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RME Based Audiobook Development for Class IV Elementary School Students

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ABSTRACT

Learning mathematics at the Elementary School (SD) level is an important basis in building a good understanding of mathematical concepts in students. However, students often experience difficulties in understanding abstract and complex mathematical concepts. This can have an impact on reducing students' interest in learning mathematics. To overcome this problem, an audiobook based on RME (Realistic Mathematics Education) was developed which emphasizes the quality of sound recordings that are close to the experience of listening to voices directly, especially for mathematics materials at the elementary level. The research method used in this study is a research and development approach using the ADDIE model developed by Robert Maribe Branch. The ADDIE model is a development model consisting of five stages, namely analysis, design, development, implementation, and evaluation. The results of the study show that audiobooks based on RME are valid and can be implemented in learning. Based on these results, the RME-based audiobook is ready to be implemented on a large scale and used as an effective alternative learning media in increasing conceptual understanding and interest in learning mathematics for fourth grade elementary school students in multiplication material.

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A. INTRODUCTION

Learning mathematics at the Elementary School (SD) level can be a challenge for some students because of the complexity of the mathematical concepts being taught (Sopandi & Sukardi, 2020). In addition, not all students have good reading skills, so it is difficult to understand the text of the mathematics textbooks provided. Therefore, we need a learning media to overcome existing problems.

Learning media is a tool to convey messages contained in learning materials whose use is adjusted to the learning objectives and needs of students (Vlachopoulos & Makri, 2019). One form of effort that can be done for learning mathematics in order to improve the ability to understand concepts and interest in learning mathematics for elementary students is to use audiobook media based on RME. Audiobook is a learning medium in the form of a book for students who have an auditory learning type (Andina, 2011). For students who cannot read and students who have an auditory learning style, audiobooks are the right solution to be used as learning media. Audiobooks are audio books that narrate all/most of the content in visual books (Al-Jarf, 2021; Aydın & Tunagür, 2021; Çarkıt, 2020; Priyadarsini, 2017). Audiobooks are more

practical learning media than e-books (Wijaya & Maspupah, 2014). This is because audiobooks do not require a device to use them.

RME (Realistic Mathematics Education) is a mathematics learning approach originating from the Netherlands. In Indonesia, the term RME approach has been adapted to PMRI (Indonesian Realistic Mathematics Education) or also known as IRME (Indonesian Realistic Mathematics Education) which is adapted to the educational situation in Indonesia (Afriansyah, 2016; Bate'e, 2016; Julie et al., 2014; Jupri, 2018; Melvinasari & Suparman, 2019). In Indonesia, RME has been implemented to reform the mathematics curriculum in schools for exactly two decades (Jupri, 2017; Sembiring, 2010). However, the development of students' mathematical abilities has not increased significantly. Especially students who are in remote areas. This is possibly due to the uneven implementation of RME in all regions in Indonesia, especially in Merauke. The uneven reach of RME in the Merauke region can be seen from the results of studies indexed by Google Scholar, only one researcher conducted research by providing RME interventions in mathematics learning in class (Bate'e, 2016). In addition, the uneven distribution of the RME approach in the Merauke area can also be seen from the results of interviews and response questionnaires in the initial research conducted by researchers on several elementary school teachers in Merauke who had not applied the RME approach to the mathematics learning process.

The RME approach is one of the most effective approaches in growing students' interest in learning, self-confidence, problem solving abilities, and reasoning (Laurens et al., 2018). This is because the RME approach itself aims to change mathematics learning to be more fun and meaningful for students by introducing it to problems in real contexts. RME starts by taking problems that are relevant to students' experience and knowledge. The teacher then acts as a facilitator to help students solve contextual problems (Julie et al., 2014; Laurens et al., 2018). Therefore, choosing the RME approach as the basis for audiobook media is an appropriate choice to address student problems related to low problem-solving skills, especially in the city of Merauke.

There are several logical reasons why the RME-based audiobook media is an emphasis in improving the problem-solving abilities of Merauke Elementary School students. First, RME-based audiobooks can increase understanding of mathematics and interest in learning both for students who have low reading skills and for students who have high abilities. This is in accordance with research that has been conducted by Fajry et al. (2016); Moe & Wright (2013); Wahyuni (2021), which shows the results that the application of audiobooks makes a positive contribution to students' reading comprehension skills and learning interest. In addition, the results of research conducted Awofala (2016), also shows the results that the RME approach can improve students' problem-solving skills and interest in learning mathematics. Second, assist teachers in explaining mathematics learning material at school and at home, because audiobooks can sound according to the text written in the book. This is in accordance with research conducted by Bircham et al. (1997); Liu et al. (2010) who say that audiobooks can increase student learning independence. So that by using audiobooks students can understand the material contained in the book even without explanation from the teacher.

Relevant research results related to RME-based audiobooks to improve students' ability to understand concepts and interest in learning mathematics were carried out by (Wallin, 2021).

