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RESEARCH ARTICLE

Scaffolding Based on Telolet Game in Teaching Integers

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ABSTRACT

Scaffolding is defined as help that can assist students to solve problems or understand concepts that were not able to complete independently. In modern times, the concept of technology-based Scaffolding in learning has developed. In this study an educational game called "Telolet" was designed with the aim of providing Scaffolding to students who experienced difficulties in integers. The problems in this study consist of closed problems, opened problems and some problems are related to integers. The purpose of this study is to provide students with a whole understanding in integers so that they can educate students with the right concepts. The results of this study, Scaffolding based on the game "Telolet" can help students who have difficulty in integer problems. Students excited to solve problems in this game because they felt challenged.

1. INTRODUCTION

The mentoring process is carried out by other people who are experts to help students so that students can solve problems, complete tasks, or achieve a goal where the level of student understanding cannot be achieved without assistance is the term Scaffolding (Wood et al, 1976). The concept of Scaffolding is in line with the opinion of Vygotsky (in McMahon, 2000) related to Zone of Proximal Development (ZPD), which states that every child, with help, can do more than he can do only if learning is carried out within the limits of development. Some of the meanings of scaffolding are explained by several researchers. Scaffolding in learning is an interactive process between teacher and student where both parties actively participate (Van de Pol et al., 2010). Brush & Saye (2002) states that scaffolding is a tool, strategy, and guidance that supports students to achieve higher understanding, which is impossible to achieve if students learn on their own.

Verenikina (2008) interpreted Scaffolding as a variation of direct learning. If the Scaffolding is given at the highest level, that is, when the assistance is given to the maximum, Scaffolding will be counterproductive. Bikmaz et al. (2010) interpret scaffolding as assistance or support that facilitates student development. Scaffolding is needed in mathematics learning because problem-solving activities are the main activities in school mathematics, where students often need help in completing them. Scaffolding ideas from Wood, Bruner, & Ross (1976) are extended through research that has been done a lot with regard to effectiveness, strategies, and tools used. Scaffolding is an effective learning method, good for all students in one class (Visnovska & Cobb, 2015; Abdu et al., 2015; Smit et al., 2012), discussion groups (Nguyen, 2013; Casem, 2013; Hunter, 2007), as well as those given by one teacher to one student (Akhtar, 2014; Murata & Fuson, 2006; McMahon, 2000). In modern times, the technology-based Scaffolding concept has been developed in learning. (Belland et al., 2016; Abdu et al., 2015; Zakaria & Salleh, 2015, 2013; Hu, 2006; Brush & Saye, 2002; Cuevas et al., 2002; Guzdial, 1994).

Technology-based scaffolding in learning is closely related to educational games. Nicenisasi (2012) states that educational games are games or games that are used as learning media to provide educational values. Kharisma (2015) and Sari (2013) stated that now learning media began to switch to digital multimedia. In this study, a computer-based "TELOLET" mathematical education game was developed, which uses Macromedia flash 8. This "Telolet" game was designed with the main purpose of giving Scaffolding to students who have difficulty in integer material. In an effort to attract students this game is associated with the latest phenomenon, Telolet (also known as #OmTeloletOm) is a phenomenon in which children and adolescents ask bus drivers to honk the modified bus into a rhythm (Wikipedia). The "Telolet" game will be designed as attractive as possible for students with the aim they can be interested in correcting the difficulties experienced about integers.

One of the materials taught in mathematics is integers. In everyday life, integers are needed and many applications, such as money, buying and selling, and others. Integers cannot be separated from human life. Almost all human activities are related to numbers, especially integers. Learning integers appropriately becomes a necessity to support daily activities. Thus the concept of integers is a very important concept to be mastered by students of Mathematics Education study programs as future educators. The following is an example of findings in the field related to student difficulties in integer concepts.

Based on the description above, a study will be carried out entitled Scaffolding Based on "Telolet" Game in Round Numbers Material.

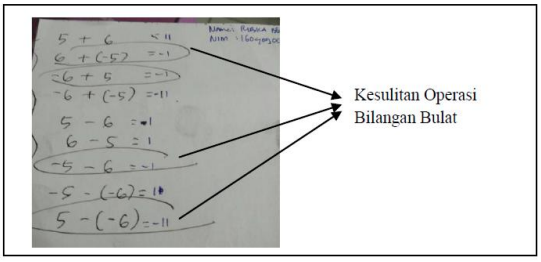

Fig. 1. Results of Student's Work

2. LITERATURE REVIEW

Numbers are an important part of mathematics. There are many uses of integers in all fields, for example in the fields of economics, physics, chemistry, medicine, and many other sciences. Integers appear to help humans to simplify their work for example in measuring the temperature of temperature below freezing with negative integers and temperatures above freezing using positive integers; in the marine field negative integers are used for measurements of ocean depth and positive integers are used for measurements of altitude from the ground. Lamb et al. (2012) state that integers mark the transition from arithmetic to algebra because of its abstractness and because students must perform algebraic procedures using the inverse of addition, which first appears in integer recognition games. The concept of integers is the main capital for students to understand concepts at the next level such as arithmetic and algebra (Badriyah, 2016). Nool (2012) revealed that students who mastered integer material had confidence in learning mathematics.

