Development of video mind mapping-based teaching materials on relations and functions to increase junior high school students' learning motivation

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Abstract: This study aims to produce teaching materials based on video mind mapping on relations and functions to increase student learning motivation. The research is a type of Research and Development (R&D) using the ADDIE development model but is only limited to the Development stage. The research instruments used in this study were validation sheets, test questions, and interviews. The subjects of this study were three students of class VIII at MTsN 1 Majalengka with high, medium, and low ability levels. The results indicate that the developed video mind mapping-based teaching materials have met valid criteria, making them suitable as alternative teaching materials to increase student learning motivation. The implementation of video mind mapping-based teaching materials shows promise in enhancing students' motivation to learn relations and functions, suggesting potential broader application in educational settings.

Keywords: Mind mapping video, Motivation, Teaching materials


INTRODUCTION

Mathematics is a subject taught from elementary school to university (Hasanah, 2020). It is one of the basic sciences that plays an important role in fostering logical, critical, systematic, and communicative thinking (Rahayu et al., 2017). Mathematics contains a collection of concepts in the form of operations, numbers, symbols, and definite patterns (Nurhikmayati, 2019). Since 1973, when the government replaced the teaching of arithmetic in primary schools with mathematics, it has been a compulsory subject for students in primary, junior high, and senior high schools. However, there is no denying that many people still have difficulty learning mathematics (Sari et al., 2021). Mathematics is considered a difficult subject for most students; frustration and anxiety when learning math can reduce learning motivation, and learning that is not interesting or not aligned with students' learning styles can also be an obstacle.

Motivation is defined as a driver that transforms energy in a person into real activity to achieve certain goals (Jainiyah et al., 2023). In the learning process, motivation is very necessary because someone who does not have learning motivation will not be able to carry out learning activities (Hikmah & Saputra, 2023). According to research by Roffina (2020), the continuity and success of the teaching and learning process are not only influenced by intellectual factors but also by other non-intellectual factors, such as the ability of a student to
motivate themselves. Khansa et al. (2018) also state that understanding of mathematical concepts and student motivation to learn mathematics is still low.

One of the materials in junior high school mathematics learning is about Relations and Functions. This material is relatively difficult, requiring a thorough understanding of each subchapter (Herawati, 2014). Students often experience confusion in distinguishing between relations and functions. Additionally, they have difficulty presenting functions in the correct form, preventing them from solving problems appropriately (Handayani et al., 2020).

Observations at MTs Negeri 1 Majalengka show that students still have difficulties when given questions about relations and functions. This is evidenced by the low test results from three students with high, medium, and low ability levels. Only students with high ability levels were able to answer the questions quite well. Interviews with students revealed that this was due to low student learning motivation.

Interviews with students and mathematics teachers identified several factors influencing low student motivation, including unattractive teaching materials. Several research studies provide insights into factors influencing student motivation in mathematics education, corroborating the claim that teaching materials play a crucial role. One study revealed that students with higher motivation perceive teaching practices and resources positively, suggesting that engaging materials significantly impact student motivation and performance (Hossein-Mohand & Hossein-Mohand, 2023). Another study indicated that innovative and creative approaches to teaching materials, which are more interactive and visually stimulating, positively affect students’ attitudes toward learning mathematics (Ampadu & Anokye-Poku, 2022). Additionally, research on the impact of various factors, including teaching materials, highlighted that learning motivation is a significant predictor of learning achievement, emphasizing the need for materials that enhance engagement and understanding (Kusuma & Retnawati, 2022). Another study pointed out that factors such as teacher attributes and instructional strategies, which include the quality of teaching materials, significantly predict students’ interest in mathematics (Abid, 2023).

The importance of teaching materials as a guide in the learning process contradicts the current situation. Research by Musyriyah et al. (2022) illustrates that most teachers are less motivated to develop learning media, including teaching materials. Interviews with several teachers in the research by Damayanti et al. (2022) revealed that many teachers have never developed teaching materials, especially those aligned with their fields. This is in line with the fact that current teaching materials in schools seem less interesting and not innovative (Nurhikmayati & Jatisunda, 2019). Therefore, learning using technology is the right choice in this era. For this reason, the researcher developed teaching materials based on video mind mapping to increase student learning motivation in relation and function material.

