
TEACHER'S AND STUDENT'S NEEDS FOR MATHEMATICAL PROBLEMS IN DISASTER CONTEXT

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ABSTRACT

Indonesia is an archipelagic country lies on the Pacific Ring of Fire, resulting in the country being vulnerable to disaster. Teachers need to accustom students to manage natural disaster situation in a more logical approach. Therefore, it is necessary to develop mathematical problems in disaster contexts. This research is an early stage of developmental research. The purpose of this study was to analyze the needs of teachers and students of mathematical problems in disaster contexts. The participants in this study were a mathematics teacher and 53 Year 7 and 8 students at one of the public junior high school, located in a Tsunami affected area, in Banda Aceh. Data collection involved an open questionnaire, and data analysis was carried out descriptively. The results showed that the teacher often provided mathematical problems in learning but had never read mathematical problems in disaster contexts. Also, only three students had ever read such problems. The results also revealed that nearly half of the students (41.5%) liked to solve mathematical problems. Besides, both the teacher and 71.7% of the students agreed and were willing to participate in the learning process involving mathematical problems in disaster contexts. The results of the study also showed that the mathematical questions in disaster contexts were limited. Thus, it is necessary to develop mathematical problems in disaster contexts.

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1. INTRODUCTION

Indonesia, geographically, is a disaster-prone country due to the Circum-Pacific belt, the earthquake zone surrounding the Pacific Ocean. This circumstance requires resilience in every element of society toward disaster risk. Disasters are events that occur due to natural or non-natural factors that lead to casualties and damage to infrastructure (McDonald, 2003). Disaster events can be triggered by natural events, human actions or a combination of both (Amri, 2017).

An important part of disaster management is the mitigation, the measures to reduce disaster risk, by improving the physical development, the awareness and the ability to

confront disaster threats. Disaster mitigation efforts are efforts to save one self from natural disasters that occur suddenly and threaten one's life (Setiawan, 2016). Communities threatened by disasters are so diverse that the most strategic way to educate people about disaster mitigation is through formal and informal education.

One of the efforts that the school can do as a formal educational institution in reducing disaster risk is through the integration of disaster risk education in extracurricular activities and various subjects (Amri, 2017). One of which through the regular lesson, such as mathematics (Shadiq, 2016) because mathematics is a clear and logical means of thinking to solve contextual problems (APEC, 2012).

Aceh is one of 34 provinces in Indonesia, with a total of 2,000 schools in a high-risk disaster area (Sinambela & Nugrahini, 2016). Since ten years after the tsunami in Aceh, disaster risk reduction has been integrated into the school curriculum, and school-based disaster preparation programs have also been carried out (TDMRC Unsyiah, 2014). So, disaster is used as one of the contexts in learning mathematics. The contexts provided in learning can be gained from nature, social life, culture, economy, and religion. Therefore, the content of learning materials is inseparable from the student's learning environment and the daily life (Zakiyah & Rusdiana, 2014). Contexts play an important role in achieving the goals of learning mathematics because they can help students understand the materials meaningfully (Johnson, 2002). They also benefit the students in solving mathematical problems, making it easier for students to choose the way to solve problems and to provide students with strategic solutions in solving problems (Van Den Heuvel-Panhuizen, 2005). Provision of contexts in the learning environment can provide answers to students' problems "why should I study this?" and can bring meaningful learning (Johar & Hanum, 2016).

Schools have a critical role in developing knowledge to build the community resilience to disasters (Oktari, Shiwaku, Munadi, & Shaw, 2015). Previous researchers, such as Fatmawati (2016), have developed the mathematical problems in disaster contexts but the availability of such questions remains lacking. Besides, research that examines the needs of students and teachers for mathematical problems in the context of disaster is limited. Therefore, the purpose of this study was to analyze the needs of teachers and students of mathematical problems in disaster contexts.

2. METHOD

This study is an early stage of developmental research, particularly the preliminary stage of the Tessmer model (Tessmer, 2013). The participants were a mathematics teacher and 53 Year 7 and 8 students in one of the public junior high school, located in a Tsunami affected area, in Banda Aceh. The participants could define disaster well, provide some examples of disasters, and explain what needs to do in the event of an emergencies. They mentioned some places to use as an early evacuation site, including the evacuation building, hill or mountain, floating ship of a diesel power plant, tsunami museum, tall buildings, and mosques. They admitted that they obtain information about disaster through electronic media, books, schools, and parents.

The data collection involved an open questionnaire and interview with several participants to analyze the unique cases of student answers deeply. Both the questionnaire and the interview were used to investigate the teacher's and student's needs for mathematical problems in disaster contexts. Data analysis was conducted descriptively.