Wallins (2021) conduct research to clarify issues related to the contemporary study of audiobook practice. The method in this study uses the concept of remediation to clarify issues related to the application of audiobooks. This study presents several findings related to audiobook practice studies, one of which is the concept of reading by listening, which shows that reading can be done with the help of the ear. That is, to understand a concept, not only through the activity of reading books, but by listening to audiobooks it turns out that it can further improve one's understanding of concepts.

From the above information, it can be concluded that the ability to understand concepts and students' interest in learning mathematics is included in the low category so that it needs to be improved by applying the RME approach in learning mathematics which has proven effective in increasing students' understanding of concepts and learning interest in mathematics. One of the media that can be combined with RME in order to improve students' ability to understand concepts and interest in learning mathematics is an audiobook.

If it is interpreted more deeply about the learning media in the form of audiobooks based on RME as stated above, then in general it can be said that the application of these learning media in learning mathematics is good for increasing students' understanding of concepts and interest in learning compared to without using learning media. This is because the steps of the RME approach to audiobooks are based on developing students' conceptual understanding abilities which involve cognitive, affective, and psychomotor processes, and are very beneficial for students at school, and in terms of the usefulness of audiobooks, they are effective in fostering students' interest in learning mathematics. Therefore, this study aims to develop an RME-based audiobook to increase students' fourth grade elementary school students' understanding of concepts and interest in learning mathematics

B. METHODS

This study uses research and development methods or Research and Development, which is a research method that aims to develop a learning product. The product developed in this research is an RME-based audiobook to improve students' ability to understand concepts and interest in learning mathematics in class IV elementary schools. According to Gall et al. (2014), research and development methods in the field of education can be used to develop various types of products, such as books, modules, learning media, evaluation instruments, curriculum models, and others.

This study uses research and development methods because the aim is to develop learning media that can improve the ability to understand concepts and interest in learning mathematics for elementary school students. In research and development methods, the products developed must refer to the needs and characteristics of the target users. Therefore, in this study, the RME-based audiobook was chosen because it can help students understand mathematical concepts in an interesting and interactive way.

Gall et al. (2014), also states that research and development methods can be applied in various aspects of education, such as learning, evaluation, supervision, and staff development. In this study, research and development methods were used in the context of learning mathematics in elementary schools. By using research and development methods, it is hoped that effective and efficient learning media can be developed in increasing elementary school

students' understanding of concepts and interest in learning mathematics. Branch (2009) presents five steps of research and development implementation, known as ADDIE, consisting of: analyze, design, develop, implement, and evaluate. This ADDIE step was used in this study which is described in Figure 1.

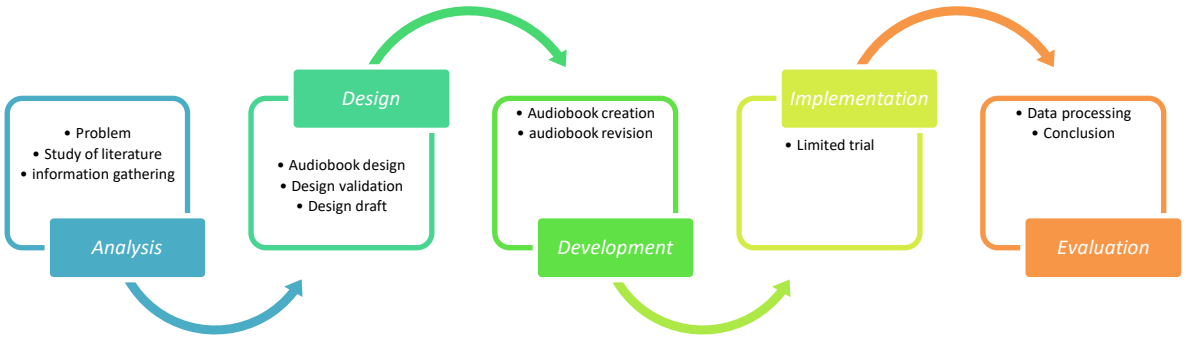


Figure 1. Research and development flowchart (adapted from Branch, 2009)

In the needs analysis stage, data was collected from 60 students. In the validation test, the participants consisted of 2 media experts and 2 material experts. In a small-scale trial, data was collected from 60 grade IV students at SD Inpres Polder Merauke and SD Muhammadiyah Merauke, and involved 13 teachers as participants. The purposive sampling method was used to select the sample. With this method, the sample is selected based on a specific purpose, not based on level or region. The following presents the details of all participants, as shown in Table 1.