When students do not understand the concept of integers, students will experience difficulties in learning mathematics at the next level. As Moses revealed (in Lamb, 2012) that difficulties in algebra are related to a lack of understanding of integers. Gallardo (2003) revealed that subtraction operations involving negative integers make it difficult for students to solve mathematical problems.

Scaffolding

The scaffold is a building that is made temporarily and is used as a buffer for labor, materials, and tools in every building construction work including maintenance and demolition work (PER.01/MEN/1980). In learning, the scaffold is defined as help that can help students solve problems or understand concepts that at first cannot be solved independently. When students are considered to have been able to do their tasks independently then help is eliminated. This is also in line with the opinion of Bruner and Ross (Lipscomb et al., 2005) stating that Scaffolding was developed as a metaphor to describe the types of assistance given by a person teacher or peer in supporting learning. The concept of Scaffolding is in line with the opinion of Vygotsky (1978) relating to Zone of Proximal Development (ZPD), which states that every child, with help, can do more than he can do only if learning is done within the limits of development (McMahon, 2000).

According to Sudrajad (2013), Scaffolding can be interpreted as a technique of giving learning support in a structured manner, which is carried out at an early stage to encourage students to work independently. Scaffolding is not carried out continuously, but along with the increase in the ability of students, gradually the educator must reduce and protect students to learn independently. If students have not progressed in their understanding, the educator again provides assistance until they can truly achieve independence in their thinking. Scaffolding is not always carried out outside the classroom but can also be carried out in class when learning takes place.

3. METHODS

The stages in this study broadly include 3 stages, namely:

1. Phase I Activities carried out at this stage include: observing students who have difficulty in integer operations, determining the location of research, and mapping problems experienced by objects related to integer material.
2. Phase II Activities carried out at this stage include the preparation of integer problems and the design of "telolet" games that contain integer problems.
3. Stage III Activities carried out at this stage include Scaffolding based on "telolet" games and observations during the Scaffolding process as material for analysis and reporting of findings in the field.

The research was conducted at first-level students at Wisnuwardhana University Malang. Calculus I classes are held once a week. At the beginning of Calculus, I subject reviewing the various number of operations, one of which is an integer. From the learning process will be selected, which students have difficulties with the concept of integers, which will be given Scaffolding. Participants in this study were lecturers of Calculus I, and students in one class/offering. In one class this consists of heterogeneous male and female students in terms of mathematical abilities. Data was collected in the form of problem training consisting of student work, interviews with lecturers, and field notes. In this study, Scaffolding given to students is based on the Telolet educational game which has been designed in such a way as to help students solve a mathematical problem in calculus material specifically the concept of integer operations. Data sources are the results of classroom observations in the form of student work, field notes, and interviews with lecturers. For data validity, the triangulation method is used.

4. RESULTS AND DISCUSSION

3.1 Results of First Stage

At this stage, researchers conducted observations to find subjects to find out information about student difficulties related to integer material. In the initial observation, interviews were also conducted with the lecturers of Calculus courses to confirm the difficulties of students related to integers. Based on the results of the observations obtained the following data.

Table 1. Error Type

Error Type	Inaccuracy	Concept Error
Total	20	29

3.2 Results of Second Stage

At this stage, researchers compiled integer problems and designed "telolet" games that contained integer problems. This game consists of 3 levels, as follows:

1. Level 1 contains closed issues about integer operations.
2. Level 2 contains open problems about integer operations.

3. Level 3 contains open problems and contextual problems related to integers.

The following is the front page design of the "telolet" educational game.

Fig. 2. Design of Telolet Game

3.3 Results of Third Stage

At this stage, researchers conduct Scaffolding based on the "telolet" game and make observations during the Scaffolding process. The following is a picture of the Scaffolding process.

a. b.

Fig. 3. Scaffolding process based on Telolet Game

During the Scaffolding process, students seemed enthusiastic about working on the problems presented in the "TELOLET" game. This was also conveyed in the questionnaire, students felt helped by the "TELOLET" game. This is supported by Wassahua (2014) who stated that learning Dienes is presented with approaches as students play until they can finally help them to find and understand the structure of mathematics in the game. Scaffolding based on this game can simplify something abstract so that students can understand it. This is in line with Scaffolding level 2 in restructuring, (Anghileri, 2006).

5. CONCLUSION

Based on the results of the research provided, it can be seen that students who initially had difficulties with integers have been able to do integer operations. From the results of Scaffolding based on the Telolet educational game the implications of this study for learning were obtained, namely:

1. Scaffolding based on this game can simplify something abstract so that students can understand it.
2. By using the Telolet educational game, students seem eager to work on the problems presented in the "TELOLET" game.
3. Computer-based educational games need to be developed as a learning media for mathematics because digital technology is currently developing.

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