The example of mathematical problems in disaster contexts provided in the questionnaire were adapted from Khalid & Ali (2016) and presented as follows.

Abu was standing on a beach when he heard the tsunami warning siren. He immediately decided to run to a safe place. He had two choices: going to a small hill or a shelter built for tsunami, which can be reached via two ways. The hill is 500 metres and the shelter is 800 metres away from the beach. However, to reach the top of the hill, Abu need to climb 300 steps of staircases. Abu can run at an average rate of 5m/s and he can climb the stairs at the rate of 3 steps/s. He may also use the curved road (specially made for the shelter) which is 900 metres long, where he can run at 6m/s. In your opinion, which way should Abu choose? Please explain!

The finding of research conducted by Khalid & Ali (2016) revealed that students were motivated to solve the problem and he suggested teachers to guide students in solving contextual problem in disaster context. In this study, students were asked to respond to the problem in a disaster context, whether they had read/solved such a problem before, and whether they were interested in and willing to solve such a problem?

3. RESULTS AND DISCUSSION

The results of teacher questionnaire showed that the mathematics teacher, who taught Year 7 and 8, had often provided mathematical problems in mathematics learning but she had never read/solved mathematical problems in disaster contexts. The teacher agreed that mathematical problems in disaster contexts should be given in mathematics learning because it can improve students’ mathematical literacy.

The questionnaire results of Year 7 students about the student’s needs for mathematical problems in disaster contexts are presented in Figure 1.

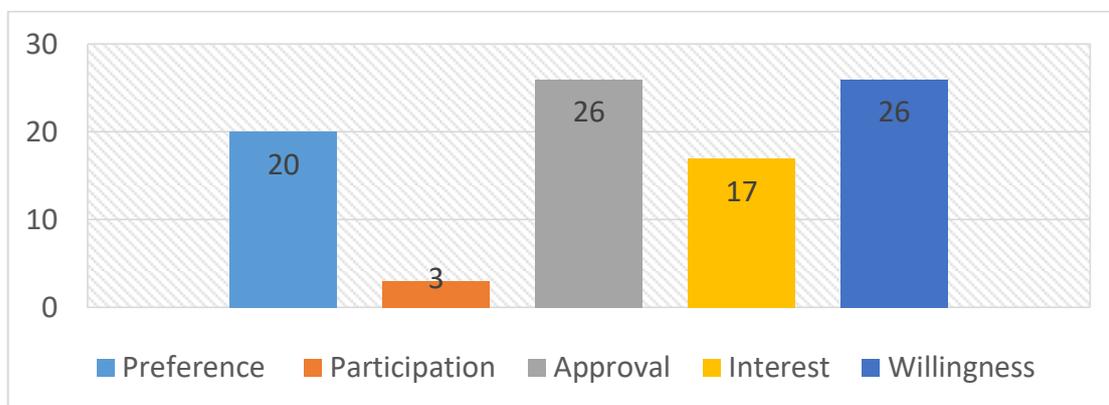


Figure 1. Year 7 students’ needs for mathematical problems in disaster contexts

Figure 1 shows all students’ preferences, meaning that 20 students were happy with mathematical problems, but only 17 students were interested in the problems in disaster contexts. Only three students had ever read/solved mathematical problems in disaster contexts. In addition, 26 students agreed if the teacher gives mathematical problems in disaster contexts in learning and they were willing to solve mathematical problems in disaster contexts.

The questionnaire results of Year 8 students concerning the students’ needs for mathematical problems in disaster contexts displayed in Figure 2.

