# Flip Science Module Using an Integrated PBL Model for Market Snacks to Improve Problem Solving Skills

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**Abstract:** Science education at junior high school level has a strategic role in forming students' problem-solving abilities. This research aims to see the effect of the Flip science module using a PBL model integrated with market snacks to improve middle school students' problem solving abilities. The experimental method carried out in this research used a one group pretest-posttest design. This research was conducted at SMPN 6 Yogyakarta in the even semester of 2023. This research was conducted in one class, namely class VIII D. The sampling technique used cluster random sampling. random sampling. The class is determined by the school with the assumption that the class is assumed to have the same abilities based on even gender. The data analysis technique for measuring problem solving abilities uses a normalized gain score. The research results show that the Science flip module flip module using a PBL model integrated with market snacks can improve students' problem solving abilities based on the results of a gain score of 0.7 in the high category. The results of this research can be used by teachers to improve the problem solving abilities of junior high school students in science subjects

**Keywords:** Flip module; PBL; Problem solving skills

## Introduction

Science and technology have experienced very rapid development in the 21st century. In line with developments that occur, the demands faced are increasingly greater. One way to deal with these changes is to improve the quality of education (Jayadi et al., 2020). One of the skills needed to face the demands of the 21st century is by improving the skills possessed by students. One of the 21st century skills that students must master is problem solving skills (Neubert et al., 2015). The problem solving skills explained can train students' abilities in dealing with the problems they face. This will enable students to compete globally with adequate quality (Geisinger, 2016).

Problem solving skills are one of the main quality parameters of a person living in a highly technical, scientific and complex modern society (Mukhopadhyay, 2013). Solving skills in science learning are very important for students to master so that they are able to provide solutions and solve problems that exist in society optimally in accordance with scientific theory (Fiore et al., 2018; Mukhopadhyay, 2013; Seyhan, 2015). Apart from that, problem solving skills are also believed to be able to make students able to think and act complexly in studying science (Voskoglou, 2011).

Science education (Science) at the Junior High School (SMP) level has a strategic role in forming students' problem solving skills. Problem solving is not just an academic skill, it is also an essential ability needed to face the challenges of the modern world (Muhali, 2019). However, the challenges faced in learning science often involve a less in-depth understanding of concepts and a lack of practical application in everyday life. Research conducted by Ardiyaningrum (2016) shows that the problem solving abilities of junior high school students in Yogyakarta are still relatively low. This was also conveyed by Arismawati et al. (2018) which shows that the problem solving skills of students in junior high school, especially grade 7, are still low.

Researchers also conducted interviews and observations at schools. Based on the results of interviews and observations at SMP Negeri 6 Yogyakarta, students' problem solving skills are still lacking. This is explained by the teacher because students who have difficulty working on questions that are problem solving analysis, find it difficult to find solutions to problem solving and are supported by daily test scores, Mid Semester Assessments (MSA) and Final Semester Assessments (FSA) below the Minimum Completeness Criteria (MCC). Therefore, there is a need to improve students' problem solving, one of the methods used is the use of the problem based learning model.

The Problem Based Learning (PBL) model has been recognized as an effective approach in improving students' conceptual understanding and problem solving skills. Research conducted by Asih et al. (2022) shows that using the problem based learning model can improve students' problem solving skills with the help of electronic modules. This is supported by research by Widyastuti et al. (2021) and Yustianingsih et al. (2017). Along with technological developments and the need to create more interactive learning, electronic modules and Flip modules have emerged as interesting alternative teaching materials (Rahmayanti & Andayani, 2023). The combination of the PBL model and learning using flip modules has the potential to increase the effectiveness of science learning at the junior high school level. The use of flip modules in science learning can include various media, from text, images, to interactive simulations that allow students to understand scientific concepts more deeply. The advantage is that this module can be accessed flexibly, allowing students to study anywhere and at any time according to their individual learning rhythm.

Research related to the Flip module has been carried out by several researchers including Nia et al. (2022), Ndoa et al. (2022), Purwoto et al. (2022), and Sholichin et al. (2022), Flip module developed previous researchers were declared worthy by the validator so that it can be used in learning, especially to improve problem solving skills. Apart from this research, Lestari et al. (2022) also conducted research using a flip module with the theme of global warming which has been declared feasible and can be used in learning to increase student learning independence. From several previous studies regarding flip modules, it appears that there is no science flip module that integrates market snacks into science learning to improve problem solving skills, this is the latest in research. Integrating elements of everyday life, such as market snacks, into science learning can provide real context for students, making learning more relevant and interesting. Market snacks as learning objects can increase students' motivation, stimulate their interest in science, and connect theory with daily practice.