Mind mapping is an effective educational tool that enhances both left and right brain functions, facilitating quick problem comprehension through layout, colors, images, and curved branches. Research supports its benefits across various subjects and educational levels. Study found that mind mapping significantly enhances science learning among 8th-grade students, resulting in higher academic achievement and knowledge retention (Munir et al., 2023). Study on metacognitive abilities showed that mind mapping improves students’ problem-solving skills, organization, and understanding of new relationships (Ding, 2023). Research on primary school English teaching demonstrated that mind mapping enhances students' listening, speaking, reading, and writing abilities, making learning more engaging and effective (Chen, 2023).

The challenges of future education are increasingly leading to technology-based learning. Teachers are required not only to be adept at conveying mathematical concepts but also to present material in a way that is more interesting and motivates learning. This research aims to develop mind mapping-based teaching materials to improve students’ understanding and motivation in learning relations and functions.
METHOD

This research is a Research and Development (R&D) study aimed at developing teaching materials based on video mind mapping on relation and function material. The research uses the ADDIE development model, which is a general research model suitable for development research (Anafi et al., 2021). The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The Analysis Stage involves analyzing the need for the development of new products (models, methods, media, teaching materials) and examining the feasibility and requirements of product development. The Design Stage is a systematic process that starts from designing the concept and content of the product. The Development Stage involves realizing the previously designed product. The Implementation Stage is the application of the product in the ADDIE development research model to obtain feedback on the created/developed product. The Evaluation Stage provides feedback to product users, so revisions can be made according to the evaluation results or unmet needs by the product. However, in this study, the stages are limited only to the Development stage due to time constraints. The stages of ADDIE are presented in Figure 1.

This research was conducted at MTs Negeri 1 Majalengka on November 09, 2023. The test subjects in this study were limited to 3 students with high, medium, and low ability levels. The research subjects were selected through interviews with the class teacher, a survey of student learning outcomes for one semester, and classroom observation to understand the current learning process conducted by the teacher. The data collection technique used involved giving test questions about relation and function material that the students were required to complete.

RESULTS AND DISCUSSION

Result

This research produces a valid teaching material based on video mind mapping on relations and functions. This teaching material is designed for VII grade junior high school students to increase learning motivation. The process of developing this teaching material uses the ADDIE development model, which is limited only to the Development stage. The results of this study are described in the development stages as follows.

Analysis Stage

In the ADDIE development model, the first stage is analysis. At this stage, an analysis is carried out to assess the need for new product development and to evaluate the feasibility and requirements for product development. Based on the analysis results at MTsN 1 Majalengka, conducted through observation, it was shown that the development of video-based teaching
materials is needed. This need is indicated by the low test results of three students with high, medium, and low ability levels. Figure 2 refers to student test results of high ability levels.

The test results show that only students with high ability levels can answer the questions quite well, indicating that many students do not fully understand the material. After conducting interviews with students, it was found that their low ability is primarily due to a lack of motivation to learn. This lack of motivation stems from the teaching materials, which consist only of textbook packets that students find uninteresting.

Interviews with teachers revealed that the teaching materials used are exclusively textbooks, with no supplementary materials, leading to student boredom and disinterest, especially in math. Therefore, it is necessary to develop more engaging teaching materials to enhance student motivation. In this context, the researcher will develop a teaching material based on video mind mapping for the topic of relations and functions.

**Design Stage**

Design activities in the ADDIE development research model follow a systematic process that begins with designing the concept and content of the product. This stage is the initial phase of creating teaching materials based on video mind mapping, involving the identification of material sources, selecting applications to be used, and outlining the production process.

