STUDENTS' PERCEPTIONS OF DISCOVERY-BASED MATHEMATICS LEARNING ACTIVITY USING REAL SITUATIONAL CONTEXT

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Abstract

This study aimed to reveal students' perceptions of discovery-based mathematics learning activity using real situation context. This learning activity not only facilitated students to learn through the context of life, but students were directly involved and act as models in the context that was created when learning takes place in the classroom. A total of 28 seventh grade junior high school students were involved in this study. The study was a mixed method study using the quantitative and qualitative instrument to measure students' perceptions of their learning experiences. The result showed that students perceptions are good towards mathematics learning activity based on discovery using real situation context. Students believed that the activity helped them to construct and understand the material effectively. Learning activity designed in a small group discussion facilitated them to interact with others within the group and also motivated them to learn actively.

Keywords: Mathematics learning activity, discovery learning, real situation context, students perceptions.

1. INTRODUCTION

The ability to understand mathematical concepts is one of the keys to success in learning mathematics. Mathematical concepts that are integrated with one another (NCTM, 2000) require students to understand each concept well so that they can distinguish, make connections, and apply them to solve certain problems appropriately (Nitko & Brookhart, 2011). A good understanding of concepts is also believed to help students learn new ideas better (NRC, 2001). Conversely, if students are not able to understand the basic concepts properly, they will have difficulty in developing their knowledge (Yuliani & Saragih, 2015).

Therefore, knowledge about how students develop their mathematics concept understanding becomes very important to be understood by teachers. This is very useful in determining appropriate learning methods and strategies that can facilitate students to achieve an understanding of their mathematical concepts optimally. One learning method that is believed to be effective is discovery learning (Yuliani & Saragih, 2015; Yurniwati & Hanum, 2017; Khasanah, et. al., 2018).

In discovery learning, students are directly involved in a series of activities of observation, exploration, investigation, problem solving, constructing conjectures, and drawing conclusions to find a new concept involving their prior experience and knowledge (Bicknell-Holmes & Hoffman, 2000; Balim, 2009; Arend & Kilcher, 2010; Schunk, 2012). As a constructivist method, the students have a central role in this learning (Bruner, 1961), while the teachers provide guidance and support to ensure that students are on the right way and do not make any misconceptions (Westwood, 2008; NCTM, 2000; Abrahamson & Kapur, 2017). The

involvement of students in the process of constructing concepts independently makes them have meaningful learning experiences. So, students can understand these concepts and remember them well (Svinicki, 1998; Westwood, 2008).

Besides the methods used, the use of context is also important to support the success of the learning process. The context that is close to the student's everyday life or even students are directly involved in the contexts created in the class, can facilitate students in understanding the concepts learned (Van den Heuvel-Panhuizen, 1996). One context that can be used is a real situational context, which is a context that is intentionally created or set up in the classroom. This context involves students as models that perform roles that can be directly observed in the situation. With this situation, students are believed to be easier to understand the concepts learned because they practice it in a real way in the learning process. Students' experience of the context presented can help them to understand mathematical concepts more meaningfully (Cooper & Harries, 2002). A number of studies have confirmed that learning using real-life contexts is effective (Selvianiresa & Prabawanto, 2017; Rusmini & Surya, 2017). Therefore, we developed the design of discovery-based mathematics learning activities using real situation contexts to facilitate students in building an understanding of mathematical concepts.

The design of learning activities that were developed must be evaluated to be able to see the quality and the contribution to creating an effective learning environment for students. One way that can be done is by knowing students' perceptions of the learning activities (Ramsden, 1991). Students' perceptions of their learning environment have a huge influence on learning experience and learning outcomes (den Brok, et. Al., 2006). Thus, student perceptions become one of the factors that improve the quality of learning (Kember, et. Al., 2002). Therefore, the main objective of this study is to reveal students' perceptions of the design of discovery-based mathematics learning activities using the real situation context.

2. DISCOVERY LEARNING

Discovery Learning is a learning method where students discover new knowledge using their own minds (Bruner, 1961). In this case, students integrate their new knowledge with prior knowledge through a series of exploration and problem-solving activities (Bicknell-Holmes & Hoffman, 2000). This is supported by Balim (2009) and Arend & Kilcher (2010), who say that discovery learning is learning that encourages students to learn and find a conclusion through a series of investigations and explorations carried out independently.

Meanwhile, according to Schunk (2012), discovery learning is a type of inductive reasoning that encourages students to find knowledge by formulating and testing hypotheses through direct experience. In this case, students can start by studying specific examples to formulate rules, concepts, and general principles. Discovery learning as a learning method has several characteristics. Svinicki (1998) says there are three main characteristics of discovery learning: (1) emphasizing active learning, (2) developing meaningful learning, and (3) encouraging students' positive attitudes in constructing knowledge.

