

Problem-Based Interactive Modules for Leveraging Higher Order Thinking Skills in Elementary Students

Donna Avianty^{1*}, Dyah Ayu Sulistyning Cipta², Welas Listiani³

1 Associate Professor, Mathematic Education Department of IKIP Budi Utomo Malang
Corresponding Author
Email : dav99.red@gmail.com

2 Associate Professor, Mathematic Education Department of IKIP Budi Utomo Malang
Other Author
Email: dyahayu.esce@gmail.com

3 Associate Professor, Mathematic Education Department of IKIP Budi Utomo Malang
Other Author
Email: welas.listiani1981@gmail.com

Abstract

This study aimed to produce an Interactive Problem-Based Module that can utilize the high-level thinking skills of elementary school students. The resulting Problem-Based Interactive Module has been adapted to the 2013 Curriculum which promotes character education and encourages students to be directly involved in the learning process. The development model in this study follows a development model adapted from the ADDIE instructional design model which includes the analysis, design, development, implementation and evaluation stages. The results showed that the Problem-Based Interactive Module that researchers designed to utilize the ability to think at a higher level was valid with a value of 3.1.

Keyword: Interactive Modules, Problem-Based, Higher Order Thinking Skills

Introduction

The application of the 2013 Curriculum (K-13) in the learning process at every level of education is expected to be able to encourage students to be able to improve their intellectual thinking abilities towards high order thinking skills (HOT Order). K-13 by giving impulses is expected that students can think critically in analyzing and evaluating so as to create solutions to existing problems.

Based on research conducted in the previous year, the application of K-13 is very varied. There are a number of schools that strive for student-centered learning and strive to improve application in accordance with K-13 objectives, but not a few schools continue to apply teacher-focused learning. In fact, according to Kusnadi, et al (2014), the successful implementation of K-13 depends on the creativity of the teacher which is an important factor that has a big influence, even very determining the success or failure of students in learning.

The statement is very much at odds with the condition of several schools where teachers dominate more in the learning process with the delivery of directional lecture material so that learning activities in the classroom are still focused on the teacher as the main source of information or knowledge. In this learning activity, students take notes or work on the questions on the worksheet. Students will rely on their ability to work by memorizing what the teacher has said. Besides tend to be less interesting, learning such as memorizing, understanding, and applying what is memorized is a low-level thinking ability. This is a barrier to the realization of increased students' thinking abilities with high quality.

The teacher should optimize his role as a motivator that is able to encourage students to be able to learn well so that their thinking skills can be improved. The teacher as a facilitator can provide learning methods and media that are able to accommodate students to be able to learn by honing reasoning, analytical

and evaluation skills. With this, it will be able to shape the creativity of students to have the right creativity to answer existing problems.

Mathematics is also a tool to hone students' thinking power in learning. But on the other hand abstract mathematical objects and the large amount of mathematical formulas to memorize make mathematics considered difficult and less desirable by students, especially for elementary school students who generally are still at the stage of concrete thinking with a focus on real objects or on various events he has ever experienced. Mathematics learning that presents in the form of problems should be able to answer these challenges. Elementary students are invited to solve real problems in everyday life related to Mathematics.

In previous studies, researchers have produced a product in the form of Problem Based Interactive Multimedia. However, the presence of multimedia is not perfect without being equipped with a guide module for teachers. So in this study, to complete the shortage, the researcher again conducted research for the development of the Problem-Based Interactive Module.

In accordance with the researchers' goal to utilize students' higher-order thinking skills, learning using interactive problem-based modules in this study refers to problem-based learning. Sunaryo (2014) revealed that the problem based learning model was able to improve students' critical and creative thinking skills better than the direct learning model. Thus, the researchers argue, problem based learning is a very effective approach in the higher order thinking process. This learning helps students to process information already made in their minds and compile their own knowledge about the social world and its surroundings. Problem based learning is also suitable for developing both basic and complex knowledge.

Suprijono (2010: 73) states that problem-based learning consists of five phases and behavior. Phase 1: giving orientation to the problem to students, phase 2: organizing students to research, phase 3: helping independent and group investigations, phase 4: developing and presenting artifacts and exhibits and finally phase 5: analyzing and evaluating the problem solving process.

