suspect that this strong earthquake had an epicenter that was on land, in an area along the Opak River fault. Based on the location and level of severe damage caused, it is estimated that this earthquake has a magnitude above 6.0 on the Richter Scales.

This Central Java and Yogyakarta earthquake is a classic example of a shallow subduction zone earthquake centered in an arc basin outside Java. On May 27, 2006 the area of Yogyakarta and its surroundings, particularly Bantul, was again shaken by a devastating tectonic earthquake. Although the magnitude of the earthquake was relatively small, it was only 6.4 on the Richter Scales but had resulted in more than 6,000 deaths, more than 40,000 injuries and more than 1 million people lost their house. The most vulnerable zone is the area that has the highest seismic hazard index measured by Micro-tremor in Yogyakarta. This fact revealed did not intend to give fear to the public. Facts about the seismic vulnerability of an area should instead be revealed and socialized to build the capacity of all levels of society in dealing with earthquakes that may occur in the future. It is rarely understood by ordinary people that a strong earthquake is like a cycle and will repeat itself over a certain period.

This condition will continue and recur to form a cycle of earthquake repeating periods in a certain region. If you look at the historical facts of the Yogyakarta earthquake, the Bantul area has always been the area that suffered the most damage every time an earthquake occurred. This natural condition is a reality that must be accepted by the people of Bantul, so whether they like it or not, it must be faced by residents who live in active seismic areas. Therefore, the understanding of disaster management needs to be understood and mastered by all levels of society, government, and the private sector to reduce the number of casualties and property losses that might arise in the event of an earthquake. The phenomenon of "belt of damage" whose distribution pattern is in accordance with the most vulnerable zones covering the districts of Pundong, Imogiri, Jetis, Pleret, Banguntapan and Piyungan. Based on these conditions, this region requires an increase in disaster litigation to be able to have good mitigation, adaptation and responsibility capabilities for earthquake disasters. Based on these conditions, this region needs an increase in disaster literacy to be able to have good mitigation, adaptation and responsibility capabilities for earthquake disasters. Based on this, this study seeks to provide an overview of student disaster literacy based on the profile of mitigation, adaptation and responsibility of students in SETS-based disaster learning. The SETS basis was chosen because it combines four elements namely science, environment, technology and society so that through this learning students will gain comprehensive knowledge about natural disasters. This comprehensive understanding includes the ability of literacy. This literacy ability can be developed through various approaches, it can be seen from the results of research (Basam et al., 2018) which revealed that Student Science Competencies in Learning Science Literacy Learning can be built through inquiry-based learning Scientific. The difference between this research and previous research is that this research develops the ability of students 'disaster literacy through SETS-based disaster learning and looks at students' disaster literacy abilities based on mitigation, adaptation and responsibility skills.

The number of disasters that occur in Indonesia, such as earthquakes, tsunamis and landslides must be taken seriously by various parties to minimize the impact of losses caused by these disasters. One of the way to improve community preparedness is to increase the ability of disaster information literacy to the community. Disaster Literacy or it can be called an effort to raise awareness of the community in the face of a disaster is certainly very important to have by the community. This was done in order to mitigate a disaster. The disaster information literacy factor is divided into four parts, namely knowing the source of disaster information, evaluating

disaster information, organizing disaster information, and utilizing and delivering disaster information. As an example, people who do not know the source of disaster information will be very confused about what kind of disaster might occur in their area, how to deal with and deal with it.

Disaster Information Literacy is a skill in finding, collecting, evaluating, and then using that information for a specific purpose. As stated by (Martzoukou & Sayyad, 2017; Oghenekohwo & Frank, 2017; Hasugian, 2008) in his writing "Information literacy as the ability to search, evaluate, and use information needed effectively is not a new ability or skill that arises as a demand of the information age." This is in line with what was expressed by (Astill, et al., 2019; Amir et al., 2019; Nahayo, et al., 2017; Bundy, 2001) which states that "In a simple formulation of information literacy is the ability to search, evaluate and use information needed effectively. The essence of information literacy is a set of skills needed to search, trace, analyze, and use information ".

