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Development of a Problem Based Learning and Mind Mapping Oriented Learning Module

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Abstract This study aims to develop a problem based learning (PBL) and mind mapping oriented learning module and to examine the feasibility of the PBL and mind mapping oriented science learning module for Grade VIII science material at MTsN 2 Sungai Penuh. This study uses the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. The subjects of this study were Grade VIII students of MTsN 2 Sungai Penuh. Data collection techniques included questionnaires, documentation, and tests. The results of the study showed that the science teaching materials were feasible for use based on the assessment of material experts, with a percentage score of ≥ 80%, and media experts, who also obtained a percentage score of ≥ 80%. Mind mapping based science teaching materials were effectively used, as indicated by the validation results of the PBL and mind mapping oriented module for science material in the third stage of science learning, with student practicality results of 95.56%, teacher practicality results of 89.6%, and student response results of 90.15%. In addition, this module is considered very feasible in the Content Component and the Presentation Component. The conclusion of this study is that the teaching materials are very feasible for use in science learning and are effective in improving student learning outcomes. Suggestions for further development include using the PBL and mind mapping oriented science teaching materials as companion teaching materials in schools.

Keywords: Mind mapping; PBL; Problem based learning; Science; Teaching module

INTRODUCTION

Science and technology have developed rapidly in recent times, advances in science and technology cannot be separated from changes in the field of education (Rahmatika et al., 2024; Strielkowski et al., 2025). Various efforts have been made to improve the quality of education in order to support the development of science and technology. The rapid development of science and technology demands that teachers carry out innovations in learning activities (Karolčík & Marková, 2025; Wu, 2024). One effort that can be made is developing learning modules that can help teachers deliver material to students effectively and efficiently so that learning objectives can be achieved. Learning modules are teaching materials or one of the components in the learning environment that can stimulate students to learn (Novita et al., 2024; Sundari et al., 2024). Learning modules can be used as stimuli to increase students' motivation so that they participate well in the teaching and learning process. The use of learning modules in teaching Islamic religious education is not merely an effort to help teachers, but also to assist students in learning (Semayang, 2014). In the current era, this has become a promising factor in the success of the learning process. Teachers must be able to act as facilitators for students, especially in utilizing various learning resources so that teaching and learning activities become more effective, efficient, and not monotonous (Pahrudin & Jatmiko, 2024; Indrawati, 2024).

Based on observations conducted with Grade VIII science teachers on November 17, 2023, most students experienced difficulties in understanding science learning materials. Their retention was low because during the learning process students relied only on explanations from the teacher and note-taking in their notebooks. The methods used were still conventional, such as lectures and discussions. Inappropriate learning methods can result in learning objectives not being achieved. The modules used were limited to printed textbooks, and there was no variety of media. This condition was evident from students' responses, which showed a lack of interest in learning. Therefore, the use of modules is highly recommended in developing learning materials, especially for science learning, to meet the needs of Grade VIII students at MTsN 2 Sungai Penuh. One learning medium that is expected to help students better understand the material is mind mapping. The selection of the mind mapping learning model is based on its potential to be developed into a learning module that serves as an intermediary between teachers and students in the teaching and learning process. With mind mapping, students do not need to write down everything explained by the teacher because mind mapping contains notes that are more concise, clear, and focused on the core material (Shi et al., 2023; Pribadi & Susilana, 2021).

The selection of the problem based learning (PBL) model is based on its ability to develop students' critical and creative thinking skills, improve their independent problem-solving abilities, increase learning motivation, encourage active learning, and connect learning with real-life contexts. This development research focuses on creating a mind mapping learning module oriented toward problem based learning (PBL) using

the ADDIE development model and the research and development (R&D) method. The ADDIE model is a systematic instructional design model arranged programmatically with sequential and systematic activities to solve learning problems related to learning resources that match the needs and characteristics of students. This study was designed using the research and development method, which is used to produce specific products. The selection of this development model is based on the suitability of the development flow used by the researcher in developing the mind mapping learning module.