In this study learning begins by presenting real problems whose solutions require collaboration between students. The teacher guides the students in breaking down the problem-solving plan into stages of the activity, the teacher gives an example of using the skills and strategies needed so that the tasks can be completed. The teacher creates a flexible classroom atmosphere and is oriented towards inquiry efforts by students.

Furthermore, this problem-based interactive module is expected to be able to complete and perfect the problem-based interactive multimedia that researchers made in the previous year.

Method

This research is a research and development. The development model in this study follows a development model adapted from the ADDIE instructional design model which includes the analysis, design, development, implementation and evaluation stages. The stages of the ADDIE model are presented in the diagram below.

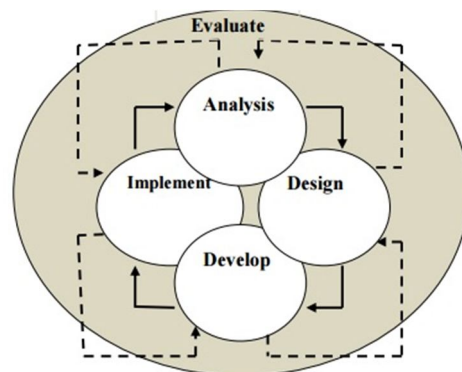


Figure 3.1. ADDIE Development Design Model Chart
(Piskurich in Abdul Gafur, 2012: 39)

The trial of the development of the Problem-Based Interactive Module to utilize the high-level thinking skills of these students will be held at SDN Ketawanggede I with parallel classes and SD Shining Star Malang. The research subjects are teachers and Grade 4 students who will receive fractional material on Mathematics learning using steps in accordance with the 2013 Curriculum. Data collection techniques in this study are presented in the following table.

Table 3.1 Data Collection Techniques

No.	Data Type	Prosedure	Instrument
1	Identification of the use of higher order thinking skills in elementary school students	Test	Problem solving tests
2	Validation of Problem Based Interactive Modules by Expert Validators and Practitioner Validators	Validation Sheet	Validation Sheet
3	Student activities in learning by using the development of Problem Based Interactive Modules	Observation	Anecdotal Notes, Documentation
4	Identification of changes in the utilization of higher order thinking skills after the use of Problem Based Interactive Module products in Elementary School Students	Test	Problem solving tests

The type of data obtained in this study are qualitative and quantitative data. So the data analysis technique used is descriptive statistical analysis techniques. Descriptive statistics are about describing (describing) or summarizing data either numerically (eg calculating averages) or graphically (in the form of tables or graphs) to get a glimpse of the data so that it is easier to read. In the product development phase, validation is done by Expert Validator and Practitioner Validator, so that qualitative data obtained in the form of input, criticism, suggestions and responses contained in the Validation sheet, and quantitative data are also obtained through this sheet in the form of scores using a Likert scale. The rules for scoring scores on each statement are carried out under the following conditions.

Table 3.2 Validation Sheet Assessment Techniques

Criteria	Score
Very Good / Very Agree	5
Good / Agree	4
Fair / doubtful	3
Less / disagree	2
Very less / strongly disagree	1

Meanwhile, to know the ranking of the final value of each item. Can be formulated through calculations as follows:

$$\bar{x} = \frac{\sum xi}{n}$$

Keterangan:

\bar{x} = average

$\sum xi$ = Total number of respondents' answers

n = Amount of data

The results obtained based on these formulas are then used to determine the level of product validity as a basis for making decisions to revise whether or not the product is, according to the qualification assessment criteria in the following table

Table 3.3 Assessment Qualification Criteria

Value Range	Validation Criteria	Information
$3,26 \leq \bar{x} < 4,00$	Very Valid	No revision needed
$2,56 \leq \bar{x} < 3,25$	Valid	No revision needed
$1,76 \leq \bar{x} < 2,56$	Invalid	Revision
$1 \leq \bar{x} < 1,75$	Very invalid	Revision

Results and Discussion

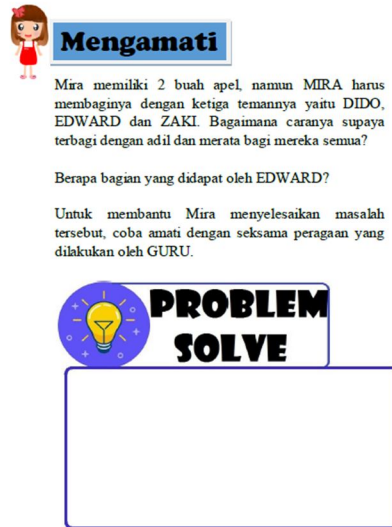
The Problem Based Interactive Module produced by researchers is designed by using figures which are also used in problem based interactive multimedia in previous studies. Following are some of the figures used in the problem-based interactive module.



