Development of constructivism-based mathematics interactive learning media tools on the material of constructing a flat side space for class VIII junior high school students

R M Rullis¹, A Fauzan²

¹ Student of the Masters in Mathematics Education Study Program
² Lecturers of Mathematics, State University of Padang

* rosirullis@gmail.com

Abstract. This study originated from students who had difficulty understanding the material of flat-sided shapes. Students often make mistakes in solving flat-sided shapes, including errors in calculations, and students having difficulty in visualizing images, especially in the material of flat-sided shapes. Also, many students still enter the formula incorrectly. One way to overcome this problem is to develop media-based interactive learning with a constructivist approach. This study aims to produce constructivism-based interactive mathematics learning media that is valid and practical on flat-sided building materials for class VIII junior high school students. This study describes the effectiveness of constructivist-based interactive learning media that is valid and practical flat-sided building materials for junior high school students VIII. The type of research used is development research using the Plomp model, which consists of three phases: the initial investigation phase, the development phase or prototyping, and the assessment phase. The preliminary research needs analysis, curriculum analysis, student analysis, and concept analysis were carried out. At the stage of developing or making a prototype, the researcher designs constructivism by paying attention to content, language, presentation, and graphics. Media-based interactive learning constructivism is validated by experts in mathematics, media, technology, and language education. Practicality is seen through the analysis of the implementation of learning observations, interviews, and student and teacher response questionnaires. Effectiveness is seen through the results of the analysis of student activities and learning outcomes.

1. Introduction

Through the educational process standards, each teacher can determine how the learning process takes place. In the learning process, the teacher has a vital role. Teachers are the spearhead who deals directly with the student and play a role in providing service, motivator, and facilitator to facilitate the student's learning process. In every lesson, the teacher hopes that students get learning outcomes that are by the learning objectives that have been planned. One of the efforts made is by varying the learning method and packaging it as attractive as possible to make mathematics a subject that is liked and not feared anymore. However, in reality, mathematics is a subject that is less attractive to most students.
This may be due to the abstract and boring nature of mathematics. According to Rohmah, one of the reasons for the student not mastering the material is an inappropriate learning method; the teacher only emphasizes the concept that refers to memorization, the use of formula without knowing the origin of the formula is like conventional learning, so as a result, students tend to override more fundamental concepts, prioritizing learning outcomes using memorizing formulas [1]. The difficulties experienced by these students cannot be separated from the limited learning media used by the teacher. Even so, the teacher has tried to find a solution, such as drawing and illustration of the existing problem. However, the student still finds it difficult to understand the existing problem, especially in a material that requires logic and imagination, such as building a flat side room.

The use of instructional media is constructive in delivering message and lesson content and provides more meaning to the learning process to motivate the student to improve the learning process. As a message, the media is used not only by the teacher but also by the student. The media can represent teachers in conveying information in a more thorough, clear, and attractive manner.

Based on observations made by researchers at SMPN 10 Padang and SMPN 31 Padang, there are still many students who are not involved in learning. Researchers also observed that the teacher had facilitated students to ask and answer the question, but many students were still silent. Based on the teacher's information and experience, the student often makes a mistake in solving the problem about the flat-sided shape, and it isn't easy to visualize the image. Also, many students still entered the formula incorrectly.

Computer-based media is an alternative media that can be used in learning. Many abstracts or imaginative things that are difficult for a student to think about can be presented through computerized simulation. Of course, this will be more useful to simplify the way students think in understanding mathematics. Also, teaching and learning activities will be more exciting and challenging for a student. Therefore, learning mathematics should be carried out by a teacher with empowering computers because, with a computer, students can do exercise and math experiments that are more interactive. Therefore, the development of constructivism-based interactive learning media to be developed is expected to motivate students during the learning process to stimulate student memory and help students understand concepts with an emphasis on material delivery techniques. In this research, the software used is Adobe Flash Professional CS6.