The understanding of the definition of information literacy is reinforced by statements issued by (Whitney et al., 2017; UNESCO, 2005) which states that information literacy is the ability to realize information needs and when information is needed, identifying and locating the information needed, critically evaluating information, organizing and integrating information into existing knowledge, utilizing and communicating it effectively, legally and ethically. From the three experts' understanding above it can be concluded that information literacy consists of four important indicators in it, the first is the ability to find information, the second is the ability to identify information, the third is the ability to evaluates information, and fourth is the ability to uses information. The four indicators are interconnected with one another as a whole in forming information literacy. In this research, disaster literacy is seen from the ability of mitigation, adaptation and responsibility.

Based on the various theories above reminds the public of the importance of literacy regarding natural disasters. Geographically, Indonesia is in a disaster-prone region. Research has concentrated on the development of natural disaster education in Indonesian society. Indonesia is in an area prone to natural disasters, including earthquakes, volcanic eruptions, and tsunamis (Susilowati et al., 2018; Harits & Nizamuddin, 2019; Pratikto, 2015). In addition to reducing the impact of disasters, disaster literacy can also accelerate post-disaster recovery. Because disasters such as earthquakes, volcanoes and tsunamis cannot be avoided. To be resilient in the face of disasters, the community must also be responsive and adapt to the changes that occur. Like globalization and climate change (Matarrita et al., 2017; Mishra, et al., 2019). With the importance of mastering this disaster literacy, the purpose of this study is to analyze student disaster literacy based on mitigation, adaptation and responsibility profiles in SETS-based disaster learning. While the question answered through this research is how is the literacy ability of elementary school students after attending SETS visionary disaster learning. This student disaster literacy can be seen from the mastery of disaster knowledge, mitigation abilities, adaptation and student responsibility for disasters (Zhu & Zhang, 2017; Oyao et al., 2015).

METHODS

Types of Research

The method used in this research was the experimental method. The experimental method can be interpreted as a research method used to look for the effect of certain treatments on others under controlled conditions (Creswell, 2014). The design of this study was nonequivalent pre-test, post-test control group design. This design uses two groups, one group is given treatment and the results are collected at the end. The control group did not receive treatment, during the same time period, but underwent the exact same test.

This design can be described as follows:

O1	X	O2
O3	-	O4

Information:
O1 : Pretest the experimental class
O2 : Postes experimental class
O3 : Pretest control class
O4 : Postes control class
X : The treatment in the experimental class is SETS based disaster learning
- : Disaster learning is different from the experimental class
(Sugiyono, 2014).

Research Location and Time

This research was conducted in January - July 2019. The locations used in this study were students at Piyungan State Elementary School, Tulung Pundong State Elementary School and Karanggayam Pleret Elementary School Bantul Yogyakarta Indonesia. Three schools were chosen randomly. The subjects of this study were drawn from the entire school population located in earthquake prone areas in Bantul, Yogyakarta, Indonesia. The number and composition of students in each school can be seen in Table 1.

Table 1. *Composition of research subjects*

No	School Name	Grade	Gender		Amount
			Male	Female	
1	SD N Piyungan	V (Five)	18	13	31
2	SD N Tulung Pundong	V (Five)	21	9	30
3	SD N Karanggayam	V (Five)	16	14	30

Data Collection Techniques and Instruments

Data collection techniques used observations, the instruments were in the form of observation sheets of mitigation, adaptation and responsibility of elementary school students. The data analysis technique used quantitative descriptive technique. The types, techniques and instruments of data collection can be seen in Table 2.

Table 2. *Types, data collection techniques and instruments*

Data Types	Data Collection Techniques	Instruments	Data Analysis Techniques
Knowledge	Test	disaster literacy test sheet	t-test & N-gain
Mitigation skills	Observation	Mitigation Observation sheet	quantitative descriptive
Adaptation skills	Observation	Adaptation Observation sheet	quantitative descriptive
Responsibility (skill to respond for disaster eccents)	Observation	Responsibility Observation sheet	quantitative descriptive

The Treatment in The Experimental Class is SETS Based Disaster Learning

The treatment given in the experimental class is SETS-based disaster learning. SETS-based disaster learning links natural disasters with elements of science, environment, technology and society through thematic learning in elementary schools. The interrelationship between the five basic competencies with each other in this SETS-based disaster learning model can be seen in Figure 1.