Although the essence of discovery learning is that students discover their new knowledge by themselves, but a number of experts still recommend guidance from teachers (Mayer, 2004; Prince & Felder, 2006). Teacher guidance in discovery-based learning is very important to ensure students work in the right way and to minimize the possible misconceptions, but still provide opportunities for students to be active in constructing their own new knowledge (Westwood, 2008).

In this study, discovery-based learning activities are designed by referring to the steps of discovery learning according to Westwood (2008). The teacher presents a problem or information. Then students identify the problems or information, collect, process, and analyze data to get a conjecture. After that, students verify the conjecture by looking at various reference sources and discussing it with other students. After students get conclusions, the teacher gives confirmation of conclusions that have been made, provides reinforcement, and rectifies if there is a misconception, so that students get the right conclusions related to the concepts that have been learned.

3. STUDENTS PERCEPTIONS OF THE LEARNING ENVIRONMENT

The quality of learning activity can be seen, one of them, by referring to the students' perception (Teh & Fraser, 1995). Students' perceptions can provide an overview of the effectiveness of learning that is done, whether learning can facilitate students in understanding the concepts learned. Therefore, the development of a good learning activity must consider the perceptions of students. Ramsden (1991) said that one way to measure student perceptions is to use *The Course Experience Questionnaire (CEQ)*. This questionnaire focuses on several aspects of learning which include good teaching, clear goals and standards, appropriate workload, appropriate assessment, and emphasis on independence. Meanwhile, according to Kember, *et. al*.

(2002), student perceptions can be measured by the *Student Feedback Questionnaire (SFQ)* which focuses on six sub-scales: learning outcomes; interaction; individual help; organization and presentation; motivation; and feedback.

In this study, the measurement of student perceptions is based on the main principles of discovery learning: active learning, meaningful learning, and good attitude in constructing knowledge. The perceptual aspects of students used are based on the opinions of Ramsden (1991) and Kember, *et. al.* (2002), i.e. learning outcomes, clear goals and standards, student interactions, and good motivation.

The perceptual aspects are defined as follow: 1) Learning outcomes refer to the quality of learning activities that are able to facilitate students to discover and understand mathematical concepts. 2) Clear goals and standards refer to the clarity of goals and instructions in conducting learning activities to find a concept. 3) Students interaction refers to the communication quality of students in small group discussion. 4) Good motivation refers to the quality of learning activities in generating student motivation.

Learning outcomes aspects and clear goals and standards will reveal students' perceptions of the principle of meaningful learning in learning activities undertaken. Students interaction aspects will reveal about the principle of active learning. While the aspect of good motivation will reveal students' motivation in learning which is part of the principle of a good attitude in constructing knowledge.

4. METHOD

This study was a mixed method research using quantitative and qualitative instruments to reveal students' perceptions of mathematical learning activities based on discovery learning using a real situation context. A total of 28 seventh grade junior high school students (12-14 years old) were included in this study.

Students were given a worksheet as a guide for conducting learning activities in order to construct and understand mathematical concepts, in this case, the material being studied is Sets. Students began activities by observing real contexts in the classroom that were deliberately created to facilitate them to carry out exploration and discovery. Students not only worked with paper but also moved actively as a model in the learning process. This activity was carried out in a small group discussion of 4 students. After the learning process students were asked to give their opinions about their learning experience.

Data on students' perceptions were collected using a reliable questionnaire with 9 surveys items using a 5-point Likert scale (a Cronbach Alpha=0.612), semi-structured interview, and observation. The data obtained was triangulated to ensure that the results really reveal students' perceptions appropriately. The survey items were statistically analyzed and the results are presented in Table 1.

5. RESULT AND DISCUSSION

After the discovery-based mathematics learning activities using a real situational context was done, students were given questionnaires to reveal their perceptions of their learning experience. The results are presented in Table 1 by presenting the mean data (M) and standard deviation (SD) for each item questionnaire

Table 1. Students' perceptions of discovery-based mathematics learning activity using real situation context

Aspect	Survey items		(M)	(SD)
Learning Outcomes	1	Learning activities help me construct concepts easily	4.214	0.651
	2	The use of real situational context helps me to understand the concept	4.250	0.466
	3	The designs and illustrations contained in the worksheet help me to understand the concept	4.143	0.476
Clear goal and standards	4	The guidelines for learning activities are clear so that it is easy to do	4.071	0.585
	5	The sentence used in the worksheet is very easy	4.179	0.576

Aspect	Survey items		(M)	(SD)
		to understand		
Students interactions	6	Group discussion activities make me learn actively	4.250	0.518
	7	Discussing with other students in the group make me understand the concept more deeply	4.036	0.686
Good Motivations	8	Learning activities motivate me to learn	4.250	0.651
	9	The designs and illustrations contained in the worksheet make me interested to learn	4.214	0.466

As seen in Table 1. according to Widoyoko (2009) the survey yielded good responses from the students with all the survey items having means above 3.4. These results are described as follow.

