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NEED ANALYSIS IN DEVELOPING RME-BASED DIGITAL TEACHING MATERIALS OF MATHEMATICS FOR JUNIOR HIGH SCHOOL

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ABSTRAK

Analisis kebutuhan merupakan kajian awal dalam penelitian pengembangan. Analisis ini diperlukan untuk menghasilkan produk yang tepat. Penelitian ini bertujuan untuk mengetahui perlu atau tidaknya bahan ajar digital berbasis pendekatan RME pada materi bangun ruang sisi lengkung perlu dikembangkan. Metode penelitian yang digunakan penelitian deskriptif dengan pendekatan kuantitatif. Data dikumpulkan menggunakan kuesioner. Teknis analisis data dilakukan dengan mengolah dan menganalisis data menggunakan skala likert. Responden dalam penelitian ini adalah 32 siswa dan 5 guru matematika salah satu SMP di Palembang. Pengumpulan data dilakukan dengan menggunakan angket, observasi, dan wawancara. Data dianalisis secara deskriptif. Berdasarkan analisis kebutuhan, peneliti menyimpulkan bahwa perlu dilakukan pengembangan bahan ajar digital berbasis RME. Digitalisasi diperlukan dalam pembelajaran di era saat ini.

Kata kunci: pengembangan, berbasis RME, bahan ajar digital, matematika SMP, analisis kebutuhan

ABSTRACT

Needs analysis is the initial study in development research. This analysis is necessary to produce the right product. This study tries to find out whether digital teaching materials based on the RME approach on curved-face three-dimensional shapes materials need to be developed. The method used is descriptive research. Data were collected using a questionnaire. Technical analysis of data is done by processing and analyzing data using a Likert scale. The respondents in this study are 32 students and 5 mathematics teachers of a junior high school in Palembang. The data were collected using a questionnaire, observation, and interview. The data were analyzed descriptively. Based on the need analysis, it can be concluded that it is necessary to develop RME-based digital teaching materials. Digitalization is needed in learning in this era.

Keywords: *developing, RME-based, digital teaching material, mathematics junior high school, need analysis*

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Introduction

The Industrial Revolution 4.0 is characterized by significant advancements in science and technology, transforming human life into one reliant on technology. The rapid development of science and technology in this era has brought about substantial changes in social, economic, and technological spheres. The acceleration of technological progress has reshaped the global lifestyle, while shifts in the social and economic sectors have created a demand for highly skilled human resources. Additionally, this evolution has influenced other areas, including politics, culture, art, and education. To adapt, digital-based teaching materials

have become essential for motivating students during the learning process (Putra, Yahya, & Nurbaiti, 2021).

Learning involves a dynamic exchange of communication. Teaching is carried out by the teacher as the educator, while students engage in the learning process (Salamah, 2020). The teacher, as an educator, interacts with students more frequently than other school staff. They are tasked with planning and implementing lessons, assessing learning outcomes, guiding training objectives, conducting research, and fostering open communication with the community (Gaol & Sinaga, 2020). In teaching and learning activities, teachers must effectively deliver the material, as learning is a process of acquiring new knowledge, skills, and behaviors through interaction with information and the environment. It is essential for teachers to accurately and effectively convey the correct content through well-structured teaching methods (Malichatin, 2019).

One of the things that must be prepared by each educational unit is the materials, teaching materials, and learning media, according to the learning method chosen, by optimizing the available learning resources according to the learning environment of each student. Teaching materials are an important component in learning (Magdalena, Khofifah, & Auliyah, 2023). Teaching materials are materials that are systematically arranged to help teachers carry out teaching and learning activities and complete oral explanations of a material so that a real environment is created for students (Prastowo, 2015; Harahap, Purba, D., Sembiring, & Akhyaruddin, 2023).