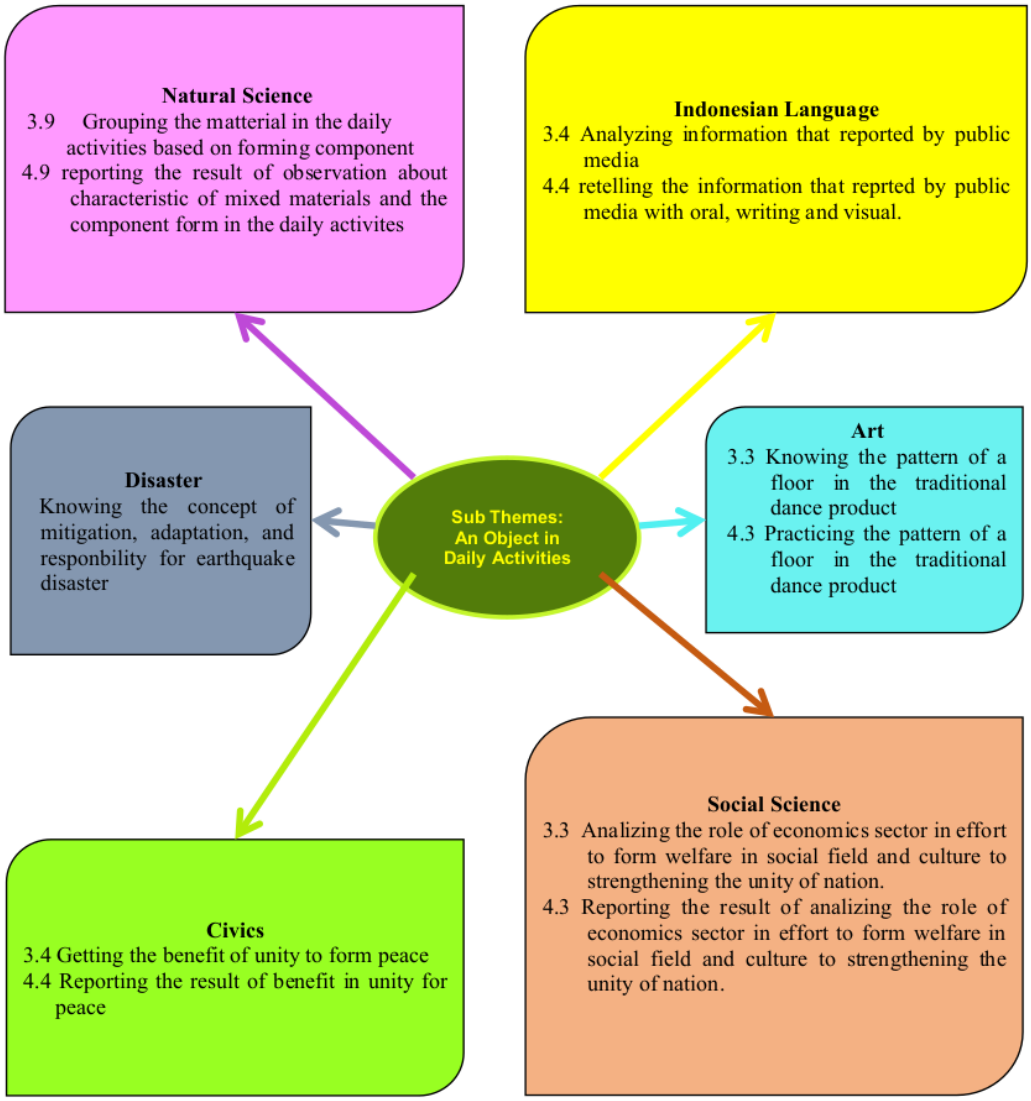

FIGURE 1. *The linkaged figure of any competencies*

This SETS-based disaster learning model refers to the 2013 curriculum. This disaster learning model become a part of the 2013 curriculum and has a position as a complement to the competencies that already exist in IC and BC that already exist in the 2013 curriculum. Competencies that complement IC and BC curriculum in 2013 in the model this learning is the mastery of competencies related to disaster which consists of mitigation, adaptation and responsibility competencies for natural disasters.