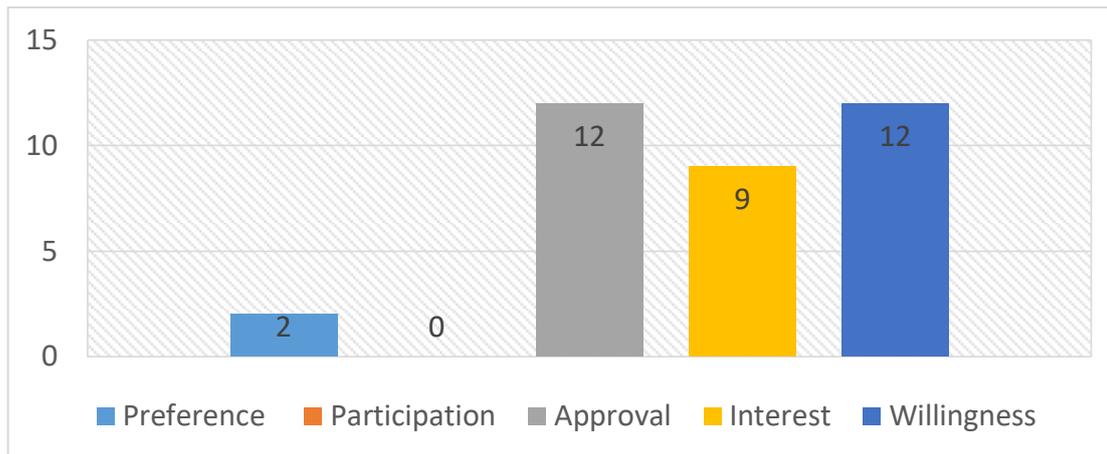


Figure 2. Year 8 students' needs for mathematical problems in disaster contexts

Only two of Year 8 students felt happy with mathematical problems. However, 12 students said that they were interested in mathematical problems in disaster contexts. All students had never read/solved mathematical problems in disaster contexts. Also, 12 students asserted that they agreed if the teacher gives mathematical problems in disaster contexts in mathematics learning, and they were willing to solve such mathematical problems.

Seven students admitted that they were not happy with the mathematical problems, but they attracted to mathematical problems in disaster contexts. Providing contextual problems can increase student motivation in learning mathematics (Khalid & Ali, 2016). That's why the participants who were not pleased with the mathematical problem showed positive attitudes towards mathematical problems in disaster contexts.

The questionnaire results of Year 7 and 8 students regarding the students' needs for mathematical problems in disaster contexts are presented in Figure 3.

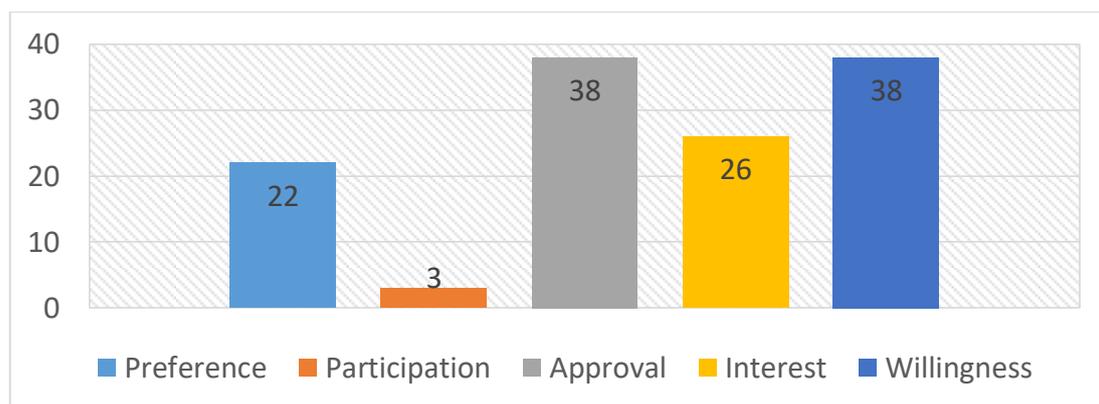


Figure 3. The student's needs of mathematical problems in disaster contexts

Figure 3 illustrated the preferences of all students. Twenty-two students (41.5%) were happy with mathematical problems, and nearly half of the students (49.1%) were interested in the problems in disaster contexts. Only three out of 53 students (5.6%) had ever read/solved mathematical problems in disaster contexts. In addition, more than 70% of the students agreed if the teacher gives mathematical problems in disaster contexts, and they were willing to solve mathematical problems in disaster contexts.

Table 1 presents the questionnaire results of Year 7 students about the students' needs for mathematical problems in disaster contexts.

Table 1. The Year 7 students' needs for mathematical problems in disaster contexts

