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Development of Learning Tools Based on a Realistic Mathematics Approach with the Karo Cultural Context to Improve Student's Mathematical Connection Ability in Class XII

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Abstract: The purposes of the research were to 1) Produce valid, practical and effective quality learning tools, which were developed based on a realistic mathematical approach with the Karo Cultural Context (RME-KCC) for class XII of SMA Masehi Berastagi; 2) Analyzing the increase in students' mathematical connection abilities using learning tools based (RME-KCC). This research is a development research using the EDDIE development model. Learning tools produced from this study are Learning Implementation Plans, Student Books, Student Worksheets, Student's Mathematical Connection Ability Tests. Based on the research results obtained 1) Learning tools based on RME-KCC have met the valid, practical, and effective criteria in terms of each criterion; 2) There is an increase in students' mathematical connection abilities by using learning tools based on RME-KCC seen from the N-gain value in trial I of 0.32 (criterion "moderate") increased to 0.56 (criteria "moderate") in the trial II.

Keywords: Realistic Mathematic Appoach, Karo Cultural, Connection Ability.

Introduction

Mathematics is a science that has a number of characteristics, namely that it is structured, hierarchical, and systematic, which means that the concepts and principles contained in it are related to one another. In learning a new concept, a student needs previous experience and knowledge related to the concept to be discussed. According to NCTM 2000, "making connections" is an important activity for teachers and students if learning mathematics is carried out with the aim of building mathematical understanding. If students are able to make connections between mathematical ideas, then their understanding of mathematics will be deeper and more durable. Students who have good connection skills will be more consistent in understanding a mathematical topic.

According to Sumarmo (Minarni, dkk 2020:101), when a student has good mathematical connection skills, the student will be able to see a broad interaction between mathematical topics, so that students learn mathematics more meaningfully. The explanation above shows that the ability to connect mathematics is a very important aspect of students' cognitive development.

The mathematics problems that exist in schools, such as low mathematical connection abilities, lead to low mathematics learning outcomes, requiring educators to apply various efforts to improve such conditions. Educators can improve learning tools and strategies. One of the mathematical strategies based on the mathematicalization of experience and the application of mathematics in everyday life is the Realistic Mathematics Learning (RML) approach. Freudental (Ningsih: 2014) states that mathematics is a human activity and must be related to reality. That is, mathematics must be familiar to students and relevant to everyday life. In the Realistic Mathematical Approach (RMA),

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mathematics is a science that students must construct themselves, not a ready-made result. The Realistic Mathematics Approach (RMA) positions reality and the learner's environment as a reference for learning. Learning does not begin with definitions, theorems, or characteristics that are accompanied by various examples, but it is hoped that the definitions, theorems, and characteristics of these characteristics will be sought by students independently. So it is clear that realistic mathematics learning encourages or challenges students to play an active role and is even expected to allow them to construct their own knowledge to be acquired. Realistic mathematics education has three main principles, including guided reinvention through progressive mathematizing, didactic phenomena (dialectical phenomenology), and the development of independent models (self-developed). In addition, Treffers (1897) identified five characteristics: 1) use of context; 2) use of the approach to progressive mathematization; 3) use of students' construct results; 4) interactive activities; and 5) continuity.
Realistic mathematics learning is a learning method originating in the Netherlands. The term "realistic" or "real world" is the real world. According to Zulkardi and Ilma (2010), realistic mathematics learning is a learning method based on various elements that are "real" for students, emphasizing the "process of doing mathematics" skills, working together and discussing, and communicating between classmates so that students create their own (student invention, which is the opposite of "teacher telling"). So it ends with mathematics being used to solve problems for individuals and groups. The main idea of realistic mathematics is to provide opportunities for students to reinvent various mathematical ideas with guidance from educators (guided reinvention). With informal knowledge, the teacher directs students to obtain various mathematical theories for their formal knowledge. With contextual problems that students understand using informal knowledge, it is used to find various mathematical materials. The procedure can support students' learning interactively. The existence of contextual problems in realistic mathematics is very important in building students' mathematical concepts from informal to formal.The contextual problems that are presented should be close to the daily lives and environments in which students live. such as linking learning with the culture in which students live. According to Efendi and Syariffuddin (2021:26), combining mathematics and culture will increase the Indonesian people's appreciation of local geniuses. According to Montago and Dawson (in Daryanto, 2015: 34), culture is a way of life, especially a way of life that radiates the identity of a nation. Meanwhile, student culture-based contextual learning, according to Hosnan (2014:64), can help students feel that Arikunto (2010:62) suggests that "to improve the quality of mathematics education, it must be accompanied by research, especially development research, namely the development of learning tools." Learning devices are devices used to carry out learning activities in the classroom. Teaching materials include student guidebooks, teaching materials, evaluation instruments or learning achievement tests, worksheets, and lesson plans. There is a need for teaching materials in learning activities, and educators are required to develop them. Research by Apulina, Saragih, and Siagian (2019:17) states, "When compared to students who are taught without teaching materials, students who are taught with teaching materials have very good achievement scores." Learning devices are the most important aspect that must be used when conducting learning in class (Trianto, 2009:201). According to research by Purnama, Khairani, and Surya (2021: 53), the importance of learning tools is to support the implementation of effective and efficient learning in order to create an environment or atmosphere that allows students to learn, improve student learning outcomes, arouse student interest in learning, provide opportunities for students to practice, and help solve problems faced by students.