The reason for the selection of 9 sub-theme 2 themes in the development of SETS-based disaster learning models is because this theme has characteristics that are appropriate for disaster learning. This characteristic can be seen from the subjects and competencies contained in this theme that can be linked to earthquake disaster competencies. The relationship between competencies in theme 9 sub theme 2 with disaster competence will be able to facilitate students in learning and mastering learning competencies including disaster competencies in

them. In SETS-based disaster learning provides a disaster learning that is delivered specifically, structured and integrative in theme 9 sub themes 2. It is in line with opinions (Unger et al., 2019; Peng & Xu, 2017; Binadja, 2005; Amaliya & Rusilowati, 2011) which states that the provision of information and knowledge about this disaster must be learned through learning that is different from ordinary learning.

RESULTS

Based on observations and data analysis, it is known that the average mastery of mitigation skills in the three elementary schools is in the high and very high categories. Comparison of mastery of mitigation skills in the three elementary schools can be seen in Figure 2.

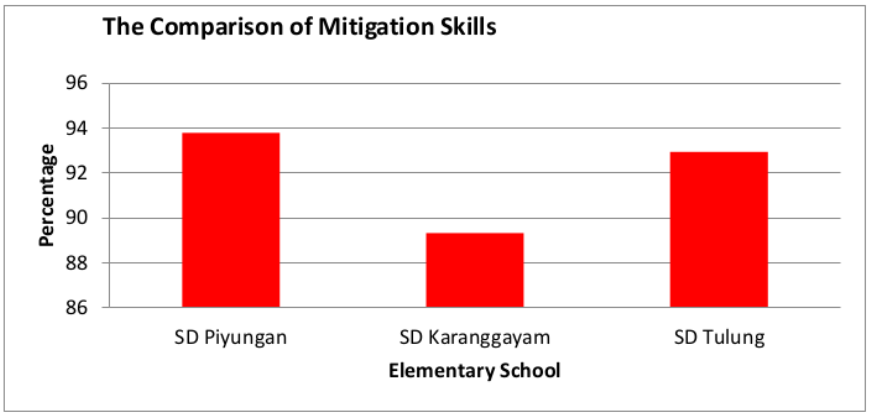

FIGURE2. *The comparison of mitigation skill*

Based on Figure 2 it is known that the highest percentage of mastery of mitigation skills is at Piyungan Elementary School, the second is Tulung Elementary School and the third is Karanggayam Elementary School. Overall the percentage of mastery of mitigation skills in the three elementary schools reaches more than 80%. This shows that the SETS-based disaster learning model has proven to be effective in guiding students to achieve high mitigation competencies.

Furthermore, based on the analysis of students' adaptation skills data, it is known that the comparison of adaptation skills in the three elementary schools that applying a SETS-based disaster learning model as shown in Figure 3.

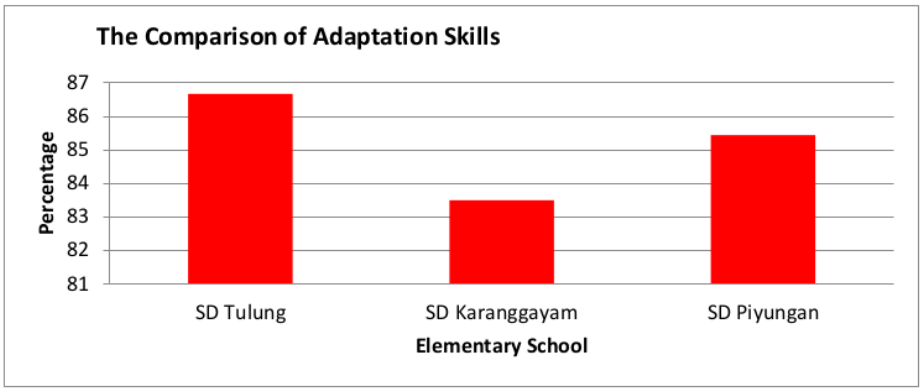

FIGURE 3. *The comparison of adaptation skills*

Based on Figure 3 it is known that the highest mastery of adaptation skills is SD Tulung with a percentage of 86.67 followed by SD Piyungan with mastery of 85.44 and the lowest mastery of adaptation skills is at SD Karanggayam with a mastery percentage of 83.5. Based on this, the overall average percentage of mastery of adaptation skills in the three elementary schools is 85.20 which is in the high category. This shows that the SETS-based disaster learning model implemented in the three elementary schools is able to encourage students to have high mastery of adaptation skills.