Another problem identified is the lack of variation in learning resources used. Therefore, it is necessary to implement learning that is appropriate to student characteristics, with the assumption that teachers are not the only source of learning, but students learn through various learning resources. The solution that can be provided to address this issue is developing learning modules that are needed and suitable for students' needs. Learning modules can be used as intermediaries between teachers and students to improve understanding so that learning becomes more effective and efficient (Azizi & Prasetyo, 2018). Learning modules include tools that are physically used to convey teaching material content in the form of books (Naharir et al., 2019).

In selecting learning modules, teachers should choose modules that are flexible, meaning that modules can be easily accessed anytime and anywhere by students through social media, which has become part of daily life for them (Barua & Lockee, 2024; Culajara et al., 2022). Through social media, students can also share ideas, information, plans, and carry out learning processes. To maximize the effectiveness of the learning process, problem based learning (PBL) and mind mapping oriented learning modules should be used. Mind mapping is also suitable for addressing problems in the learning process faced by teachers. Mind mapping is a powerful organizational thinking tool and an easy way to place information into the brain and retrieve it. Mind mapping automatically links new information with information that is already stored in the brain.

The research problems in this study are as follows: (i) How is the construction of the PBL and mind mapping oriented learning module for Grade VIII science material at MTsN 2 Sungai Penuh?, (ii) How feasible is the PBL and mind mapping oriented learning module for Grade VIII science material at MTsN 2 Sungai Penuh?, and (iii) How practical is the PBL and mind mapping oriented learning module for Grade VIII science material at MTsN 2 Sungai Penuh?

LITERATURE REVIEW

Learning Module

A learning module is an important part of the implementation of education in schools, through learning modules, teachers can more easily deliver material, and students are more assisted and find it easier to learn (Nisa et al., 2022; Primayana, 2022; Fahmi et

al., 2021). The procedure for developing learning modules involves preparing modules with the following objectives:

a) Providing learning modules that are in accordance with curriculum demands by considering students' needs, namely learning modules that match the characteristics and social settings or environments of students.

b) Assisting students in obtaining alternative teaching materials in addition to textbooks, which are sometimes difficult to obtain.

c) Facilitating teachers in implementing the learning process.

The principles in selecting learning materials include: (a) the principle of relevance, (b) consistency, and (c) adequacy.

Mind mapping (concept mapping) was introduced by Tony Buzan around the 1970s. According to him, mind mapping is an extraordinary system for storing, retrieving, and accessing data for a giant library that actually exists in the astonishing human brain (Buzan, 2024). The form of mind mapping is like a branching tree that connects one piece of information to another (Tatipang et al., 2021). Mind mapping helps in writing, solving problems, and making life easier.

Mind Mapping

Mind mapping is a method that makes it easier to place information into the brain and retrieve information from the brain (Buzan, 2024). Mind mapping is a relatively creative and innovative note-taking method that can "map" information contained in the human mind. Mind mapping is also a powerful alternative for remembering. Remembering becomes easier than using conventional note-taking methods. The use of Mind mapping can be combined with images and preferred colors to stimulate students to be more creative and make the material easier to understand because they create it themselves according to their imagination.

According to Buzan (2024), mind mapping helps us in many ways, such as planning, communicating, becoming more creative, saving time, solving problems, focusing attention, organizing and explaining thoughts, remembering better, learning faster and more efficiently, seeing the "big picture," and saving trees.

The benefits of mind mapping include activating the entire brain, clearing the mind from mental clutter, enabling focus on the main topic, helping to show relationships between separate pieces of information, providing a clear overview and details, and enabling the grouping and comparison of concepts.

Problem Based Learning

The learning model using problem based learning (PBL), or problem-oriented learning, is a student-centered learning model. The PBL learning process presents real problems as learning resources so that students can solve problems and find solutions (Maulina et al., 2024; Apriyanti & Rahayu, 2024). Problem-oriented learning is student-centered

learning based on the principles of constructivism (Chen, 2024). The principle of constructivism is that students can build their knowledge through the problems provided.

