



DESIGN STUDY: INTEGER SUBTRACTION OPERATION TEACHING LEARNING USING MULTIMEDIA IN PRIMARY SCHOOL

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Abstract

This study aims to develop a learning trajectory to help students understand concept of subtraction of integers using multimedia in the fourth grade. This study is thematic integrative learning in Curriculum 2013 PMRI based. The method used is design research consists of three stages; preparing for the experiment, design experiment, retrospective analysis. The studied was conducted on 20 students of grade four SDN 1 Muara Batun, OKI. The activities of students in this study consisted of six learning trajectories. The first activity asks the students to classify heroism and non-heroism acts, summarize, and classify integers and non-integer. The second activity asks the students to answer the questions in the film given. The third activity asks students to count the remaining gravel in the film. The fourth activity asks students to count remaining spent money in the film. The fifth activity invites students to play rubber seeds in the bag. The last activity asks students to answer the questions in the student worksheet. The media used along the learning activities are a ruler, rubber seed, student worksheet, money, gravel, and film. The results indicate that the learning trajectory using multimedia help students understand the concept of integer subtraction integer.

Keywords: Subtraction Integer, PMRI, Multimedia

Abstrak

Penelitian ini bertujuan untuk menghasilkan lintasan belajar yang dapat membantu siswa memahami konsep pengurangan bilangan bulat menggunakan multimedia di kelas empat. Penelitian ini terkait dengan kurikulum tematik integratif pembelajaran 2013 berbasis PMRI. Metode yang digunakan adalah *design experiment*, *design experiment* terdiri dari tiga tahap; *preliminary design*, *design experiment*, dan *retrospective analysis*. Penelitian ini dilakukan pada 20 siswa kelas IV SDN 1 Muara Batun, OKI. Kegiatan siswa dalam penelitian ini terdiri dari enam aktivitas, dimana aktivitas pertama siswa mengklasifikasikan sikap kepahlawanan dan bukan sikap kepahlawanan, meringkas, dan mengklasifikasikan bilangan bulat dan bukan bilangan bulat, aktivitas kedua siswa menjawab persoalan di film, aktivitas ketiga siswa menghitung sisa kerikil di film, aktivitas keempat siswa menghitung sisa uang belanja di film, aktivitas kelima siswa bermain biji balam dalam tas, dan aktivitas keenam hanya menjawab persoalan di LAS saja. Media yang digunakan adalah mistar, biji karet, LAS, uang, kerikil dan video. Hasil penelitian ini menunjukkan bahwa lintasan yang dihasilkan menggunakan multimedia dapat membantu siswa memahami konsep operasi pengurangan bilangan bulat.

Kata Kunci: *Pengurangan Bilangan Bulat, PMRI, Multimedia*

How to Cite: Aris, R.M., Putri, R.I.I., & Susanti, E. (2017). Design Study: Integer Subtraction Operation Teaching Learning using Multimedia in Primary School. *Journal on Mathematics Education*, 8(1), 95-102.

The integers consist of positive numbers, negative and zero (Kilpatrick, Swafford, & Findell, 2001). One of the useful materials for students are integers and integers is also an important matter to be taught to students. By studying integers, students solve problems and apply it in everyday life (Musser, Burger, & Peterson, 2005; Nasrullah & Zulkardi, 2011). In addition, when students in advanced classes, to understand algebra, understanding of integers need to be controlled, it is consistent with the statement Sheffield & Cruikshank (2005) who said to understand the material algebra, understanding of integers must be mastered first.

Vlassis (2008) said that in studying integers, students have difficulty in making changes in the role of a minus sign, for example, on the material reduction of integers, students often ignore the changes signs as an example, $8 - (-4) = 4$. To resolve the errors in the operation required significant knowledge after the learning process, so that students are not wrong in doing operation.

To overcome learning less meaningful, necessary modifications to the learning process, the modification in question is a learning approach and learning materials (Putri, 2011; Haris & Putri, 2011; Prahmana, Zulkardi, & Hartono, 2012). In accordance with the statement, researchers used PMRI in this study. Wijaya (2012) said PMRI approach is an approach that emphasizes the significance of the concept.