Teaching materials consist of two types, namely printed teaching materials and non-printed teaching materials (Prastowo, 2015). Then more specifically, the forms of teaching materials are grouped into 4, Prastowo (2015) namely: (1) Printed teaching materials, namely teaching materials which function is to convey information in paper form. Examples: books, handouts, wall charts, student worksheets, modules, leaflets, and models. (2) Audio teaching materials, namely teaching materials whose devices use radio signals and can be adjusted so that many people can hear them. Example: audio tapes/record/ compact disks, radio, and others. (3) Audio visual teaching materials, namely teaching materials that combine audio signals with moving images. Examples: video, electronic signal transmission technology (capture, record, process, and rearrange) of a moving image. (4) Interactive teaching materials, namely teaching materials that combine two or more media such as audio, image, video, and animation that have been manipulated by the user to control a command. In preparing interactive teaching materials, it is required adequate supporting knowledge and skills, especially in operating equipment such as computers, video cameras and photo cameras (Lohr, Sailer, Stadler, & Fischer, 2024). Example: Interactive multimedia.

The increasingly sophisticated technology today encourages teachers to be able to develop teaching materials that are capable of displaying interactive simulations by combining video, animation, audio, and images. Such teaching materials are called digital or electronic teaching materials. Digital teaching materials are materials conveyed through digital media, such as computers connected to the internet, laptops, multimedia classes (audio-visual), digital textbooks, and so on (Amie-Ogan & Osuji, 2016).

Technology enables students to interact widely and unlimited. A technology that synergize with teaching materials can be an "intellectual partner" for students (Smaldino &

Lowther, 2019). Teaching materials are one of the important elements in learning that are systematically compiled by the teacher, both written and non-written. Teaching materials consist of various types, including: textbooks, printed and digital modules, handouts, worksheets, and others (Kusmana, Pujiatna, & Gloriani, 2020).

The use of printed teaching materials has problems, namely it is difficult to present motion pictures to teach psychomotor steps or principles (Prastowo, 2015). Some students complained about the use of printed teaching materials because they were ineffective and tended to be incomplete in presenting the material. The survey results showed that more than 90% of students preferred teachers who used creative media/teaching materials (not contemporary) and more than 75% of students stated that they better understood the material being taught if they studied with the media/teaching materials (Febrianti, Bakri, & Nasbey, 2017).

The use of teaching materials/printed books in mathematics learning is sometimes not optimal, students still record the material that the teacher delivers even though the material is already in the book. If you look further, the printed teaching materials cost more for the book production, moreover the forest which is currently losing its trees for making paper (Saluky, 2016). Digital teaching materials have many advantages, including: making the learning atmosphere more flexible, interesting, and less boring, so that students are motivated to learn independently (Sidiq, Najuah, & Suhendro, 2021). Digital teaching materials can help learning to be more efficient and effective because it can be accepted by students without having to be face to face. Digital teaching materials can be sent via e-mail, WhatsApp, and various other applications.

Attractive teaching materials must create a group learning atmosphere that engages in solving problems related to everyday life (Suprihatin & Manik, 2020). Realistic Mathematics Education (RME) is a learning approach that starts from real things for students, emphasizing process skills (process of doing mathematics) such as discussing, collaborating, and arguing with teachers and classmates so that they can find their own concept (students' invention) and students are able to use mathematics to solve problems both individually and in groups (Zulkardi, Putri, & Wijaya, 2020).

The development of teaching materials at schools must pay attention to the characteristics and needs of students according to the curriculum. So, the developed teaching materials can motivate students to learn and actively participate in learning more. One of the recommended learning approaches for learning mathematics is Realistic Mathematics Education (RME). Mathematics should be kept close to student life. RME is an approach to learning mathematics based on the view that mathematics is as an activity/process not as a final result. There are three RME principles that can be used as references by researchers in preparing learning tools. The three principles are: (1) guided reinvention and didactical phenomenology; (2) progressive mathematization; and (3) self-developed models (Heuvel-Panhuizen & Drijvers, 2014). In addition, there are five characteristics in RME, namely: using contextual problems, using models, using student contributions, interactivity, and being integrated with other learning topics (Dowling, 2014).

The RME approach is a learning approach that is in line with the 2013 Curriculum. Students are invited to build their own knowledge through the contextual problems presented. The curved-face three-dimensional shapes is one of the contextual materials because there are

many objects around it whose shape resembles the curved-face three-dimensional shapes. This is considered very interesting to be examined more deeply. Based on the background above, this study tries to find out whether digital teaching materials based on the RME approach on curved-face three-dimensional shapes materials need to be developed.