Table 1. Details of the participants

Phase	Group	Number of participants
Needs analysis	Student	30
	Teacher	13
Validation test	Media expert	2
	Material expert	2
Small scale trials	student	60

In this study, data was collected through interviews, tests and questionnaires. Interviews were conducted to collect initial data about learning mathematics in class, the learning approaches and media used in learning, as well as students' abilities. The interview guide was used as a research instrument. The test consists of several questions to measure students' conceptual understanding abilities which consist of 6 descriptive questions that must be answered by students. This test is used to measure conceptual understanding in needs analysis as well as to increase conceptual comprehension skills after small-scale trials have been carried out. Questionnaires were used to collect data about students' interest in learning, product validity, and teacher and student responses about the use of teaching materials. Questionnaires were distributed to teachers, students, and experts. The data collection instrument is an important element because it determines whether or not the data obtained is good. The following presents the aspects assessed, the instruments used, the observation data, and the respondents involved, as shown in Table 2.

Table 2. Details of Instruments, Observational Data, and Respondents

Data	Instrument	Observed data	Respondents
Needs analysis	Interview Questionnaire	Learning mathematics in class, approaches and learning media used in learning	Student Teacher
Product	Validation sheet	media validity Material validity	Media expert Material expert
Effectiveness	Test Questionnaire	Concept understanding Interest to learn	student

Descriptive analysis is a data analysis technique used in this study. The collected data is classified into two, namely quantitative data in the form of numbers and qualitative data expressed in words. Quantitative descriptive data analysis was carried out by grouping information from the data in the form of input, suggestions, responses, and criticism contained in the data collection instruments. This analysis is used as a reference to revise the product. Qualitative data is used to accompany and complement the figures obtained from quantitative data analysis.

Quantitative descriptive data is used to process data obtained through questionnaires or checklists in the form of descriptive percentages. Questionnaire responses regarding the requirements of teachers and students produced data in the form of scores which stated the respondents' preferences in providing and developing audiobooks. This preference is summarized by calculating the percentage of answers for each question item. Furthermore, the RME-based audiobook is said to be effective in increasing students' understanding of concepts and students' interest in learning mathematics if the N-Gain value of students' understanding of mathematical concepts and interest in learning mathematics is medium and high effectiveness.

To analyze the increase in students' ability to understand concepts, problem solving, and interest in learning mathematics before and after using the RME-based audiobook, the N-Gain formula is used. Gain is the difference between the pre-test and post-test, which indicates an increase in students' ability to understand concepts, problem solving, and interest in learning mathematics. According to Creswell (2014), N-Gain can be calculated by the following formula:

$$\text{N-Gains} = \frac{Skor\ posttest - skor\ pretest}{Skor\ maksimal - skor\ pretest} \quad (1)$$

The following is the categorization of the N-Gain scores described in Table 3.

Table 3. Categorization of N-Gain scores

Range	Category
N-Gains ≥ 0.7	High
0.3 ≤ N-Gain < 0.7	Medium
N-Gain < 0.3	Low

Source: Hake (1999)

C. RESULT AND DISCUSSION

1. Analysis

The need for developing an RME-based audiobook was based on initial research using interviews and questionnaires conducted on two grade IV teachers at SD Inpres Polder and SD Muhammadiyah Merauke. The results of interviews with 2 showed that teachers found it difficult to instill the concept of multiplication in fourth grade students in Merauke. This is due to the unavailability of innovative learning media.

Then questionnaires from 13 teachers spread across 4 elementary schools (SD Inpres Polder Merauke, SD Inpres Mopah Baru Merauke, SD Muhammadiyah Merauke, SDN 2 Wasur Merauke) with the following question descriptions: (1) As a teacher, I have used learning media in the learning process. mathematics learning; (2) As a teacher, I feel that learning media can help and support the process of learning mathematics more effectively; (3) As a teacher, I feel that it is easier for students to understand subject matter when using instructional media; (4) As a teacher, I feel that learning media in the form of audiobooks is more interesting than non-audiobook media; (5) As a teacher, I have used learning media in the form of audiobooks in teaching mathematics; (6) I agree that learning media in the form of audiobooks has an attractive appearance; (7) I feel that mathematics lessons will be interesting by using learning media in the form of audiobooks; (8) I feel that learning media in the form of audiobooks will make students learn more independently; (9) I feel that learning media in the form of audiobooks will make it easier for me to teach mathematics; (10) As a teacher, I feel that learning media in the form of audiobooks is an interesting medium and will make students more enthusiastic about learning; (11) I feel that media in the form of audiobooks is needed in learning mathematics; (12) I have never taught multiplication material using the RME approach in class; (13) As a teacher, I find it difficult to instill an understanding of the mathematical concept of multiplication due to limited teaching materials and media; (14) As a teacher, it will be easier for me to instill the ability to understand concepts through learning media; (15) There is no learning media in the form of audiobooks that are used to improve students' understanding of the multiplication concept; (16) There is no learning media in the form of audiobooks that are used to improve student problem solving; (17) There is no learning media in the form of audiobooks that are used for students' learning interest; (18) It is necessary to have mathematics learning media that can increase students' understanding of concepts and learning interest; and (19) As a teacher, I need mathematics learning media in the form of audiobooks that can improve students' understanding of concepts and interest in learning mathematics. The results of the questionnaire are shown in Figure 1.