The implementation of the PBL model enables students to improve understanding by searching for and exploring information, identifying and recognizing problems, finding solutions, and drawing conclusions based on their analysis. PBL is a learning model in which learning resources originate from problems. The types of problems used are adjusted to the learning material and are usually problems from everyday life. Real-life problems are introduced and studied so that students understand the problems and are able to determine how to solve them.

METHOD

Research Approach

This study is a type of development research using the ADDIE model. The ADDIE model is a systematically structured development model that is easy to understand. According to Branch & Varank (2009), the ADDIE development model consists of five steps: Analysis, design, develop, implement, and evaluate, in which each step is systematically arranged and interconnected. These steps can be seen systematically in the figure below.

There are many development models that can be used; one of them is the ADDIE development model developed by Branch & Varank (2009) to design instructional systems. The ADDIE model uses five development stages, namely:

Analysis

Analysis is the process of identifying problems at the research site. In this study, the analysis stage involves collecting data related to problems that occur in learning, which are then identified to find solutions through needs analysis in accordance with the identified problems. Analysis includes identifying needs, identifying problems, identifying products that are suitable for the target, and conceptualizing the product to be developed.

Design

The design stage is the stage of planning the concept of the product to be developed. Design includes creating the layout of the learning media and the navigation flow. In this study, the design stage involves developing learning media. The media design is adjusted to the characteristics and needs of the identified problems.

Development

Development is the process of turning the design into a tangible product. At this stage, the media are revised by media experts and material experts to obtain improvements

and then validated for feasibility for use in learning. Validation is conducted by media experts and material experts using questionnaires provided by the researcher. At the development stage, the researcher uses questionnaires as assessment instruments.

Implementation

Implementation is the product trial stage as a concrete step to apply the developed product. At this stage, test questions are used as evaluation instruments. The questions consist of multiple-choice items about the structure and function of living organisms.

Evaluation

Evaluation is the process of determining whether the developed product is successful and meets the initial expectations.

This research was conducted with Grade VIII students at MTsN 2 Sungai Penuh in November 2023. This study is a type of development research using the ADDIE model. The ADDIE model is a systematically structured development model that is easy to understand. According to Branch & Varank (2009), the ADDIE development model consists of five steps: analysis, design, develop, implement, and evaluate, where each step is systematically arranged and interconnected.

Data Collection Methods

The data collection methods used in this study were questionnaires, documentation, and tests. After the data were collected, data analysis was conducted. Data analysis in this study used descriptive percentage analysis. The analysis included the feasibility of the mind mapping and problem based learning (PBL) oriented learning module for science material, expert validation, validation of the module display, and student responses to the mind mapping and problem based learning (PBL) oriented science learning module.

Based on the results of observations with Grade VIII science teachers on November 17, 2023, most students experienced difficulties in understanding science learning material. Their memory retention was low because during the learning process students relied only on teacher explanations and note-taking in notebooks. The data used in this study were primary data, obtained directly through the administration of research instruments (validity and practicality questionnaires) to the research subjects.

FINDINGS AND DISCUSSION

Curriculum Analysis

The development of the problem based learning (PBL) and mind mapping oriented learning module for chapter i and chapter ii for grade VIII at MTsN 2 Sungai Penuh uses the merdeka curriculum. The merdeka learning competencies consist of three aspects: commitment, independence, and reflection (Jahidi et al., 2024). These three

aspects are equally important because they are interconnected and develop simultaneously according to the stages of students' growth and maturity.

Material Analysis

Referring to the merdeka curriculum, in addition to functioning as a source of natural science knowledge, science also serves as a medium for thinking. Science acts as a platform for expressing knowledge about nature. The scope of the main science material in this study focuses only on chapter I and chapter II for grade VIII.

Table 1. Scope of main science material for chapter I and chapter II (grade VIII).

No	Aspect	Description
1	Chapter I: Introduction to Cells	Includes microscopic cells, animal cells and plant cells, and cell specialization
2	Chapter II: Structure and Function of Living Organisms	Includes nutrition and the digestive system, circulatory system, respiratory system, and excretory system

Based on Table 1 it can be seen that chapter I, introduction to cells, includes microscopic cells, animal and plant cells, and cell specialization, while chapter II includes nutrition and the digestive system, circulatory system, respiratory system, and excretory system.