Subject	Question Number				
	1. Do you like to solve mathematical word problems?	2. Have you ever read/solved mathematical problems in disaster problems?	3. Do you agree if the teacher gives a mathematical word problems in disaster context as the example?	4. Are you interested of mathematical problems in disaster context as the example?	5. Are you willing to solve mathematical problems in disaster context (see an example)?
A	Not Happy	Never	Disagree	Not Interested	Willing
B	Happy	Never	Agree	Not Interested	Willing
C	Happy	Never	Agree	Interested	Willing
D	Not Happy	Never	Agree	Not Interested	Willing
E	Happy	Never	Disagree	Not Interested	Not Willing
F	Happy	Never	Agree	Not Interested	Willing
G	Not Happy	Never	Agree	Not Interested	Willing
H	Not Happy	Never	Agree	Interested	Willing
I	Not Happy	Never	Agree	Interested	Willing
J	Not Happy	Never	Agree	Interested	Willing
K	Happy	Ever	Agree	Interested	Willing
L	Happy	Ever	Agree	Not Interested	Willing
M	Happy	Ever	Agree	Interested	Willing
N	Not Happy	Never	Agree	Interested	Willing
O	Happy	Never	Agree	Interested	Willing
P	Happy	Never	Agree	Interested	Willing
Q	Happy	Never	Agree	Interested	Willing
R	Not Happy	Never	Agree	Not Interested	Not Willing
S	Happy	Never	Agree	Not Interested	Willing
T	Not Happy	Never	Agree	Interested	Not Willing
U	Happy	Never	Agree	Interested	Willing
V	Happy	Never	Agree	Not Interested	Willing
W	Happy	Never	Disagree	Not Interested	Willing
X	Happy	Never	Disagree	Not Interested	Not Willing
Y	Happy	Never	Agree	Interested	Willing
Z	Not Happy	Never	Disagree	Not Interested	Not Willing
AA	Not Happy	Never	Agree	Not Interested	Willing
AB	Happy	Never	Agree	Interested	Willing
AC	Happy	Never	Agree	Interested	Willing
AD	Happy	Never	Agree	Interested	Willing
AE	Happy	Never	Agree	Interested	Willing

Here are the interview excerpts with one of the participants (K). K was one out of three Year 7 students who had ever read/solved a mathematical problems in disaster context:

Q : do you like mathematics?

A : yes miss.

Q : which one do you prefer, problems on number or word problems?

A : word problems miss

Q : you answered question number 2. What is the problem and where do you read it?

A : yes mis, the problem was about how much medicine needs for disaster victim. I read it in the elementary school, "Thematics" book.

Both the questionnaire and the interview results of K showed that she liked mathematics and word problems. She had read/completed mathematical problems in disaster contexts from the book "Thematics" when she was in elementary school.

"Thematics" book consists of themes to link the contents of several subjects and to develop materials based on the environment to provide a meaningful experience for students.

Five out of six students interviewed mentioned similar answer concerning their reasons for the low interest in mathematical problems in disaster contexts. Here is an interview excerpt with student B.

Q : do you like mathematics?

A : not really miss

Q : which one do you prefer, problems on number or word problems?

A : both of them miss

Q : why did you said happy for number 1 but your response was not interested for number 4?

A : because of the length of the problem miss.

Both the results of the interview and questionnaire of B represented five other people who mentioned a similar reason. Thus, it can be concluded that they liked mathematics. They agreed and would solve the problem if the teacher gave it, but they had a low interest in mathematical word problems in disaster contexts. The negative response was due to the length of the problem, indicating that they tried to abstain from more complex problems.

The responses to student questionnaires and the interviews with several participants concluded that there were some students who were happy with mathematical problems but were not interested in mathematical problems in disaster contexts because the sample form presented was too long. However, students should accustom to solving contextual problems because those without this experience will face difficulties in the future, even leading to the refusal to solve them.

Contextual problems alone cannot directly help students in understanding the concept or motivate them (Boaler, 1993; Carraher & Schliemann, 2002). Moreover, the problems do not necessarily guarantee students to learn meaningfully. So, teachers need to engage students to interpret the contexts and to explore ideas in solving mathematical problems (Widjaja, 2013). Students who are not familiar with solving contextual problems will experience difficulties in learning because they need to connect their knowledge and real-life applications. Therefore, mathematics contextual problems should also be developed by using a sentence that easily understood by relatively average student. In regard to the textbooks in Indonesia, Wijaya, van den Heuvel-Panhuizen, & Doorman (2015) found that only 10% of the tasks in the textbooks are context-based. The use of contextual problems support students to develop mathematical understandings (Dolk, Widjaja, Zonneveld, & Fauzan, 2010). Therefore further research needs to develop mathematics problem or mathematics textbooks in the context of disasters and analyze their impacts on students' problem solving skills.

4. CONCLUSION

This study on the importance of mathematical problems in disaster contexts resulted in several findings. The teacher often provided mathematical problems in learning but had never read mathematical problems in disaster contexts. Besides, nearly half of the students (41.5%) liked to solve mathematical problems, but only three students had ever read the problems in disaster contexts. Both the teacher and 71.7% of the students agreed and were willing to participate in the learning process involving mathematical problems in

disaster contexts. Further research developing mathematical problems in disaster contexts is necessary to develop literacy skills and raise students' awareness of disasters.

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