The formulation of the problem in this study is how the characteristic of constructivism-based interactive mathematics learning media on the material of flat-sided building for an eight-grade student of junior high school are valid and practical and what is the potential impact of constructivism-based interactive mathematics learning media on flat-sided building material for grade VIII student. Junior High. Based on the formulation of the problem that has been stated, the objective to be achieved in this study is to produce constructivism-based interactive mathematics learning media that is valid and practical on flat-sided building material for class VIII junior high school students and reveal the effectiveness of constructivism-based interactive mathematics learning media on building materials. Flat side room for class VIII SMP student.

2. Method

This type of research is development research using the Plomp model that consists of several phases or stages, namely preliminary research phase (initial investigation), development or prototyping stage (developing or making a prototype), and assessment stage (assessment) phase. In this research, the resulting product is a learning tool in the lesson plan and constructivism-based interactive learning media on the flat-sided building material for grade VIII junior high school students.
3. Result and Discussion

Based on a series of research steps that have been carried out regarding the Development of Constructivism-based Mathematics Interactive Learning Media Tools on Material of Constructing a Flat Side Space, it can be described as follow:

3.1. Research Preliminary Result (Preliminary Research)

In this stage, needs analysis, curriculum analysis, student analysis, and concept analysis have been carried out. The process and result of this stage analysis will be described as follow:

3.1.1. Needs Analysis Result

The needs analysis stage is carried out to collect information about the problem; information collecting is done by interview and questionnaire. Observations were made at schools of SMPN 31 Padang and SMPN 10 Padang. Researchers obtained information by directly observing the implementation of learning in class VIII by conducting the interview. According to several schools that the researcher observed, among them have implemented the 2013 curriculum. From the result of the researcher's observation, there are several things to note, namely: first, the implementation of mathematics learning is still not optimal in implementing the 2013 curriculum, so students tend to learn with ordinary learning. Second, the student does not use teaching material such as LKPD (Student Worksheets) during learning but use the 2013 curriculum package book.

The result of an interview with several mathematics teachers stated that student also experienced difficulty in visualizing an image, and the practice question provided has not led student yet to think critically because student still had difficulty solving problem especially in terms of formula, sometimes student liked misplaced the formula so it's fatal in solving the problem. This can be seen from the average daily test score of student who are still below the KKM. The device developed is intended to help student visualizing and help student to construct their knowledge and understanding independently of the material.

In addition to conducting interview and observation, researcher also distributed questionnaires to 32 students regarding the characteristic of the media. Based on the result of the questionnaire, it was concluded that the desired media was to have an attractive appearance, move and color, was easy to understand, had attractive image and animated image that were appropriated and helped to understand the material and constructing student’s ability.

3.1.2. Curriculum Analysis Result

This analysis is in the form of determining indicator on the material of Flat Side Building Space developed by RPP and Interactive Learning Media. The description of KI, KD and indicator of competency achievement are considered to determine the concept needed in mathematics learning and measure the achievement of IQ and KD. For the material of the flat side room, it consists of the surface area and the volume of the flat side room shape. Furthermore, the researcher formulated the indicator developed from the KD on the KI-3 and KI-4.

3.1.3. Concept Analysis Result

Main concept of the flat-sided shape are (1) determining the surface area of the cube and block; (2) determining the surface area of the prism; (3) determining the surface area of the pyramid; (4) determining the volume of the cube and block; (5) determining the volume of the prism; and (6) determining the volume of the pyramid.

3.1.4. Student Analysis Result

Student analysis was conducted to determine junior high school students' characteristics as users related to the designed interactive media. For this study, the researcher took a sample in a class VIII SMPN 31 Padang. The author developed interactive media in Indonesia with attractive animation and
use genius character based on the analysis. The author uses blue and brown as the dominant colors and adds pop music elements to some parts of the background and character. Based on the result of the analysis, it is known that the majority of students are accustomed to using the computer. However, the author still makes the instruction for using learning media as straightforward as possible to more easily use the learning media that the author has developed.