Student Needs Analysis

Table 2. Results of student needs analysis questionnaire.

No	Student Needs	Results (%)
1	Science textbooks/learning materials	100%
2	Science books/learning resources	90%
3	Problem Based Learning modules	92%
4	Mind Mapping based learning materials	90%
	Average percentage	93%
	Category	Very Feasible

Based on the results of the student needs questionnaire in Table 2 it can be concluded that, in general, respondents stated that many students need science textbooks or learning materials, science books or learning resources, problem based learning modules, and mind mapping based learning materials.

Practicality Questionnaire Results

The PBL and mind mapping oriented learning module that has been assessed by experts and declared very feasible as a teaching material was subsequently evaluated for readability. Data collection for the readability of the PBL and mind mapping oriented learning module was conducted with eight Grade VIII students of MTsN 2 Sungai Penuh. The method used was a practicality questionnaire. The results of the module assessment in the readability test are presented in the Table 3.

Table 3. Student practicality results.

No	Indicator	Percentage	Category
1	Student interest	100%	Very Practical
2	Usage process	100%	Very Practical
3	Available time	94.4%	Very Practical
4	Improvement of student creativity	91.7%	Very Practical
5	Evaluation	91.7%	Very Practical
Average percentage		**95.56%**	
Category		**Very Practical**	

Based on the Table 3 it can be seen that students gave positive responses to the PBL and mind mapping oriented module, with readability levels reaching a score of ≥80%. The results of the teacher practicality questionnaire also indicated that the module is very feasible as a teaching material. Data collection for the readability of the PBL and mind mapping oriented learning module was conducted with eight Grade VIII students at MTsN 2 Sungai Penuh using a practicality questionnaire.

The results of the module assessment through teacher responses were needed to determine module feasibility using a response questionnaire. The teachers selected as respondents were two science teachers at MTsN 2 Sungai Penuh. The results of the module assessment through teacher response questionnaires are shown in the table below.

Table 4. Teacher practicality questionnaire results.

No	Indicator	Percentage	Category
1	Ease of use	98.8%	Very Practical
2	Time effectiveness	80%	Practical
3	Benefits	90%	Very Practical
Average percentage		**89.6%**	
Category		**Very Practical**	

Based on the table above, the results of teacher responses to the PBL and mind mapping oriented module obtained a score of 89.6%, categorized as very practical for use as a teaching material.

The PBL and mind mapping oriented science module that met the assessment standards in the display validation stage was then reevaluated using assessment instruments in the material presentation validation stage. Material presentation validation includes three feasibility components: content feasibility, language feasibility, and presentation feasibility. The assessment instrument for content feasibility consists of 10 assessment items.

Based on the results of the material presentation validation, the PBL and mind mapping oriented science module met the feasibility standards, which require a feasibility percentage of ≥ 80%. The content feasibility score obtained was 87.5%, indicating that the module is very feasible for use as a teaching material. The scores for each assessment item ranged from 3 to 4 and were categorized as good.

The content feasibility assessment achieved the "very feasible" criterion because the material aligns with the competency standards and basic competencies. Chapter I and chapter II materials align with the formulation of learning objectives and indicators, learning activities support the competencies, science information adds to students' understanding of the material, images in the module effectively convey messages to students, and the PBL and mind mapping note taking techniques foster student creativity in summarizing material. Additionally, puzzle-based questions encourage students to complete tasks (Kalkan et al., 2022; Khadem et al., 2022). Thus, the module content is proportionally appropriate.

The language feasibility assessment score of the module was 95%, which is categorized as very feasible for use as a teaching material. This is because the language used is standard Indonesian, communicative and interactive, and appropriate for students' maturity levels.

CONCLUSION

Based on the results of the research and development, the PBL and mind mapping oriented learning module for chapter I and chapter II is feasible for use as a teaching material. This conclusion is based on several feasibility indicators obtained from the stages of research and module development, including expert validation of the science module, teacher response assessments, student response assessments, and student learning outcomes, all of which achieved satisfactory results by reaching scores above the 80% feasibility standard.

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