Therefore, this study aims to develop a learning tool that is able to improve students' mathematical connection skills. The title of this research is "Development of Learning Tools Based on a Realistic Mathematics Approach with the Karo Cultural Context to Improve Students' Mathematical Connection Ability in Class XII."

Materials and Methods

This type of research is developmental research using the ADDIE model. The goal of this study is to create mathematics learning tools based on a realistic mathematical approach in the context of Karo culture.The research was carried out in the even semester of the 2021–2022 school year at Berastagi Christian High School for Class XII students. The subjects of this study were Berastagi Christian High School class XII students for the academic year 2021-2022, as well as the object of this research, which was a learning device based on a realistic mathematical approach with the Karo cultural context.

There are two stages to this research. The first stage is the development of learning tools based on a realistic mathematical approach. The development of learning devices includes the design of learning devices. The development of learning tools includes i) the validity of lesson plans; ii) the validity of student activity sheets (LKPD); iii) the validity of student books; and iv) the validity of problem-solving ability test instruments. The second stage is the implementation of learning tools as well as research measuring tools that are considered appropriate based on the test results. The scheme of the development model in this study is shown in Figure 1.

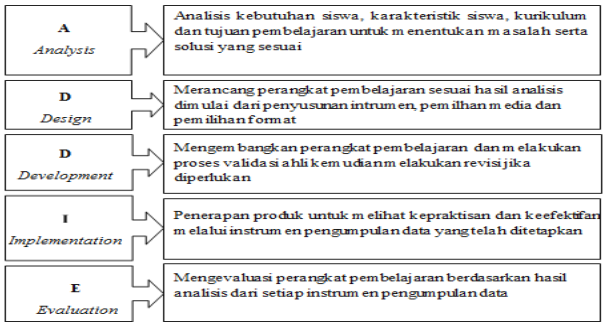

Figure 1. Schematic of the ADDIE Model

The learning tools developed must meet the criteria of being valid, practical and effective. Learning tools are said to meet valid indicators if the RME-KCC learning tools developed are at least in the assessment category ($4 \leq Va \leq 5$). Learning tools are said to meet practical indicators based on the results of observations of the implementation of learning tools in the classroom including in the category of "Well implemented" ($3 \leq 0k < 4$).The learning tools developed are said to be effective if: (1) the minimum test score for students' connection abilities is 75 (category "medium") and classically at least 80% of students meet the learning mastery; (2) the average student response is in the range of $3 \leq Rs < 4$ (category "positive response");

The normalized N-Gain data, according to Hake (1999), can be used to determine the improvement in students' capacity for connection mathematical problems as follows:

$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Utilizing the normalized gain index criterion (g) presented in

Table 1. Normalized N-Gain Score Criteria

Gain Score	Criteria
$g \leq 0,3$	Low
$0,3 < g \leq 0,7$	Medium
$g > 0,7$	High

Results and Discussion

The results of this development research are learning tools based on a realistic mathematical approach in the Karo cultural context. This development research aims to (1) analyze the effectiveness, practicality, and effectiveness of the developed learning tools and (2) improve students' mathematical connection abilities. In order to achieve this goal, the ADDIE model was used to initiate the development research. The results of the development of learning tools based on a realistic mathematical approach with the Karo cultural context, namely lesson plans, student books, the LKPD, and measuring tools for testing students' mathematical connection abilities

Table 2. Validated Instruments

No.	Validated Instruments	Scor	Category
1	Lesson Plan	4,41	Valid
2	Student book	4,34	Valid
3	Student worksheet	4,29	Valid
4	Mathematic problem solving ability test	valid and Reliable	

Student Learning Completeness in Classical Trial 1

The results of the classical mastery assessment of students' mathematical connection abilities in the pretest and posttest for trial 1 are contained in the following table:

Table 3: Levels of Mastery of the Pre- and Post-Test of Students' Mathematical Connection Ability in Trial 1