The source of the material used is the LKS book on relations and functions. The material is organized using the mind mapping concept with the Mindmap application. The design stages for creating teaching materials based on video mind mapping include summarizing the material to be presented in the video, preparing the material with the mind mapping concept using the Mindmap application, creating video slides from the mind-mapped material, systematically arranging the video slides, and adding music as an audio background. Figure 3 shows the results of the design of mind-mapping video-based teaching materials that have been developed.

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**Figure 2. Student test results of high ability levels**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the difference between a relation and a function?</td>
<td>Function - a domain that has only one member in the codomain</td>
</tr>
<tr>
<td>2. Given A= {1, 2, 3, 4} and B= {0, 2, 4, 6}, create an arrow diagram that represents the relation “comes after” between the two sets.</td>
<td>Relation - half of</td>
</tr>
<tr>
<td>3. Observe the following arrow diagram. Is the diagram a function? Determine the domain, codomain, and range.</td>
<td>Yes, domain = {1, 2, 3, 4}. Codomain = {a, b, c, d}. Range = {a, b, c, d}</td>
</tr>
<tr>
<td>4. Given the function formula (f(x) = 2x+5). If (f(a) = 11), the value of (a) is...</td>
<td>(2x = 6)  (x = 3)</td>
</tr>
</tbody>
</table>
The initial display contains an opening and stimulation for students to listen to the contents of the video. It starts with a greeting and continues with a command to listen until the end of the video. This approach aims to create a relaxed and stress-free learning environment, allowing students to learn calmly and pleasantly.

The next slide contains materials presented systematically, starting from definitions and examples to exercises and more. This material is delivered using the concept of colorful mind mapping to make it more visually appealing to students. The material presented can be seen in the Figure 4.
After the mind-mapping video-based teaching material is completed, the validation process will be carried out by an expert to determine the level of validity of the developed mind-mapping video-based teaching material.

**Development Stage**

The next phase is the development stage, which includes the validation process. The purpose of this stage is to produce the final form of the teaching materials developed during the design stage. This mind-mapping video-based teaching material has been validated by an expert with the following results (see Table 1).

Table 1. Expert Validation Results

<table>
<thead>
<tr>
<th>Validator</th>
<th>Score</th>
<th>Intervals</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>41</td>
<td>32 &lt; x &lt; 47</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on the validity analysis by the expert, it is evident that the validator gave a validity assessment in the "valid" category for the developed mind-mapping video-based teaching materials. Therefore, it can be concluded that this mind-mapping video-based teaching material is considered valid. These validation criteria confirm that the teaching materials developed have good quality and reliability for use in teaching mathematics in the classroom, especially for 8th-grade junior high school students.

A detailed validity assessment for each component was also conducted to gain more insights into the validity of the developed mind-mapping video-based teaching materials. The results of the component-wise validity analysis can be seen in Table 2.

Table 2. Validation Results of Each Component

<table>
<thead>
<tr>
<th>Validation Aspects</th>
<th>Score</th>
<th>Intervals</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Contents</td>
<td>21</td>
<td>16 &lt; x &lt; 23</td>
<td>Valid</td>
</tr>
<tr>
<td>Video Display</td>
<td>20</td>
<td>16 &lt; x &lt; 23</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Based on the results of the validation, the mind-mapping video-based teaching materials that have been developed are categorized as valid, with scores of 21 and 20 for each aspect. Therefore, it can be concluded that the developed teaching materials are valid. The following are some suggestions given by the validators for improving the mind-mapping video-based teaching materials: the video should be presented at a slower pace to ensure students can understand it better, and it should include more challenging problems.

**Discussion**

The development of mind mapping-based teaching materials for relations and functions has met the valid criteria based on the validity test. These validity criteria indicate that these teaching materials are both valid and reliable and can be used for teaching mathematics in the classroom. In the development process, we have analyzed various aspects, including the needs of students and teachers and the low understanding of students regarding relations and functions. Learning media for students and teachers, especially at MTS Negeri 1 Majalengka, still rarely use technology, even though technology is very important for improving the quality of classroom learning and motivating students to become more interested in learning (Hidayat et al., 2020). Based on the test results and observations, it is evident that many students still struggle to solve problems related to relations and functions correctly. Therefore, the development of mind mapping-based teaching materials is a suitable alternative to address low student understanding and motivation.