Besides mitigation and adaptation in this study, it was also known that the comparison of the mastery of students' responsibility in the three elementary schools implementing the SETS-based disaster learning model as shown in Figure 4.

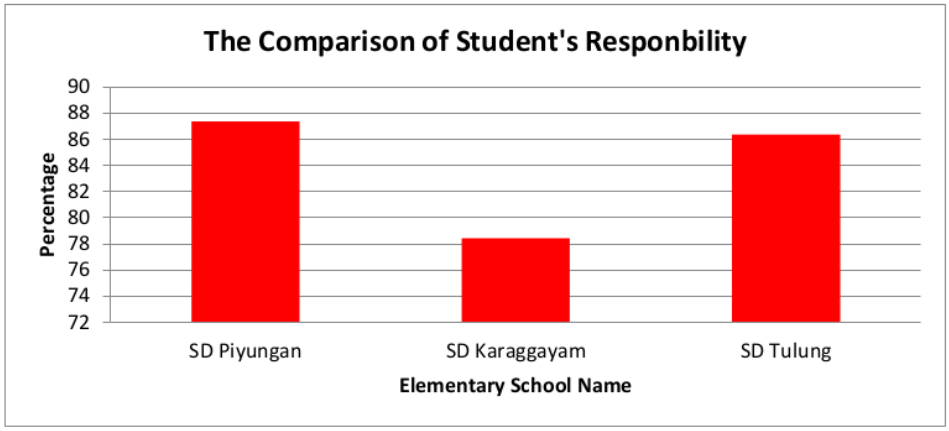

FIGURE 4. *The comparison of student's responsibility*

Based on Figure 4 it is known that SD Karanggayam is the school with the lowest mastery of responsibility with a mastery of 78.43 percent. Besides that, based on Figure 4 it can also be seen that overall the average mastery of responsibility of students in all three elementary schools is 84, 04 which is included in the high category. In this research, students' mitigation, adaptation and responsibility skills were observed in each school. To see a comparison of mitigation, adaptation and responsibility of students in each school can be seen in **Figure 5**.

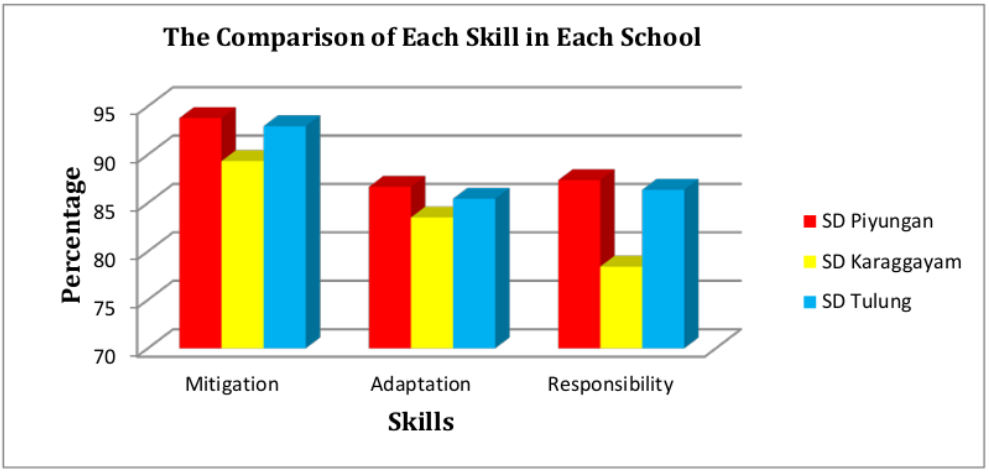

FIGURE 5. *The comparison of mitigation, adaptation, and responsibility skill*

Based on Figure 5 it can be seen that there is a link between mastering mitigation, adaptation and student responsibility skills. This can be seen in each elementary school where Piyungan Elementary School has the highest mitigation skills and also has the highest students' adaptation and responsibility skills. The same thing happened in Karanggayam Elementary School and Tulung Elementary School where the three skills influence and relate to one another. Based on these results it can be concluded that the implementation of the SETS-based disaster learning model is able to provide a change in students' mitigation, adaptation and responsibility skills. Through SETS-based disaster learning also shows the link between mitigation, adaptation and responsibility capabilities, whena schools have good mitigation capabilities, the it will have good adaptation and responsibility capabilities and vice versa.