In teaching mathematics concepts, PMRI emphasizing the use of context as the starting point in the learning of mathematics such as traditional games, folklore, legends, and formal mathematical shapes could be used as a context or realistic problems (Prahmana, 2010). Similarly, in the curriculum 2013, mandated learning to use a scientific approach, where one of the criteria of scientific learning that is based on facts or realistic problems (Depdikbud, 2013)

Wawan & Tegeh (2015) said multimedia learning is a component that can be used in supporting the learning process. Choi, Lee, & Jung (2008) said that multimedia is the use of multiple media in the presentation of learning through computers. Costantinescu (2007) said that multimedia refers to computer-based systems that use different types of content such as text, audio, video, graphics, animation, and interactivity.

Accordingly, in applying learning integer operations, some researchers suggested that using multimedia to help students understand the concept of integer operations (Lestari, Putri, & Hartono, 2015). Lestari, Putri, & Hartono (2015) use multimedia in research that aims to help students understand the concept of the sum of the integers, media it uses them is money, pieces of color, and dominoes in which each of the media used in each of the activities that have had designed, for example dominoes used at the time activities to six. The results showed that with the use of multimedia during a lesson, the student can understand the concept of integer addition operation (Lestari, Putri, & Hartono, 2015).

Arwadi, Darmawijoyo, & Putri (2012) collect students of the University of Sriwijaya also advice against using the multimedia while doing research on the sum of the integers. Media were used during the research period among which marbles are used in the activity of 1 to 3, research shows that using multimedia in learning when applying integer addition operation, can help students understand the concept of integer addition operation.

Based upon this, the researchers found that by using a multimedia during the learning integer operations can help students understand the concept of subtraction on integer, and therefore the researcher wants to conduct research using six media as the media is seed fowl, gravel, ruler, money, sheet student activity and video. Media will serve as game fowl seeds by researchers with the provisions made

researchers. Based on the background mentioned above, this study aims to produce a learning trajectory that can help students understand the concept of subtraction of integers using multimedia.

METHOD

The method used in this research is the method of design research. Design research has different characteristics than other methods. Design research has three stages: preparing for the experiment, the design of experiments, and the retrospective analysis (Gravemeijer & Cobb, 2006; Bakker, 2004). Three stages in the research design will be described below:

1. Phase I: *Preparing For The Experiment*

Gravemeijer & Cobb (2006) explained that the main objective at this stage is to formulate local instructional theory elaborated and refined during the course of the experiment. A series of activities that includes a conjecture of the student's thinking developed by researchers through a Hypothetical Learning Trajectory (HLT) done at this stage. Strategy thinking of students that occurred during experiment design can be customized with HLT as HLT is dynamic. Therefore, the first step that must be done at this stage is to review the literature on integer operations, approach PMRI, K-13 and methods of design research as a foundation in designing the learning trajectory. The things that will be done in this phase are: (1) analyze the learning objectives, (2) to determine and set the initial conditions of research, (3) designing and discuss conjecture or HLT to be developed, (4) determining the class character and role of the teacher. In addition, researchers conduct classroom observations, interviews with teachers to determine the circumstances and prior knowledge of students who become subjects of this study.

2. Phase II: *Design Experiment*

In this second phase is to implement the activities carried instructional design that has been designed in the first phase that aims to explore, know the strategy and thinking of students in learning how to find. At this stage there are two cycles were performed, namely pilot experiment as one cycle and the teaching experiment as cycle 2. Cycle 1 is aimed to improve the quality of the HLT has been designed in order to obtain better applied in cycle 2.

Cycle 1 in this study involving six students of the class were not the subject of research that has the ability of high, medium and low and researchers act as teachers. In cycle 2, there is one class of students the subject of research and act as a model teacher.

3. Phase III: *Retrospective Analysis*

All the data obtained during the teaching experiment at this stage is analyzed and the analysis results are used to plan activities and develop the next learning activity design.