5.1. Students Perceptions of Active Learning Activity

The questionnaire result shows that learning activities designed in small group discussions help students learn mathematics actively (Item 6. M = 4.250, SD = 0.585). Other result shows that the interaction between students in the group helps students understand the concept more deeply (Item 7, M = 4,036, SD = 0.576). It means that students feel comfortable learning in groups. They think that collaboration in groups can help them understand the concept more easily. It was seen during the learning process. Even though at the beginning of the activity students feel unfamiliar, but after that, they were very excited to work in groups. Students were also not awkward to ask the teacher when they faced problems that they could not solve in the groups. These results are supported by the results of the interview as follows.

"I glad to study in groups because when I don't understand I can ask my friends."

"Learning in groups is very fun, so I am excited to learn."

This conclusion is in line with a number of experts. Activities designed in discussion groups provide opportunities for students to exchange ideas with other group members and developing shared meaning (Mills & Alexander, 2013). The diversity of background and experience possessed by group members allows students to get more information than when working individually. The diversity of information obtained in groups can stimulate students' creativity in learning (Burke, 2011). Thus, students can solve various obstacles that occur in the process of constructing and understanding concepts. Koichu *et al.* (2007) also say that discussion groups can help students understand mathematical concepts better.

5.2. Students Perceptions of Meaningful Learning Activity

Discovery-based learning activities carried out using worksheets are able to facilitate students to learn effectively. Worksheets are made using easy-to-understand language (Item 5, M = 4,179, SD = 0.476) and supported by appropriate illustrations (Item 3, M = 4,143, SD = 0.651). In addition, the guidelines in the worksheet are very clear, making it easier for students to carry out exploration and discovery activities (Item 4, M = 4,071, SD = 0.466). It could be seen from the results of observations, that students did activities well. They followed the guidelines available on the worksheet to find mathematical concepts. This is confirmed by the opinions of students through interviews as follows.

"I can follow the instructions given on the worksheet."

Students believe that discovery-based learning activities help them to construct mathematical concepts (item 1, M = 4.214, SD = 0.630). In addition, the use of real situation contexts can facilitate them in understanding the concepts learned (item 2, M = 4.250, SD = 0.585). It means that the activities were able to facilitate students to construct their new knowledge. Student involvement in situations that were set in the classroom as a learning context, made them easier to understand the concepts learned. After constructing the concept, students were able to apply it to solve the related problems provided in the worksheet. It showed that students were able to understand the concepts obtained. This is also confirmed by the results of the interview as follows.

"Learning using this worksheet made me understand the concept, I hope the next learning will be like

this."

"This activity helps me understand the concept easily."

"The demonstration carried out in learning made help me to imagine the concept easily".

Based on the theory, observation and exploration activities carried out by students make them have meaningful experiences. This helps them to understand concepts and remember what they learned well (Svinicki, 1998; Westwood, 2008). The direct involvement of students in the context created in learning also provides great benefits. The experience of students in this context can provide a meaningful basis for the mathematical concepts learned (Van den Heuvel-Panhuizen, 1996). This is in line with previous research which revealed that discovery learning has a positive impact on learning outcomes (Ramdhani, et.al., 2017; Anggraini, et.al., 2018), as well as the use of real context (Surdin, 2018).

5.3. Students Perceptions of a Good Attitude in Constructing Knowledge

Freedom to explore in finding a concept through discovery learning activities makes students motivated in learning (Item 8, M = 4.250, SD = 0.518). Moreover, the designs and illustrations used in the worksheet are considered very interesting, making students excited about finding concepts (Item 9, M = 4.214, SD = 0.686). It shows that students enjoy learning activities. It is also confirmed by the response from the interview as follows.

"The activities carried out were very pleasant and made me excited in learning mathematics."

"This worksheet is designed to be very interesting and easy to understand because it is equipped with pictures."

This result is In line with Svinicki (1998), that says that discovery learning fosters enthusiasm and confidence that understanding concepts can be built independently. In addition, the use of context also has a positive impact on students' scientific attitude (Suryawati, et. Al., 2018)

6. CONCLUSION

Students have good perceptions of mathematics learning activity based on discovery using real situation context. They believed that the activity helped them to construct and understand the material effectively. Active involvement of students in finding concepts by being directly involved in the context created in learning makes them have meaningful learning experiences. Thus, students were able to understand the concept well. Learning activity designed in a small group discussion facilitated them to interact with others within the group and also motivated them to learn actively.

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