In addition to the differences, the impact of the implementation of the SETS vision learning disaster also occurred the magnitude of the increase in disaster literacy before and after learning. The magnitude of the increase in disaster literacy in each elementary school can be seen in Table 3.

Table 3. *Mastery of disaster lieteration*

School Name	Pre Test	Post Test	Gain	N gain	Criteria
SD Negeri Piyungan	51,35	72,25	20,90	0,42	Medium
SD Negeri Tulung Pundong Bantul	53,57	72,75	19,18	0,41	Medium
SD Negeri Karanggayam Pleret Bantul	51,76	74,32	22,56	0,46	Medium
SD Negeri Segoroyoso	52,32	66,25	13,93	0,29	Low

Based on Table 3, it is known that there is an increase in mastery of disaster literacy in three elementary schools (SD Piyungan, SD Tulung Pundong and SD Karanggayam) which implement SETS-oriented disaster learning and at one elementary school (SD Segoroyoso) which teaches disaster with other learning methods.

DISCUSSION and CONCLUSION

The SETS-based disaster learning activities have covered all three mitigation, adaptation and responsibility skills. In the SETS-based learning process students learn by observing and practicing directly the disaster simulation process, with a little guidance from the teacher students can understand how to escape from disasters. By carrying out disaster mitigation simulation activities students will work according to the steps contained in the instructions on the student worksheet that have been distributed at the previous meeting. Observation activities, discussing, and then presenting the results in front of the class after students have carried out simulation activities are aspects of disaster mitigation skills which if done well overall by students, then after learning students will have better disaster mitigation skills than before (Han et al., 2017; Cretney, 2016; Wakui et al., 2017).

Increased mastery of disaster literacy is due to the involvement of students during the learning process. This is in accordance with the opinions (Novak et al., 2018; Kimura et al., 2017; Wakui et al., 2017; Ronan & Johnston, 2015) which states that one of the principles of learning is self-experience, meaning that students who do it themselves will gain mastery of the concept of optimal disaster material. In learning to use the SETS-based disaster learning model students are actively involved in learning so that they have a better mastery of disaster material concepts than students who learn by conventional disasters learning. Students who are active in learning activities will have better mitigation, adaptation and responsibility skills and mastery of disaster material concepts than students who only listen to teacher's explanations and are passive during learning activities (Battarra & Xu, 2018; He & Zhuang, et al., 2016).

Based on observations it is known that the mitigation, adaptation and responsibilty skills of students in learning activities have a positive impact on mastery of disaster material concepts, so the higher the mitigation, adaptation and responsibility skills of students in learning the higher the mastery of disaster material concepts achieved by students. This is in line with the results of research from Cvetković, et al. (2015) who examine students' knowledge and perceptions about disasters. Students' perceptions about this disaster will depend on the literacy that is owned by students. Where the better disaster literacy students will make students have the ability to mitigate and respond appropriately to a disaster event that occurs (Manandhar, 2016; Ronan & Johnston, 2015; Huang & Xiao, 2015) An increase in students' mitigation, adaptation and responsibility skills as well as mastery of the concept of disaster material in SETS-based disaster learning shows that the SETS-based disaster learning model resulting from this development is appropriate if applied in the classroom. Disaster learning in this study can be used to improve student disaster literacy. This is in line with research from Sampurno et al. (2015) which also improves student literacy, but in this study using the SETS basis while in Sampurno research et al. (2015) use the integration basis of STEM (Science, Technology, Engineering, Mathematics) and Disaster (STEM-D).