RESULT AND DISCUSSION

These lessons are designed to understanding of student learning integer's reduction through learning the track which has been designed using multimedia in the fourth grade. This article is more

focused on teaching experiment conducted on 20 students. The activity of the student in this study consisted of six events, where each of these activities using different media. Activity 1 its media such as video and LAS, the activity of two media in the form of bar, money, seed fowl, LAS, videos, activity 3 medium such as gravel, LAS and videos, activities of four media in seed fowl, LAS and video, the activity of its 5 medium form seeds are used as game fowl seeds in the bag, LAS and video, and the last is 6 media activity just LAS alone.

At the time of the learning process, students are very enthusiastic to work on the problems at each LAS, before carrying out the activities of students first given about the pre-test and post carried out activities students are given about the post-test. From both of these tests, the students' answers on the posttest questions better than answers Pre-test. It can be concluded that students have understood the operation of subtraction of integers through the activities that have been designed using multimedia.

Activity 1 aims to help students understand the mathematical integer, the IPS aims to understand the heroism and not heroism, the Indonesian aims to understand how to summarize the content of a story or a movie. Before working LAS, firstly students are invited to watch the later students were asked to answer the question in the film and wrote the answer in LAS has been given, the time group discussions students were active in addressing the existing problems, and it appears in the Figure 1, when they classify integer and non-integer.



Figure 1. Group 2 (Focus Group) discussion group to summarize the contents of the film

The results obtained in this first activity, students can understand integer and non-integer, it is seen from the students' answers are able to classify an integer and non-integer, and here is the Picture 2 of the students' answers in classifying integer and non-integer.

Kaitan Bilangan Bulat Dengan Mata Pelajaran Matematika
3. Tuliskan 5 Contoh Bilangan Bulat dan Bukan Bilangan Bulat

Bilangan Bulat	Bukan Bilangan Bulat
$17, -18, -20,$ $4, 3$	$\frac{3}{4}, \frac{2}{5}, \frac{6}{7}, 0,9$ $\frac{1}{2}$

Figure 2. Answer group 2 (focus groups) about the activity no.3, when teaching experiment

In activity 2, 3, and 4, the purpose of activities designed researchers have achieved, it is seen from the students' ability to answer the issues that exist in the activity of 3, 4, 5, and 6. It can be concluded that the activities that have been designed using multimedia on the activity of 2, 3, 4 can help students in understanding negative numbers, order numbers from smallest to largest, as well as calculating the reduction of positive numbers with the positive.

Interest on these 5 activities that help students understand the concept of integer reduction surgery especially involving negative numbers, while playing fowl seed in the bag is visible cooperation among students so that the students were active and happy in learning process that has been designed (Figure 3).



Figure 3. Group focus group took the rubber seeds to be aligned

The purpose of the activities designed activity 5 has been reached, it is seen from the students' ability to answer the issues that exist in the activity of 5 while playing fowl seeds in a bag, the following is the picture the students' answers on the activity of 5 (Figure 4).

TAHAP I				
Angka yang keluar pada cangkir undian	Gambar biji balam sesuai dengan angka yang keluar pada kertas undian	Gambar perhitungan biji balam sesuai dengan ketentuan	Jumlah biji balam dalam tas putih	Jumlah biji balam dalam tas hitam
$16 - 20$ 16 = angka putih 20 = angka ke hitam				$16 - 20 = -4$

Figure 4. Answer one question no.1 group activity 5, when teaching experiment.

It can be concluded that the activity through the game fowl seeds in these bags can help students understand the concept of subtraction operation involving integers mainly negative. At 6 activity, the purpose of the activity 6 which is designed researchers have achieved, it is seen from the students' ability to answer the issues that exist in activity 6. Overall activity that has been designed starting from 1 to 6 activities can help students in understanding the operation of subtraction of integers.

CONCLUSION

Based on the results and discussion, it can be concluded that the resulting trajectory learning can help students understand the concept of subtraction on integer using multimedia. It can be seen from the various activities undertaken during the research period, activities of the student is the one activity that is not classify acts of heroism and heroic attitude, summarizing the contents of the film, classify integers rather than integers via video. Activity 2 is to answer the question in the film using a ruler, money, seed fowl, activity 3 is calculating the remaining gravel based videos watched, activity 4 is replacing the context of money with media seed fowl, activity 5 ie play seeds fowl, activity 6 only answer questions in LAS alone. All of these activities can help students in understanding the concept operation of subtraction of integers.

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