Method Research

The method used in this need analysis research is descriptive research. Need analysis plays an important role as an underlying and initial point for identifying learners' needs as well as for curriculum design, text selection, tasks design, and material development. According to Long in Sari Wienanda, & Nugraheni (2020), needs analysis encompasses various data collection procedures, including non-expert and expert practitioner intuition, unstructured and structured interviews, scheduled interviews, surveys, and questionnaires. Meanwhile, this research used a questionnaire to collect dataAdditional methods include language audits, ethnographic approaches, participant and non-participant observation, class observation, and the use of diaries, journals, and notes. Techniques such as role-playing, simulations, content analysis, discourse analysis, rhetorical analysis, computer-based corpus analysis, genre analysis, performance tests based on criteria, and triangulation methods are also utilized to gather data effectively.

This study tries to find out whether digital teaching materials based on the RME approach on curved-face three-dimensional shapes materials need to be developed. Data were collected by distributing questionnaire and doing interview. The respondents consists of two groups, namely teachers and students.

The respondents in this study are students and teachers of a junior high school in Palembang. The needs analysis is carried out from 5 mathematics teachers and 32 ninth grade students. The objects of study in this article include: (1) the suitability of main competence and basic competence; (2) the teaching materials used by the teacher; (3) the needs of teachers and students regarding digital teaching materials; and (4) the difficulties of students in learning curved-face three-dimensional shapes materials.

The data were collected by using a questionnaire that adapted from previous research (Rahmadani, Roza, & Murni, 2018). In addition, researcher also made the observation of teachers' teaching materials and conducted interviews with teachers and students. The data analysis technique used in this study is in the form of descriptive statistics.

Results and Discussion

A. Result

Needs analysis aims to obtain information about what students and teachers want which will then be used as the basis for designing (Lisana, 2015). Teachers are asked several questions through a questionnaire. Teacher's questionnaire consist of 6 'yes or no' questions. The results of teachers' questionnaire are:

Table 1. The Results of Teachers' Questionnaire

No.	About	%
1	Teachers have textbooks or other handbooks to study curved-face three-dimensional shapes	60%

2	The teaching materials used are in accordance with main competences and basic competences	100%
3	Teachers look for materials other than books from schools to assist in understanding a material, for example through the internet.	60%
4	Teachers apply the RME approach in learning curved-face three-dimensional shapes so that students can more easily understand the material of curved-face three-dimensional shapes.	20%
5	Teachers need RME-based digital teaching materials that can be used to learn curved-face three-dimensional shapes to make it easier and more interesting.	100%
6	Teachers agree if RME-based digital teaching materials are developed for learning curved-face three-dimensional shapes materials so that the concept is easy to understand.	100%

Teachers have indeed used several references in teaching about curved-face three-dimensional shapes. Based on the teachers' answers, they have compiled teaching materials according to main competences and basic competences. They also look for references via the internet. However, almost all teachers do not apply RME in teaching. In conclusion, teachers require and agree to develop teaching materials based on RME.

Table 2. The Results of Students' Questionnaire

No.	About	%
1	Students have textbooks or other handbooks to study curved-face three-dimensional shapes.	18.75%
2	Students look for printed materials other than books from school to help in understanding a material.	56,25%
3	Students have difficulty learning the curved-face three-dimensional shapes of the textbook sub material.	93,75%
4	Students look for references via the internet.	87,50%
5	Students enthusiastically participate in learning on curved-face three-dimensional shapes material.	50,00%
6	Students want the material to be connected in everyday life through contextual problems.	81,25%
7	Students have difficulty understanding the curved-face three-dimensional shapes material through the teaching materials and methods applied by the teacher.	81,25%
8	Students need digital teaching materials that can be used to study curved-face three-dimensional shapes materials to make it easier and more interesting.	100%
9	Students agree that digital teaching materials are developed for studying curved-face three-dimensional shapes materials so that the material is easy to understand.	93,75%

Students are asked several questions through a questionnaire. Questions for students consist of 9 'yes or no' questions. The results of students' questionnaire are in Table 2. The results of questinnaire indicate that teachers and students realize the importance of digital teaching materials in learning in today's sophisticated technology.