Therefore, this research aims to see the effect of the Flip Science Module using an integrated PBL model of market snacks in improving students' problem solving abilities in junior high schools. By studying it in depth, it is hoped that this research can provide practical guidance for educators in designing electronic modules that are interesting, educational, and in accordance with the science curriculum at the junior high school level.

## Method

This research was conducted at SMPN 6 Yogyakarta in the even semester of 2023. This research was conducted in one class, namely class VIII D. The sampling technique used cluster random sampling. These classes are determined by the school with the assumption that they have the same abilities based on gender that is evenly distributed. The experimental method carried out in this research used a one group pretest-posttest design (Marsden et al., 2012) by giving an initial test and then giving a final test. The research flow is shown in Figure 1.

The data collection technique is carried out in the form of a test to measure students' problem-solving skills. The test questions used are multiple choice with 10 numbers. These questions are structured to measure problem-solving skills based on Bransford et al. (1993), Cheng et al. (2013), and Tan (2021) namely understanding and identifying problems, determining alternative solutions to solving problems, applying appropriate solutions, and evaluating the results obtained from solving problems.
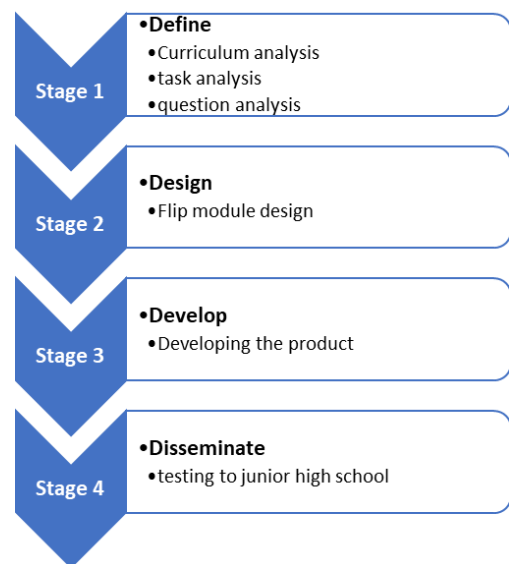


**Stage 1**
- **Define**
  - Curriculum analysis
  - task analysis
  - question analysis

**Stage 2**
- **Design**
  - Flip module design

**Stage 3**
- **Develop**
  - Developing the product

**Stage 4**
- **Disseminate**
  - testing to junior high school

**Figure 1.** 4D development procedure

The data analysis technique for measuring problem solving skills uses a normalized gain score. The calculation of score gain refers to the steps carried out by Hake (1999) as follows: Calculate the score gain for each student and the score gain from the overall average score of problem solving skills using the formula:

$$< g > = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}} \quad (1)$$

After getting the data, then categorized with the following table 1.

**Table 1.** Criteria for Improving Problem Solving Skills

| Limitation | Category |
| --- | --- |
| g ≥ 0.7 | High |
| 0.3 ≤ 0.7 | Medium |
| g < 0.3 | Low |

Apart from that, the author also calculated the increase per each indicator of problem solving skills by calculating the average score for each category. The science module flip design was created with the help of the Canva application as shown in Figure 2. The Flip Module consists of a title page, foreword, table of contents, instructions for using the flip module, learning outcomes, learning objectives, flow of learning objectives, concept map, learning activities, and bibliography.



**Figure 2**. Science module flip design

## Result and Discussion

The research was carried out in one class using a flip science module using an integrated PBL model for market snacks. The activity carried out at the beginning of the research was giving a pretest to students. The next activity was to provide lessons on additives and digestive organs using the science flip module that had been developed with each student's cellphone and

carried out in groups. After the series of learning activities have been completed, students carry out a posttest to determine the improvement in problem solving skills. Research on addictive substances and digestive organs has also been carried out by previous researchers, including Astuti et al. (2023), Oktaviani et al. (2023), Widodo et al. (2023). Based on previous research, it shows good results in using the problem based learning model to improve problem solving skills.