The development of mind mapping-based teaching materials for mathematics has proven to be valid and effective, addressing student needs and enhancing their understanding of concepts such as relations and functions. Studies have shown that such teaching materials, validated through rigorous testing, are reliable and suitable for classroom use. Study focused
on mind mapping-based student worksheets for exponential and logarithmic topics, highlighting their validity and suitability for enhancing mathematical reasoning (Fitrianingrum & Sari, 2022). Furthermore, mind mapping materials have been developed for algebra using a scientific approach, resulting in materials ready for classroom implementation (Nada, 2023). These developments underscore the importance of integrating technology and innovative teaching strategies to improve student engagement and understanding in mathematics.

Based on several research results, mind mapping is believed to improve students' understanding and motivation to learn (Agustin et al., 2018; Kusuma, 2019; Nurvita, 2021). The use of the mind mapping method encourages students to skim read thoroughly and then identify important points by writing down keywords from the text. Students become accustomed to complementing these keywords with pictures or symbols to facilitate understanding of real objects or circumstances (Imaduddin & Utomo, 2012). Mind mapping can also focus attention because it allows students to capture the main idea conveyed without needing to note every word explained by the teacher or others (Bobbi, 2013). By focusing on key points that are easy to remember, students can better understand the concepts. Concentration is crucial because if student concentration is low, it leads to low-quality activities and a lack of seriousness in learning. This lack of seriousness affects material comprehension (Aviana & Hidayah, 2015). Mind-mapping video-based teaching materials can be used as an alternative teaching material. With these materials, students can watch the video while the teacher explains, making learning more enjoyable and less monotonous. This approach makes learning more interesting and increases student motivation.

The development of mind mapping-based teaching materials has significant implications for teacher and student motivation in classroom learning, particularly in mathematics. Research highlights that such materials can make learning more engaging and enjoyable, thus enhancing both teaching and learning experiences. For instance, a study demonstrated that mind mapping in mathematics for junior high school students helps optimize brain potential and capacity, making learning more meaningful and enjoyable (Dayani et al., 2021). Another study discussed the use of mind maps in creating interactive web-based learning resources, which increases student motivation and engagement by integrating these resources into the learning process (Tosheva, 2022). Moreover, research on junior high school classrooms found that mind mapping helps clarify knowledge structures, enhancing learning autonomy and ability (Du & Liu, 2023). Additionally, a study on mind mapping-based modules in mathematics indicated that these materials significantly improve students' motivation, activities, and learning outcomes (Rukhmana & Wahyuni, 2020). These findings underscore the value of mind mapping in enhancing educational quality and motivating both teachers and students.

CONCLUSION

The teaching materials based on video mind mapping on relation and function material have met the valid criteria according to the validity test stages. These materials are suitable for use in the classroom, especially for teaching mathematics to junior high school students in grade VIII. Teachers and students can use video mind mapping as an alternative learning medium in lesson plans. Teachers can integrate this media into classroom learning to incorporate technology.

However, there are some shortcomings in this video mind mapping teaching material. The video lacks dubbing that explains the material presented, and the mind mapping content is not fully visible. Future researchers are encouraged to conduct further studies on increasing student learning motivation using video mind mapping teaching materials. Enhancing the videos with dubbing can facilitate better understanding and increase learning motivation. The use of mind maps as an activity can increase interest, attention, and motivation. Additionally, creating mind mapping in the form of posters or dictionary books is recommended.

Video mind mapping teaching materials can serve as an alternative teaching resource for mathematics lessons on relations and functions. The development of technology-based
teaching materials, such as mind mapping, supports students' learning needs in the era of the industrial revolution and contributes to improving the quality of mathematics education.

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