B. Discussion

According the interview about number 1 Table 1, teachers often depend on textbooks or supplementary handbooks as their main resources for teaching curved-face three-dimensional shapes, such as cylinders, cones, and spheres. These resources provide structured guidance with theoretical explanations, formulas, and practice problems to aid student learning. They also include step-by-step methods for calculating surface areas and volumes, along with illustrations to help students visualize the shapes. However, while these materials offer a solid foundation, they frequently lack practical applications or interactive features that could make the concepts more relatable and engaging. Teachers recognize the value of these resources for standard teaching but find them insufficient in addressing the diverse needs of students or promoting a deeper conceptual understanding. For example, many textbooks present mathematical concepts in isolation, which can make it difficult for students to connect the lessons to real-life situations or familiar objects. To bridge this gap, teachers often complement textbooks with additional teaching methods, such as hands-on activities, visual aids, and technology-based tools. Despite these efforts, they still face challenges such as limited time, resources, and curriculum constraints. Therefore, while textbooks and handbooks remain indispensable for teaching curved-face three-dimensional shapes, there is a clear need for materials that integrate real-world examples, interactive components, and problem-solving exercises to better engage students and deepen their understanding.

Based Table 1 number 5 and 6, teachers greatly need Realistic Mathematics Education (RME) in teaching to make learning more meaningful and relevant to students' daily lives. RME encourages students to connect mathematical concepts with real-world situations, fostering a deeper understanding and problem-solving ability. By using this approach, teachers can create engaging and interactive learning experiences that help students visualize and apply mathematical ideas effectively. RME also supports teachers in addressing diverse student needs, promoting collaboration, and enhancing critical thinking skills, which are essential for success in modern education.

Based on interviews conducted with teachers (about number 4 Table 1), it was revealed that they do not utilize the Realistic Mathematics Education (RME) approach when teaching the topic of curved-face three-dimensional shapes. This has made it more challenging for students to grasp the material effectively. The traditional methods employed often focus heavily on abstract explanations, formulas, and rote memorization, which fail to connect the mathematical concepts to real-life contexts. As a result, students struggle to visualize and understand the properties and applications of curved-face three-dimensional shapes, such as cylinders, cones, and spheres. Teachers admitted that they face difficulties in designing lessons that bridge the gap between theory and practical understanding.

They also expressed concerns about limited resources and time constraints, which hinder their ability to adopt innovative approaches like RME. However, they recognized that the RME approach could provide significant benefits, such as helping students relate these geometric shapes to everyday objects, fostering a deeper understanding, and improving their ability to solve problems. By incorporating realistic scenarios and interactive activities, students could see the relevance of these shapes in their surroundings, making the learning process more engaging and meaningful. This suggests a need for training and support for teachers to integrate the RME approach into their mathematics instruction, enabling them to

address students' learning needs more effectively and enhance their comprehension of curved-face three-dimensional shapes.

Digitalization can support students who learn at a slower pace by offering a more personalized and effective learning environment. They remain patient, never tire, and consistently follow the programmed instructions. Digital teaching materials are designed to serve as a new learning resource, helping users enhance their understanding of concepts and fostering greater independence in learning (Imansari & Sunaryantiningsih, 2017). However, based on interviews, there are still teachers who have not utilized digital technology effectively. This aligns with the opinion of Sholihat, Koswara, & Irawan (2024), who states that the use of digital media has not yet been fully maximized. The contributing factors include issues such as technological accessibility and inadequate infrastructure support, both of which require further attention to enhance the implementation of educational technology in schools.

Research by Fonda & Sumargiyani (2018) highlights the effectiveness of digital modules, showing that students display strong enthusiasm when using them, whether guided by teachers or as standalone learning resources. The digital modules are designed to promote students' independence, both in group settings and individual study.