In this research, to measure problem solving skills, it is seen from several indicators that have been prepared. The problem solving skills questions given consist of 10 multiple choice questions which include understanding and identifying problems, determining alternative problem solving solutions, applying appropriate solutions, and evaluating the results obtained from problem solving. Solving skills questions with 10 multiple choice questions have also been carried out by previous researchers by Elmas et al. (2018), Maryani et al. (2021), Rintayati et al. (2020) the results also show good data. The pretest and posttest results were then analyzed for each aspect. The results of problem solving skills for each aspect can be seen in Figure 3.
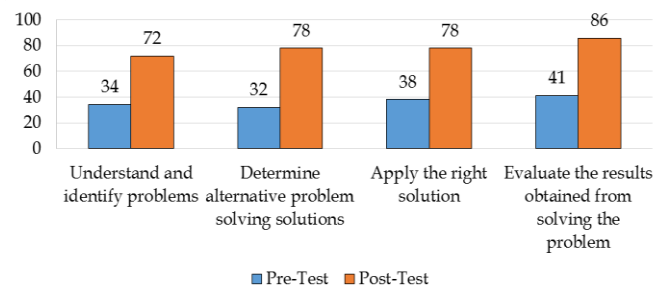


**Figure 3.** Problem solving skills test assessment results for each aspect

Based on figure 3, it shows that there is an increase in students' problem-solving skills for each indicator. The results of the problem-solving skills test, namely in the aspect of understanding and identifying problems, the pretest score was 34 and the posttest was 72, in the aspect of determining alternative problem-solving solutions, the pretest score was 32 and the posttest score was 78, in the aspect of applying the right solution, the pretest score was 38. and the posttest score was 78, and the aspect of evaluating the results obtained from problem solving obtained a pretest score of 41 and a posttest score of 86. The test results showed an increase in every aspect of problem-solving skills. The results of this research are in line with researchers by Anggraeni et al. (2022), Indriana et al. (2023), Nazifah et al. (2022), Nurmasyitah et al. (2022), and Sugianto et al. (2023) which shows that research using flip modules and electronic modules based on problem based learning

models can improve students' problem solving skills effectively.

The results of the problem-solving skill value data were also analyzed using the normalized n gain score. The overall pretest score was 62 and the posttest score was 88, so the n gain score was 0.70, which is in the high category based on table 1 of the criteria for improving problem solving skills. Therefore, it can be concluded that there is an increase in students' problem solving skills before and after using the flip science module. The results of this research are in line with research conducted by Miswami et al. (2020) which states that science learning carried out using web-based science modules is effective in improving students' problem solving skills at SMP Negeri 1 Wungu. Apart from that, research conducted by Islahiyah et al. (2021) which shows that e-modules are effective in improving problem solving abilities with a percentage of 80% of students achieving classical completeness. Flip science modules are effective in improving problem solving skills because they are equipped with the syntax/steps of the Problem Based Learning (PBL) learning model which trains students in the problem solving process from orientation to the problem, organizing students to learn, designing investigations to choose problem solving strategies, presenting data and presentations as well as evaluation and reflection (Arend, 2012; Hidaayatullaah et al., 2020).

The flip science module facilitates and helps students to be actively involved in learning, involved in group discussions, designing and finding the best solutions to solve problems, presenting in front of the class and evaluating and reflecting on the solutions that have been created so that students' problem solving skills improve (Jolly & Jacob, 2012). Learning activities using the flip science module make learning activities active and interesting so that the research results show that there is a high increase in problem solving skills by using the flip science module. Students who use the PBL model flip module for market snacks material are more active and interested in learning activities, thus showing an increase in problem solving abilities before and after using the flip module.

## Conclusion

The product developed in this research is the Flip Module based on problem based learning (PBL) which has been successfully developed by researchers. The research results showed that the posttest scores achieved by students were higher than the pretest scores because students were given a PBL model e-module which contained problems that existed around the students and were related to market snacks. Based on the research

results, it can be concluded that the flip module using an integrated PBL model for market snacks can improve students' problem solving abilities based on the results of obtaining a score of 0.7 in the high category. The average student pretest score is 30, while the average student posttest score is more than 70. The results of this research can be used by teachers to improve the problem solving abilities of junior high school students in science subjects. It is also hoped that the results of this research can make a positive contribution in updating science learning methods in the digital era, strengthening students' conceptual understanding, and preparing students to face the challenges of science and technology in the future.

**Author Contributions**
Conceptualization, R.S, I.W.; methodology, I.W, R.M.F.; software, S.S., R.M.F.; validation, R.S, I.W.; investigation, R.S, S.S.; writing—original draft preparation, R.S, S.S.; writing—review and editing, R.S, S.S.

**Conflicts of Interest**
The authors declare that there is no conflict of interest regarding the publication of this paper.

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