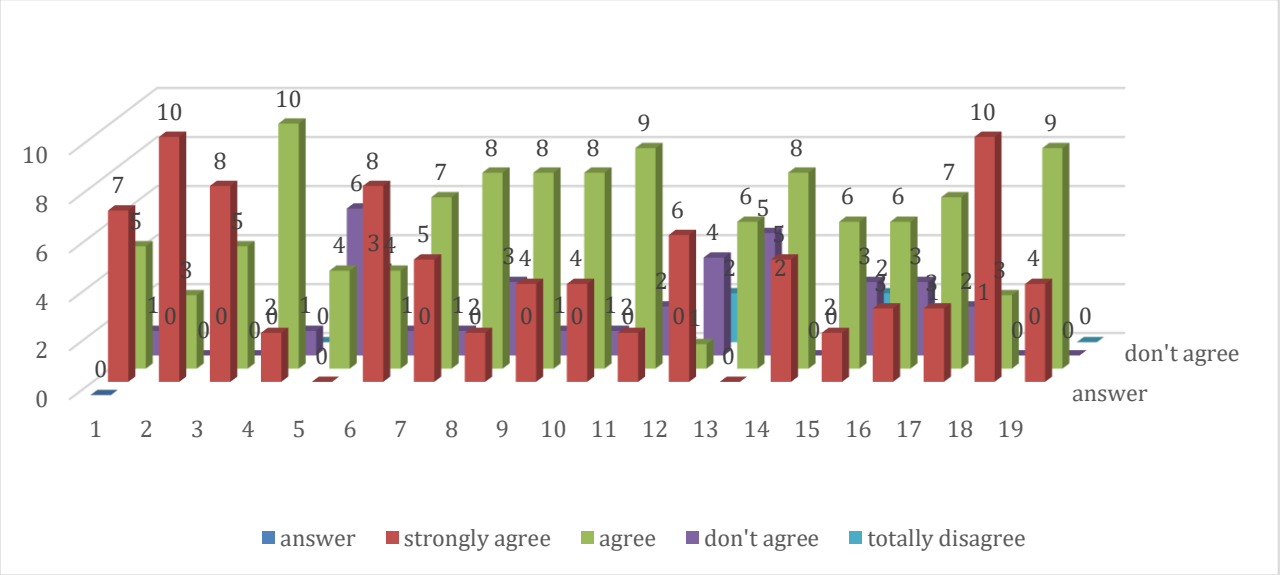


Figure 1. Results of Needs Analysis through Teacher Questionnaires

The data provided regarding the use of instructional media in the mathematics learning process, as well as the teacher's views on the use of learning media in the form of audiobooks in mathematics learning. In this data, there are 19 statements that discuss the use of learning media in the process of learning mathematics, and 10 statements that discuss the use of learning media in the form of audiobooks in learning mathematics. In general, the data shows that the majority of teachers (at least 5 out of 7 teachers) strongly agree or agree that instructional media in the process of learning mathematics can help and support the process of learning mathematics more effectively.

When discussing the use of learning media in the form of audiobooks in learning mathematics, the majority of teachers (at least 12 out of 13 teachers) agree or strongly agree that learning media in the form of audiobooks is more interesting than non-audiobook media. In addition, the majority of teachers (at least 11 out of 13 teachers) agree or strongly agree that the use of learning media in the form of audiobooks can increase students' interest in learning, and can improve students' conceptual understanding abilities. Finally, the majority of teachers (at least 13 teachers) agree or strongly agree that there is a need for mathematics learning media that can increase students' understanding of concepts and learning interest.

Furthermore, the results of the mathematical ability tests and questionnaires for students' interest in learning mathematics were analyzed using the help of the SPSS version 25 application which showed that the ability to understand concepts for grade IV students tended to be low and the results of the questionnaire for students' interest in learning mathematics for grade IV SD Merauke also showed that interest learning mathematics students tend to be low. In the overall data, it can be seen that the use of learning media in learning mathematics can help and support the process of learning mathematics more effectively, and the use of learning media in the form of audiobooks in learning mathematics has the potential to increase students' interest in learning and students' ability to understand concepts.

A study by Yunita (2021) shows that the use of instructional media in learning mathematics can improve student learning outcomes. The results of the study show that instructional media in the form of learning videos and simulations are very effective in increasing students'

understanding of concepts (Jupri & Herman, 2017; Yunita et al., 2021). Similar results were also found by Pencheng et al. (2020), which shows that the use of technology-based learning media, such as learning videos, can increase students' interest and motivation in learning mathematics. Another study by Wang et al. (2020) also shows that the use of audiobooks in learning mathematics can increase students' interest in learning. The results of their research showed that students who used audiobooks in learning mathematics had better scores on tests of understanding mathematical concepts compared to students who used conventional textbooks.