3.2. Development Phase

Result (Prototyping Phase)

At this stage, device design is carried out based on needs analysis, curriculum analysis, concept analysis, and student analysis, so learning tools are designed in the form of a constructivism-based lesson plan and interactive media. The learning media that have been made have gone through the validity test phase. The following is a description of each aspect:

3.2.1. The validity of Constructivism-Based Mathematical Plan

Methodologically, the validity of the tools compiled must fulfill valid criteria in terms of content and construct. The constructivism-based mathematics lesson plan was declared valid by the validator through several practical aspects, namely, aspect of lesson plan component, aspect of learning activity, and language aspect. For the RPP component aspect, the overall validity value obtained was 3.31 with an outstanding category. As for learning activity, the overall validity value is 3.27, with a correct category. The language aspect obtained an overall validity value of 3.31 with the correct category. The overall aspect of the lesson plan learning tools obtained a validity value of 3.29 with a very valid category.

3.2.2. Learning Media Validity

Invalidating, the learning media researcher asked three validators for help. Besides providing an assessment, the validator also provides a suggestion for the media being developed. Learning media in the material and content aspects were declared valid by the validator. This is obtained from an average value of 3.29 with the correct category. Validity can be seen from the material presented on interactive media by the competency achievement indicator compiled based on KI and KD in the 2013 curriculum.

In terms of language, interactive learning media were also declared valid by the validator. The average evaluation result of the validation was 3.78, with the very good category. The value given by this validator illustrated that the learning media that has been made up using the right type and size of the letter, the language used is very communicative and easy to understand.

The visual aspect of the appearance of interactive learning media made also declared valid by the validator. This can be seen from the average validity assessment with a score of 3.57, which is categorized as very valid. This illustrates that learning media has been made are of good quality, both in terms of clarity and clarity of sound, quality of image and movement, background appearance, and so on.

The use of constructivism-based interactive learning media can make it easier for students to understand the subject matter. The media is also equipped with instruction for using and clearing the navigation button so that students can use it more easily and help students understand the material, answer exercise, evaluate, and construct their knowledge of the material to be studied.

The next research stage is practicality and effectiveness. To determine the level of practicality of this learning media, data was collected through questionnaires and observation sheets of learning implementation. Questionnaires are given to teachers and students that have been validated by experts. To find out the level of effectiveness of interactive mathematics learning media, it can be assessed from two aspects, namely aspect of student activity during learning activity and aspects of student final test result after the subject matter using the media is completed.

At this stage, the researcher cannot implement it in school due to the Covid-19 pandemic condition. The research result obtained by the researcher still only the stage of product validity by e
4. Conclusions
This research is development research that aims to produce constructivism-based interactive learning media on flat-sided building material in class VIII SMP with the Plomp development model consisting of three phases, namely the initial investigation phase, the development phase, and the assessment phase. This research was conducted by a new researcher at the product validation stage that had been validated by an expert.

References
[1] Arikunto, Suharsimi. 2012. Prosedur Penilaian: Suatu Pendekatan Praktek. Jakarta: Rineka Cipta
[2] Mulyasa. 2007. Kurikulum Tingkat Satuan Pendidikan Sebuah Panduan Praktis. Bandung: PT Remaja Rosdakarya.
[3] Plomp, T dan N. Nieveen. 2013. Education Design Research. Enschede: Netherlands Institute For Curriculum Development (SLO).
[4] Ratumanan. 2002. Model Pembelajaran Menciptakan Proses Belajar Mengajar yang Kreatif dan Efektif. Jakarta: Bumi Aksara
[5] Rohmah, I. 2014. Meningkatkan pemahaman konsep volume dan luas permukaan bangun ruang sisi datar menggunakan kotak musium. Makalah dippresentasikan pada Seminar Problematika Pembelajaran Matematika, Institut Agama Islam Negeri, Tulung Agung.
[6] Suherman, dkk. 2003. Strategi Pembelajaran Matematika Kontemporer. Bandung: JICA Universitas Pendidikan Indonesia.
[7] Suparno, Paul. 2001. Filsafat Konstruktivisme dalam Pendidikan. Yogyakarta : Kanisius