The development of digital teaching materials by teachers represents an innovation in instructional resources. The primary goal is to help students better understand the material being taught. Teachers play a vital role in the learning process at school. The teaching materials they create significantly enhance students' comprehension of the subject matter. This is evident in the minimal difficulties observed during classroom learning when using the materials developed by teachers. Moreover, these teaching materials have successfully improved student learning outcomes, motivating students to engage more actively in the learning process. Teachers also benefit from this dynamic, as the appreciation they receive from students inspires them to be more creative in designing innovative teaching materials for classroom use

The results of students' questionnaire are in Table 2. The results of questinnaire indicate that teachers and students realize the importance of digital teaching materials in learning in today's sophisticated technology. Learning subject that utilizes technology is able to expand and facilitate access to information, helps visualize material, makes learning more interesting, and creates multidirectional interactions (Halidi, Husain, & Saehana, 2015). In addition, digitization in learning can train students to explore concepts, improve reasoning skills, encourage students to think systematically, and improve students' interest in learning mathematics (Sumarni, Prayitno, & Nurpalah, 2017). Then, learning that use technology can form students' habit of thinking flexibly (Pitriani, 2016). In another study, it can improve students' learning achievement, and increase students' independent learning (Pitriani, 2018).

Based on interviews conducted by researchers with students, it was found that they had no learning resources other than the textbooks provided by the school. These textbooks often serve as the sole official reference in the teaching and learning process, but students feel that the content is limited and lacks depth in providing clear and comprehensible explanations. In such circumstances, students end up relying solely on the internet, particularly Google, as an alternative to find additional information. While the internet offers broad access to a wide range of learning materials, students acknowledge that not all the information they encounter is accurate or relevant to their school curriculum. Furthermore, limited digital literacy skills make it challenging for some students to filter and understand the information they find online. This

reliance highlights a significant gap in the availability of diverse and high-quality learning resources for students. They expressed that additional resources, such as interactive modules, educational videos, or engaging contextual materials, would greatly enhance their understanding of the subjects. These findings underscore the critical need to develop richer, more integrated learning materials to better support students in their educational journey.

In students opinion, it was revealed that many face significant challenges in learning the sub-material on curved-face three-dimensional shapes provided in their textbooks. Students explained that the explanations in the textbooks are often abstract and heavily reliant on formulas, with minimal illustrations or real-world examples to help them visualize the concepts. For instance, while the textbook outlines the steps for calculating the surface area and volume of shapes like cylinders, cones, and spheres, it rarely provides practical applications or relatable contexts to enhance understanding. This lack of connection to everyday life makes it difficult for students to grasp the properties and uses of these shapes, leading to confusion and a lack of motivation to learn. Additionally, some students mentioned that the language and structure of the textbook are not user-friendly, making it harder for them to follow the instructions or retain the information. They also expressed frustration over the absence of interactive elements, such as diagrams they could manipulate or step-by-step visual demonstrations, which could make the learning process more engaging and effective. As a result, students often resort to searching for additional explanations online or relying on their teachers to clarify the material during class. These challenges highlight the need for more comprehensive and interactive learning resources that cater to different learning styles and help students build a stronger conceptual understanding of curved-face three-dimensional shapes.

Students need Realistic Mathematics Education (RME) to make their learning experiences more meaningful and effective. This approach emphasizes connecting mathematical concepts to real-world situations, enabling students to see the relevance of what they are learning in their daily lives. Many students struggle to understand abstract mathematical ideas because they are often taught in isolation, with little to no connection to practical applications. RME bridges this gap by encouraging students to explore problems rooted in realistic contexts, which helps them develop a deeper understanding of concepts and improves their problem-solving skills. For example, instead of simply memorizing formulas for calculating areas or volumes, students can learn how to apply these concepts by solving problems related to everyday objects, such as determining the amount of paint needed for a cylindrical water tank or calculating the volume of a cone-shaped ice cream cone. This not only makes learning more engaging but also fosters critical thinking and creativity.