In addition, research by Wahyuni (2021) shows that the use of learning media in the form of audiobooks can improve students' understanding of concepts in learning mathematics. The results of this study indicate that students who use audiobooks in learning mathematics have higher scores on tests of understanding mathematical concepts compared to students who use conventional textbooks. Based on the results of the data provided, it appears that the majority of teachers agree or strongly agree that the use of learning media in the mathematics learning process can help and support the mathematics learning process more effectively, and that the use of audiobook learning media in mathematics learning can increase students' learning interest and comprehension abilities student concept.

2. Design

The following RME-Based Audiobook Design, as shown in Table 2.

Table 2. RME-Based Audiobook Design

Component	Audiobook Design
Front cover	
Back cover	
Audiobook sound device	

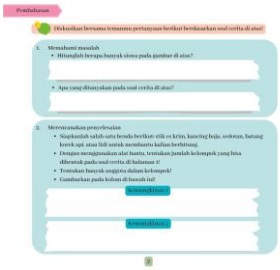
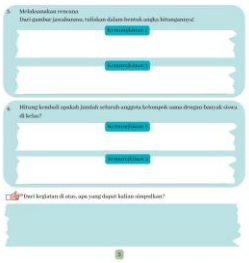
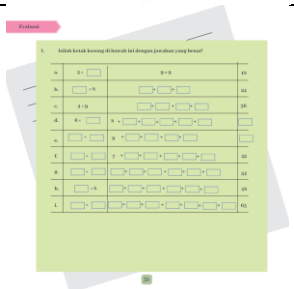
Audiobooks	
Realistic math problem posing	
Solve realistic problems	
Interactivity	
Conclude	
Affirmation and assignment	

Table 2 above shows the RME-based audiobook design for multiplication material for fourth grade elementary school students. Books in audiobooks are designed using the Canva

application, while the audio is designed using the Tinkercad online application. The audiobook developed according to the design above is then printed with a size of 23 x 23 cm using glossy art paper. This is intended so that the book is durable, not easily soiled, and not easily damaged.

The developed audiobook consists of 66 pages. The audiobook developed is adapted to the characteristics of RME, namely (1) using a realistic context as a starting point for learning mathematics; (2) using a model as a representation of a problem that emphasizes solving informally before using formal methods or formulas; (3) linking fellow topics in mathematics or with other topics outside of mathematics; (4) using interactive methods in learning mathematics; and (5) respecting the results of various answers and the contribution of students in solving a problem.

The material contained in the RME-based audiobook is the initial concept and properties of multiplication, which consists of instilling the initial concept of multiplication to working on problem solving questions. According to Koenoeni et al. (2020), RME-based audiobooks provide a more realistic approach to learning mathematics by relating mathematical concepts to students' daily lives. The material contained in the RME-based audiobook about the initial concepts and properties of multiplication will help students to understand the basic concepts of multiplication and improve their ability to solve problem solving questions.

Instilling the initial concept of multiplication in students is carried out using a more concrete approach and relevant to students' daily lives. This is in accordance with constructivist theory which states that students will more easily understand mathematical concepts if they are introduced to examples that are relevant to their lives (Mulyana, 2020). In addition, RME-based audiobook materials also discuss the properties of multiplication, namely commutative, associative, and distributive properties. This material will help students to understand and apply multiplication properties in solving more complex math problems in the future.

In order to deepen students' understanding of this material, the RME-based audiobook also provides problem-solving exercises. These exercises will help students to develop critical and creative thinking skills in using the multiplication concept in solving more complex math problems. Overall, the RME-based audiobook material on the initial concepts and properties of multiplication provides a more realistic approach to learning mathematics and helps students to understand the basics of multiplication operations and improve their ability to solve problem solving problems.

3. Development

Before the audiobook product is tested on fourth grade elementary school students, it is necessary to carry out the validation stage by a team of experts and practitioners. This is done to ensure audiobook quality and make improvements to components deemed necessary. Validation by experts in the field of media and material is important to ensure the accuracy and clarity of the material in audiobooks and the proper use of media. Table 3 presents the results of the validation that has been carried out by a team of experts and practitioners on audiobooks for elementary school students. The results of this validation can be used to make repairs and improvements to the audiobook before it is tested on students, as shown in Table 3.

Table 3. Media Validation Results

No.	Validated indicators/aspects	Score		Average Validation Score
		Validators 1	Validators 2	
1	General Aspect	96	92	94
2	Audio Aspect	100	85	93
3	Language Aspect	81	86	79
4	Presentation Aspects	90	100	95
	Average			92

The media validation results showed that the RME-based audiobooks tested had an average value of 92 with very valid criteria, where this value indicated that the product being tested had very good quality in helping students understand the material presented, as shown in Table 4.