Figure 1: Introducing Figure in a Problem-Based Interactive Module

Learning activities in the problem-based interactive module include four stages, namely observing, asking, digging information, reasoning, and communicating. Abdullah et al (2016) state that high-order thinking skills are the ability to apply knowledge or methods to solve problems creatively, innovatively and consequently able to create a new dimension based on knowledge that has been learned. Soeharto (2018) also found that there was a relationship between Higher Order Thinking Skills of students and academic achievements in physics subjects where physics problem solving skills were part of Higher Order Thinking Skills.

In observing activities contain information about a problem. For example, in chapter 1 contains the sentence: Mira has two apples, but Mira must share it with her three friends namely Dido, Edward and Zaki. How can they be shared fairly and evenly for all of them? How many parts does Edward get? To help Mira solve the problem, try to carefully observe the demonstration conducted by the teacher. Following is an example of the display at the observing stage.



Mengamati

Mira memiliki 2 buah apel, namun MIRA harus membaginya dengan ketiga temannya yaitu DIDO, EDWARD dan ZAKI. Bagaimana caranya supaya terbagi dengan adil dan merata bagi mereka semua?

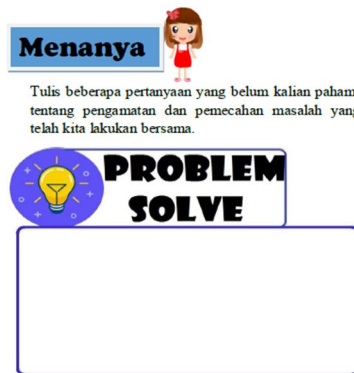
Berapa bagian yang didapat oleh EDWARD?

Untuk membantu Mira menyelesaikan masalah tersebut, coba amati dengan seksama peragaan yang dilakukan oleh GURU.

PROBLEM SOLVE

Figure 2: Display in the "Observing" Stage

Furthermore, from the results of observations and problem solving that have been carried out in the previous stages, at this stage students are invited to ask questions that they have not yet understood. The questioning stage contains activities for writing questions that students may have. The following is an example of a screenshot in the questioning stage.



Menanya

Tulis beberapa pertanyaan yang belum kalian pahami tentang pengamatan dan pemecahan masalah yang telah kita lakukan bersama.

PROBLEM SOLVE

Figure 3: Appearance at the "Asking" Stage

Students with the teacher will discuss problem solving from questions made by students. Then it will be continued by paying attention to the explanation of the material in problem-based interactive multimedia. This stage is called the stage of information gathering.



Menggali Informasi

Temannya akan menggali informasi dari tayangan Video yang akan kita lihat. Mari kita perhatikan dengan seksama ya, apa yang DIDO, EDWARD dan ZAKI lakukan.


Figure 4: Display in the "Digging Information" Stage

The next step is reasoning. For example like this. "So that we can better understand what we learn together, try to solve the following problems. Mira bought Pizza to eat with her friend. Mira cuts the Pizza into 8 equal portions. Zaki ate a slice, while Edward finished 2 slices of Pizza and Mira ate a slice and gave a


slice to his mother too. And the remaining slices of pizza become part of Dido. Who gets the bigger part? Why?

That way, students will try to reason the fraction abilities that they get from interactive multimedia that they have listened to. He must also look for problem solving from the given problem.

Menalar



Supaya kita lebih bisa memahami apa yang kita pelajari bersama ini, coba selesaikan permasalahan berikut.