The current condition and condition of facilities and infrastructure in schools also needs to be developed so that it can give double function, namely as an infrastructure and means of supporting education and learning in schools as well as functioning as infrastructure and facilities for learning and disaster simulation practices in the context of disaster mitigation earthquake. Some examples of infrastructure and facilities referred to include the following. First is the school yard, each school must have a large enough space or school yard that can be used as a place to carry out educational activities, such as flag ceremony activities and sports activities, but also can also function as an evacuation site in the event of an earthquake. Second is the school building, each school building should be built with strong construction and earthquake resistance so that in addition to serving as a place of learning can also ensure the safety of students who study indoors at the school from the threat of earthquake hazards. Third is the chairs and desks where students study, each classroom must be facilitated with chairs and desks that are sufficiently adequate so that they can function as good learning facilities and also as a shelter for students in the event of an earthquake. Fourth, there is an evacuation route map, each school should have an evacuation map for residents of all schools that can illustrate the direction of the evacuation that all school members can follow when an earthquake strikes. These things are expected to improve the ability of schools in disaster prone areas to anticipate earthquake events that can occur at any time (Klein et al. 2019; James et al., 2019; Anafiah & Arief, 2018; Atmojo et al., 2018; Amri et al., 2016; Hong et al., 2015).

Provision of disaster literacy knowledge through SETS visionary learning is included in non-structural disaster mitigation which aims to equip elementary students with complete knowledge about disaster. Provision of knowledge through SETS visionary disaster learning is implemented in three elementary schools in earthquake prone areas. Based on the results of the implementation of learning, it is known that there is a difference in disaster literacy between students who learn to use SETS vision learning and students who learn disasters using other learning methods. t-test results from scores obtained by students when pre-test the initial ability of students obtained t count = 1.586 <t table = 1.998 which means that there is no difference in the ability of students before carrying out disaster-oriented SETS learning. While the results of the t test on the post test results obtained the value of t count = 5.873> t table = 1.998 and (p) count = 0 <0.05 which means that the null hypothesis is rejected, so the conclusion obtained is that there are significant differences in knowledge of disaster literacy between students who learn to use disaster preparedness with SETS vision and students who study disaster using other learning methods.

In this research, disaster literacy includes the ability of mitigation, adaptation and responsibility for disasters. Through good literacy mastery can alert, increase alertness, and adapt to disasters. Disaster literacy in this research is not just literacy in general reading and writing, specifically disaster literacy is defined as the ability of people to read natural signs, natural changes, and natural damage so that it is manifested in disaster mitigation (Kunreuther,

2019; Kimura et al., 2017; Brown & Haun, 2014); Masuzawa et al., 2014). This research on disaster literacy does not include physical mitigation such as building a building to deal with disasters. This research is more aimed and focused on increasing awareness of disasters so that they are always alert when facing disasters. The mastery of good literacy will make people able to anticipate earlier, adapt and have the right response in the event of a disaster. In principle, mitigation is built before a disaster occurs and strengthened after a disaster (Young et al. 2019; Lixin et al., 2012; Benjamin et al., 2011). Disaster literacy material must be adjusted to the target audience. When the target is students and students take precedence over material or lessons about disaster and disaster simulation. Likewise, if the target is elementary school and kindergarten students, then it needs to be adjusted to the nature of children who really like picture books. Disaster material can be inserted and included in the form of images as well as in the reading text.

All schools that teach disaster material to their students both with SETS vision learning and with other learning methods have increased their overall disaster literacy. The increase is seen in the N-gain score obtained by each elementary school. The highest increase occurred in Karanggayam Public Elementary School with a gain score of 0.46 which was included in the moderate category, the next two schools that provided disaster literacy by implementing disaster-oriented SETS learning also experienced an increase at moderate level. While one other school which is a control school has a gain score of 0.29 which is in the low category. This disaster literacy is divided into three sub-knowledge namely pre-disaster knowledge, knowledge in the event of a disaster, and post-disaster knowledge. Overall student's disaster literacy based on the profile of the average percentage of mastering students' mitigation skills of 92.01 included in the very high category, adaptation skills of 85.20 were in the high category, and responsibility of 84.04 included in the high category. Based on these results it can be seen that there is a link between mastering mitigation, adaptation and student responsibility skills.

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