Table 4. Material Validation Results

No.	Validated indicators/aspects	Score		Average Validation Score
		Validator 1st	Validator 2nd	
1	Relevance to the competencies that students must master	80	100	94
2	The depth of the material is according to the level of student development	87	93	93
3	The description of the material according to the curriculum	80	90	79
4	The description of the questions is relevant to measuring conceptual understanding	87	100	95
5	The material presented is relevant to the RME theory	80	100	
	Average			92

The results of the material validation show that all aspects assessed are included in the very valid criteria. The highest score is found in the aspect of relevance to the competencies that students must master, which gets a score of 97. This shows that the material presented is very relevant to the competencies that students must master. Furthermore, the depth of the material also gets a very valid value, which is 90. This shows that the material presented is quite in-depth and in accordance with the level of student development. In addition, the description of the material is also considered very valid, with a score of 90. This shows that the material presented is in accordance with the applicable curriculum and explains in detail the concepts presented. Although the description of the questions is considered slightly lower, namely 85, this value is still included in the very valid criteria.

Finally, the material presented is considered very valid with a score of 93. This shows that the material presented is in accordance with the theory of RME (Realistic Mathematics Education) which encourages students to understand mathematical concepts through real experiences in everyday life. With an average value of 91 and very valid criteria, it can be concluded that the material validation results are very good and meet the expected standards. This shows that the material presented is very relevant and in accordance with the needs of students in understanding mathematical concepts.

4. Implementation

Small-scale field trials to measure the effectiveness of RME-based audiobooks included tests of students' understanding of concepts and interest in learning mathematics. The research was conducted by taking 60 fourth grade elementary school students as subjects consisting of two classes, where one class (experimental class) applied RME-based audiobooks, and the other class (control class) applied conventional learning. The purpose of this study was to determine the effectiveness of RME-based audiobooks in improving the ability to understand mathematical concepts in the multiplication material for fourth grade elementary school students. The following presents the results of the effectiveness test using the SPSS version 25 application, as shown in Table 5.

Table 5. N-Gain scores of students' conceptual comprehension ability

Group Statistics					
	Class	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
N-gain score	Experiment	30	.7122	.05389	.00984
	Control	30	.1759	.15050	.02748

From the research results, it can be seen that the average N-Gain in the experimental class is 0.712, which indicates that the use of RME-based audiobooks is quite effective in increasing the ability to understand mathematical concepts in the multiplication material for fourth grade elementary school students. Meanwhile, in the control class, the average N-Gain was 0.1759, indicating that conventional learning was not effective in increasing the ability to understand mathematical concepts in the multiplication material for fourth grade elementary school students. Thus, it can be concluded that the use of RME-based audiobooks in mathematics learning can make a significant contribution in increasing students' understanding of concepts, especially in multiplication material, and can be a more effective alternative to conventional learning, as shown in Table 6.

Table 6. Normality Test Results

	class	**Kolmogorov-Smirnova**			**Shapiro-Wilk**		
		Statistics	**df**	**Sig.**	**Statistics**	**df**	**Sig.**
Ngain_percent	experiment	.208	30	002	.893	30	.006
	control	.177	30	.017	.897	30	.007
a. Lilliefors Significance Correction							

The results showed that there was a significant difference between the two groups tested. To test the significance of this difference, the Mann-Whitney statistical test was used. The Mann-Whitney test is used because the data tested is not normally distributed. Because the amount of data is more than 50, the Kolmogorov-Smirnov test is used to test the normality of the data. From the test results, a significance value of 0.002 is obtained which is smaller than the alpha value (0.05), indicating that the data is not normally distributed. Therefore, for data analysis a non-parametric statistical method was used, namely the Mann-Whitney test, as shown in Table 7.

Table 7. Mann-Whitney Test Results

Statistics test	
	post test
Mann-Whitney U	193,000
Wilcoxon W	658,000
Z	-3,862
asymp. Sig. (2-tailed)	.000
a. Grouping Variable: class	

Based on Table 7 above regarding the results of the Mann-Whitney test, it is shown that the asymp sig value is 0.000 <0.05, so the hypothesis is accepted, which means that there is a difference in the ability to understand mathematical concepts of students' multiplication material for fourth grade students between the experimental class and the control class. Because there is a significant difference, it can be said that there is an effect of using RME-based audiobooks on the ability to understand mathematical concepts of fourth grade elementary school students on multiplication material. Furthermore, Table 8 below presents the results of student responses regarding interest in learning mathematics as measured by students in the experimental class.

Table 8. N-Gain Interest in learning mathematics

Report			
Ngain_Persent			
Class	**Means**	**N**	**std. Deviation**
1	.621476	30	.1643839
Total	.621476	30	.1643839

Based on Table 8 above, it shows that the average N-Gain score of students' interest in learning mathematics is 0.6215 where the score is in the range of 0.3 - 0.7 in the effectiveness category according to Hake (1999) which means the level of effectiveness is medium. This can be interpreted that RME-based audiobooks are effective in increasing students' interest in learning mathematics.