Mira membeli Pizza untuk dimakan bersama dengan temannya. Mira memotong Pizza tersebut menjadi 8 bagian sama besar. Zaki makan sepotong, sedangkan Edward menghabiskan 2 potong Pizza dan Mira memakan sepotong serta memberikan sepotong pula kepada ibunya. Dan potongan Pizza yang tersisa menjadi bagian Dido. Siapa yang mendapat bagian yang lebih besar? Mengapa?

PROBLEM SOLVE





Figure 4: Display in the "Digging Information" Stage

The next step is reasoning. For example like this. "So that we can better understand what we learn together, try to solve the following problems. Mira bought Pizza to eat with her friend. Mira cuts the Pizza into 8 equal portions. Zaki ate a slice, while Edward finished 2 slices of Pizza and Mira ate a slice and gave a slice to his mother too. And the remaining slices of pizza become part of Dido. Who gets the bigger part? Why?

That way, students will try to reason the fraction abilities that they get from interactive multimedia that they have listened to. He must also look for problem solving from the given problem.

Mengkomunikasikan



Setelah kita mengikuti rangkaian belajar ini, apa kesimpulan yang kalian dapat? Tuliskan. Bagaimana kalian memahami tentang bilangan pecahan berikut ini? Bagaimana kalian membilang pecahan tersebut dan ilustrasikan dengan menggunakan kertas warna yang tersedia. Kemudian demonstrasikan.

$$\frac{4}{6} \text{ dan } \frac{3}{10}$$

PROBLEM SOLVE




Figure 6: Display in the "Communicate" Stage

Through the validation sheet that has been made by the researcher, using the formulas that have been described in the method chapter, it is found that the problem-based interactive module created by the researcher is declared valid with a final value of 3.1. This module has been through the validation process twice. The first validation obtained a value of 2.4 so the researcher revised it. Weaknesses in the previous module, high-level thinking content is less visible so it is not optimal. In line with Hugerat's (2014) statement, "Transition from a teaching method based on" material transfer "and imparting knowledge to one that nurtures high order thinking skills and, in particular, develops inquiry skills, involves changes in the perception of the essence of the teaching-learning process, the teaching strategies required, and of the way the teacher functions in the classroom. "

Problem-based interactive modules created by researchers are also stated to be able to maximize learning even better because it perfects previous research that produces problem-based interactive multimedia. Problem-based interactive multimedia is appropriate for use in K-13 because in addition to instilling character education, it can also utilize the ability to think of high-level elementary school students (Avianty and Cipta, 2018).

Conclusion

Problem-based interactive modules created by researchers are declared valid able to utilize the ability of high-level thinking of elementary school students. This research can be developed more broadly in other subjects as well as in further research, for example to assess responses, thought processes, and so on.

Reference

- Abdullah, dkk. 2017. Mathematics Teachers' Level of Knowledge and Practice on the Implementation of Higher-Order Thinking Skills (HOTS). *EURASIA Journal of Mathematics Science and Technology Education*. 13(1): 3-17
- Avianty, Donna, Dyah Ayu Sulistyning Cipta. 2018. Pengembangan Multimedia Interaktif Berbasis Masalah untuk Mendayagunakan Kemampuan Berpikir Tingkat Tinggi pada Siswa Sekolah Dasar. *Aksioma*. 7 (2): 237 – 242
- Hugerat, Muhamad, Naji Kortam. 2014. Improving Higher Order Thinking Skills among freshmen by Teaching Science through Inquiry. *EURASIA Journal of Mathematics Science and Technology Education*. 10(5): 447-454
- Kusnadi, dkk. 2014. Implementasi Kurikulum 2013 dalam Pembelajaran Matematika di SMA Negeri 1 Makassar. *Jurnal Matematika dan Pembelajaran*, 2 (1): 123-135
- Soeharto, Rosmayadi. 2018. The Analysis of students' higher order thinking skills (HOTS) in Wave and Optics Using IRT with winstep Software. *Journal of Educational Science and Technology*. 4 (3): 145-150
- Sunaryo, Yoni. 2014. Model Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Berpikir Kritis dan Kreatif Matematik Siswa SMA di Kota Tasikmalaya. *Jurnal Pendidikan dan Keguruan*, 1 (2): 41-51
- Suprijono. 2010. *Cooperative Learning Teori dan Aplikasi PAIKEM*. Yogyakarta: Pustaka Pelajar.