Additionally, RME promotes collaborative learning, where students can work together to explore and solve problems, further enhancing their communication and teamwork skills. By adopting RME, educators can address diverse learning styles and provide a more inclusive and dynamic classroom environment. Ultimately, students need RME to develop a stronger foundation in mathematics, equipping them with the skills and confidence necessary to apply mathematical thinking in both academic and real-world contexts.

After conducting a deeper analysis from observation and interview, it is known that the learning media used so far are printed teaching materials. From making the design of printed teaching materials, sometimes there are no covers, there is no list of materials, there are no main competences and basic competences, and indicators, there is no explanation of the content

of the material, there are no animated videos that explain the material, there are no discussions for practicum, evaluation, and references.

Furthermore, the content format is only available in the form of two-dimensional images. Besides, in terms of digital teaching materials, the delivery is not clear, it is not detailed because it is only in the form of pictures. And in terms of language, printed teaching materials use one language and a language that is not straightforward and not communicative. In the interview, the teacher suggested to researcher to make digital teaching materials in two languages (*Bahasa Indonesia* and English). The printed teaching materials have not been prepared based on the approach recommended by the 2013 Curriculum.

Needs analysis is needed by teachers to create teaching materials which can improve the quality of learning and students' competences. Thus, researcher will develop RME-based digital teaching materials that are felt to be able to eliminate student boredom when studying mathematics. Digital teaching materials are contextual media that will provide variations in the learning process that involves students actively. Digital teaching materials can integrate sound, text, images, animation, video, music, and interactive quizzes so that the information conveyed is richer than printed teaching materials.

Digital teaching materials enable the implementation of distance learning and do not have to be done in the classroom (Martha, Adi, & Soepriyanto, 2018). During the pandemic time, distance learning was increasingly popular and more relevant because it can expand learning and teaching spaces (Leontyeva, 2018). The results of the need analysis that have been carried out are used as guidelines and considerations in the preparation of mathematics teaching materials.

The results of this research indicate that it is necessary to develop learning media in the form of digital teaching materials. Integrating technology into learning has several positive impacts, including more effective teaching and greater flexibility in evaluation and assessment, because these activities can be done anywhere. In addition, it is more efficient because the results can be accessed immediately, without time limits, and creates a more conducive learning environment (Aisa & Lisvita, 2020). Technology-based digital teaching materials also support teachers in delivering learning effectively (Apriani, Harun, Erlina, Sahputra, & Ulfah, 2021). According to Munzil, et al. (2022), digital teaching materials are easy to use and suitable for independent learning, especially during online learning. Preliminary research suggests that one of the major challenges lies in the low levels of 21st century skills among students, particularly critical and creative thinking abilities. These deficiencies have a negative impact on students' academic performance, often due to a lack of adequate digital teaching materials to enhance the learning process. Therefore, there is an urgent need for digital teaching materials designed to improve academic achievement.

Conclusion

Based on the need analysis, it can be concluded that it is necessary to develop RME-based digital teaching materials. In addition, based on suggestions from teachers, it is necessary to develop teaching materials in two language or bilingual (*Bahasa Indonesia* and English). The development of these teaching materials is an effort to continue and to innovate in realizing active, creative, and innovative learning.

Athorough needs analysis should involve teachers, students, curriculum developers, and educational technology experts. This analysis helps identify students' challenges in understanding math and gaps in current materials. Teachers play an important role in highlighting difficult topics and sharing effective teaching strategies. The materials should incorporate RME principles by connecting math concepts to real-world problems, making learning more engaging and meaningful. As this study focuses only on need analysis, future researchers are encouraged to expand on these findings by developing and implementing RME-based digital teaching materials identified as necessary. They could create prototypes of the recommended materials and test their effectiveness in real classroom environments, particularly in enhancing students' understanding of mathematics and problem-solving skills. Furthermore, researchers might investigate how these materials affect students' engagement, motivation, and ability to connect mathematical concepts with real-world situations. Conducting experimental or quasi-experimental studies to compare the learning outcomes of students using RME-based digital materials with those using traditional methods could provide valuable insights. Lastly, exploring the potential for scaling and adapting these materials to different educational settings and diverse student groups could further enhance their usability and impact on mathematics education.

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