5. Evaluation

Based on the results of the development of RME-based audiobooks to improve students' understanding of concepts and interest in learning, it can be said that the RME-based audiobooks that have been developed are very valid in terms of relevance to the competencies that students must master, the depth of the material is in accordance with the level of student development, the description of the material is in accordance with the curriculum, the relevance of the material to the RME theory, and the descriptions of questions that are relevant to the measurement of conceptual understanding. In addition, this audiobook has also proven to be effective in increasing the ability to understand concepts and interest in learning fourth grade elementary school students in multiplication material. Therefore, it can be concluded that the developed RME-based audiobook is very valid and effective in increasing the understanding of concepts and interest in learning mathematics of fourth grade elementary school students in multiplication material.

D. CONCLUSION AND SUGGESTIONS

Based on the results of the study, it can be concluded that the development of an RME-based audiobook is quite effective in increasing the ability to understand concepts and interest in learning mathematics in fourth grade elementary school students in multiplication material. RME-based audiobooks are able to have a positive impact on students' understanding of mathematical concepts, as indicated by an increase in the N-Gain score of 71.2 in the experimental class. In addition, RME-based audiobooks were also able to increase students' interest in learning mathematics, as seen from the results of the increase in the N-Gain score of students' interest in learning mathematics which reached 62.15 in the experimental class. Therefore, the use of RME-based audiobooks is ready to be implemented on a large scale and used as an effective alternative learning media in increasing conceptual understanding and interest in learning mathematics for fourth grade elementary school students in multiplication material.

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REFERENCES

Afriansyah, E. A. (2016). Makna Realistic dalam RME dan PMRI. *Lemma*, *II*(2), 96–104. https://core.ac.uk/download/pdf/229189196.pdf

Al-Jarf, R. (2021). Mobile Audiobooks, Listening Comprehension and Efl College Students. *International Journal of Research -GRANTHAALAYAH*, *9*(4), 410–423. https://doi.org/10.29121/granthaalayah.v9.i4.2021.3868

Andina, E. (2011). Buku Digital dan Pengaturannya. *Jurnal Aspirasi*, *2*(2), 95. https://doi.org/https://doi.org/10.22212/aspirasi.v2i1.429

Awofala, A. O. (2016). Effect of Personalisation of Instruction on Students' Motivation to learn Mathematics Word Problems in Nigeria. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *7*(3), 486–486. https://doi.org/10.16949/turkbilmat.267339

Aydın, E., & Tunagür, M. (2021). *Effect of Audiobook Applications on Listening Skills and Attitudes of 6th Grade Students: A Mixed-Method Study Effect of Audiobook Applications on Listening Skills and Attitudes 2* (Vol. 43, Issue 3). https://files.eric.ed.gov/fulltext/EJ1340717.pdf

Bate'e, I. (2016). Perbedaan Peningkatan Kemampuan Representasi Matematis dan Motivasi Belajar Siswa Antara Pendekatan RME DAN SAVI DI SMP. *Didaktik Ikip Gunung Sitoli*. https://ojs.ikipgunungsitoli.ac.id/index.php/dk/article/view/51

Bircham, A., Shaw, M., & Robertson, A. (1997). Enhancing reading development using audio-taped books. *Educational Psychology in Practice*, *13*(3), 181–187. https://doi.org/10.1080/0266736970130307

Branch, R. M. (2009). Instructional Design The ADDIE Appoach. In *Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship*. https://doi.org/10.1007/978-3-319-15347-6_300893

Çarkıt, C. (2020). Evaluation of Audiobook Listening Experiences of 8th Grade Students. *Educational Policy Analysis and Strategic Research*, *15*(4), 146–163. https://doi.org/10.29329/epasr.2020.323.8

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Method Approaches* (4th ed.). SAGE Publications.

Fajry, K., Komariah, E., & Silvianti, T. M. (2016). Audio book: Teaching Listening Comprehension. *Research in English and Education*, *1*(August), 62–70. https://files.eric.ed.gov/fulltext/EJ1340717.pdf

Gall, J. P., Gall, M. D., & Borg, W. R. (2014). *Applying Educational Research: How to Read, Do, and Use Research to Solve Problems of Practice* (Sixth). Pearson.

Hake, R. R. (1999). *Analyzing change/gain scores. Unpublished*. http://lists.asu.edu/cgi-bin/wa?A2=ind9903&L=aera-d&P=R6855

Julie, H., Suwarsono, S., & Juniati, D. (2014). Undertanding Profile from the Philosophy, Principles, and Characteristics of RME. *IndoMS-JME*, *5*(2), 148–159.

Jupri, A. (2017). Pendidikan Matematika Realistik Sejarah, Teori, dan Implementasinya. *Bunga Rampai Kajian Pendidikan Dasar*. http://aljupri.staf.upi.edu/files/2017/11/Artikel-Pengabdian_UMTAS_2017_Al-Jupri.pdf

Jupri, A. (2018). Peran Teknologi dalam Pembelajaran Matematika Dengan Pendekatan Matematika Realistik. *Seminar Nasional Matematika Dan Pendidikan Matematika*, 303–314. http://ejournal.radenintan.ac.id/index.php/pspm/article/view/2630

Jupri, A., & Herman, T. (2017). Theory and practice of mathematics teacher education: An explorative study at the department of mathematics education, Indonesia University of Education. *Advances in Social Science, Education and Humanities Research*, 175–179.

Koenoeni, K., Widyastuti, F., & Haryanti, R. (2020). Pembuatan Audiobook Berbasis Realistic Mathematics Education pada Konsep Awal Perkalian untuk Siswa Sekolah Dasar. *Jurnal Pendidikan Dasar*, *11*(2), 265-275. https://doi.org/10.20961/jpd.v8i2

Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2018). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement? *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(2), 569–578. https://doi.org/10.12973/ejmste/76959

Liu, K. P., Liu, C. C., Huang, C. H., Hung, K. C., & Chang, C. J. (2010). An audio book platform for early EFL oral reading fluency. *Proceedings - 10th IEEE International Conference on Advanced Learning Technologies, ICALT 2010*, *26*, 94–98. https://doi.org/10.1109/ICALT.2010.34

Melvinasari, & Suparman. (2019). Design of mathematics module based on rme to improving the problem-solving ability. *International Journal of Scientific and Technology Research*, *8*(11), 3918–3922. https://www.ijstr.org/final-print/nov2019/Design-Of-Mathematics-Module-Based-On-Rme-To-Improving-The-Problem-solving-Ability.pdf

Moe, S., & Wright, M. (2013). Can accessible digital formats improve reading skills, habits and educational level for dyslectic youngsters? *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *8011 LNCS*(PART 3), 203–212. https://doi.org/10.1007/978-3-642-39194-1_24

Mulyana, E. (2020). Model Pembelajaran Konstruktivis pada Mata Pelajaran Matematika di Sekolah Dasar. *Jurnal Ilmiah Pendidikan Dasar*, *4*(1), 13–24. http://dx.doi.org/10.30659/pendas.7.2

Pencheng, Y., Jiong, Z., & Xiaofeng, L. (2020). Study on the application of multimedia technology in mathematics teaching. *Journal of Physics: Conference Series*, *1573*(3). https://doi.org/10.4028/www.scientific.net/AMM.631-632.1387

Priyadarsini, K. (2017). Audiobook for Enhancing Listening Skills. *Journal of English Language Teachers' Interaction Forum*, 40. http://eltif.in/journals/Journal%20VIII.4.%20.pdf#page=40

Sembiring, R. K. (2010). *Pendidikan Matematika Realistik Indonesia (PMRI): Perkembangan dan Tantangannya*. *1*(1), 11–16. http://dx.doi.org/10.22342/jme.1.1.791.11-16

Sopandi, W., & Sukardi, R. R. (2020). Using four tier diagnostic tests to understand the conceptions held by pre service primary school teachers about sea pollutant migration. *Review of International Geographical Education Online*, *10*(2), 13–29. https://doi.org/10.33403/rigeo.629388

Vlachopoulos, D., & Makri, A. (2019). Online communication and interaction in distance higher education: A framework study of good practice. *International Review of Education*, *65*(4), 605–632. https://doi.org/10.1007/s11159-019-09792-3

Wahyuni, S. (2021). The effect of audiobook media on the understanding of mathematical concepts in elementary school students. *International Journal of Educational Research Review*, *6*(1), 11-22. https://www.ijere.com/volume/volume-6-issue-1

Wallin, E. T. (2021). Reading by listening: conceptualising audiobook practices in the age of streaming subscription services. *Journal of Documentation*, *77*(2), 432–448. https://doi.org/10.1108/JD-06-2020-0098

Wang, W., Liu, Z., Wang, H., & Zhang, J. (2020). The application of audiobooks in mathematics learning. *Journal of Physics: Conference Series*, *1573*(4). https://iopscience.iop.org/issue/1742-6596/1573/1

Wijaya, A. E., & Maspupah, W. M. (2014). Pengembangan Perangkat Lunak Berorientasi Objek sebagai Media Pembelajaran Resep - resep Masakan Bentuk Audio Book Berbasis Java. *Jurnal Teknologi Informasi Dan Komunikasi*, *5*, 1–15. http://ejournal.upnjatim.ac.id/index.php/scan/issue/archive?issuesPage=2#issues

Yunita, D., Nurhadi, D., & Rosyada, D. (2021). The use of learning media in mathematics learning to improve student learning outcomes. *Journal of Physics: Conference Series*, *1818*(1). https://iopscience.iop.org/issue/1742-6596/1818/1