Category	*Pre-test*	Classical Student Learning Mastery	*Post-test*	Classical Student Learning Mastery
	The Total Number Of Students		The Total Number Of Students	
Complete	6	18,75 %	19	59.37 %
Not Complete	26	81,25 %	13	40,62 %
Total	32	100 %	32	100 %
Average	43,22		75,25	

Student Response Trial 1

The results of the response questionnaire from 32 students after attending lessons with a realistic mathematical approach in the Karo cultural context are shown in the following table:

Table 4: Student Response Questionnaire Recapitulation Results

No	Statement	Score
1	Students who express pleasure in learning media components	92.24 %
2	Students stated that learning components and activities were still new.	89.38 %
3	Students who express interest in participating in mathematics learning on other materials such as the learning that is carried out	96,50 %
4	Students who state the language in the student book, LKPD and tests are clear and understandable	90.63 %
5	Students who expressed interest in the appearance of student books and LKPD	92.31 %
Overall Average		92.21 %

Based on the effectiveness of student response categories, the percentage of student responses is positive if it gets more than or equal to 80% of students who give positive responses to the elements of the learning tools developed.

Improvement of Mathematical Connection Ability Trial 1

The increase in mathematical connection ability for trial 1 can be seen in the N-Gain from the pretest and posttest results of the mathematical connection ability for test 1. The summary results of the n-gain mathematical connection capability of test 1 are contained in the following table:

Table 5: Connection Capability Test Results in Trial I

N-Gain Score	**Interpretasi**	The Number Of Students
$n > 0,7$	Hight	3
$0,3 < n \leq 0,7$	Medium	22
$n \leq 0,3$	Low	7

The average N-Gain value is 0.32, so the total increase in mathematical connection ability obtained for trial I is included in the "medium" level, or 32% with the Gain percentage.

Student Learning Completeness in Classical Trial 2

The results of the classical mastery assessment of students' mathematical connection abilities in the pretest and posttest for trial 2 are contained in the following table:

Table 6: Levels of Mastery of the Pre- and Post-Test of Students' Mathematical Connection Ability in Trial 1

Category	*Pre-test*	Classical student learning mastery	*Post-test*	Classical student learning Mastery
	The Total Number Of Students		The Total Number Of Students	
Complete	5	15,62 %	28	87,5 %
Not Complete	27	84,37 %	4	12,5 %
Total	32	100 %	32	100 %
Average	45,25		81,25	

Student Response Trial 2

The results of the response questionnaire from 32 students after attending lessons with a realistic mathematical approach in the Karo cultural context are shown in the following table:

Table 7: Student Response Questionnaire Recapitulation Results

No	Statement	Score
1	Students who express pleasure in learning media components	91.24 %
2	Students stated that learning components and activities were still new.	90.35 %
3	Students who express interest in participating in mathematics learning on other materials such as the learning that is carried out	97.50 %
4	Students who state the language in the student book, LKPD and tests are clear and understandable	93.65 %
5	Students who expressed interest in the appearance of student books and LKPD	94.33 %
Overall Average		93.41 %

Based on the effectiveness of student response categories, the percentage of student responses is positive if it gets more than or equal to 80% of students who give positive responses to the elements of the learning tools developed.

Improvement of Mathematical Connection Ability Trial 3

The increase in mathematical connection ability for trial 2 can be seen in the N-Gain from the pretest and posttest results of the mathematical connection ability for test 1. The summary results of the n-gain mathematical connection capability of trial 1 are contained in the following table:

Table 7: Connection Capability Test Results in Trial 2

N-Gain Score	**Interpretasi**	The Number Of Students
$n > 0,7$	Hight	3
$0,3 < n \leq 0,7$	Medium	22
$n \leq 0,3$	Low	7

Discussion

Learning tools created with a realistic approach in the context of Karo culture produce valid, practical, and effective results, as well as positive value.The learning model used in the RME-based learning process encourages students to participate actively in the learning process, increasing student learning completion (Amalia et al., 2017). According to Vygotsky, social interaction between teachers and students or between students and other students can help students develop intellectually (Arends, 2008).Students can actively construct their knowledge using the RME-CTL approach that was developed. Through a series of activities organized in learning tools, students can relate existing concepts. The concept is built not only on one path, but on many different paths based on the reasoning abilities of the students.According to Jean Piaget (Harahap, 2012: 55), "theory of knowledge" is the beginning of thinking in order to respond to real-world situations, such as living things that adapt to their surroundings. This is consistent with the concept of a contextual approach, which begins activities with problems that students are already familiar with from their surroundings.

Conclusions

Based on the results of the study, we obtained learning tools that are valid, practical, and effective. As a result, it is possible to conclude that the learning tools developed using a realistic learning approach with the Karo cultural context are beneficial. Learning tools that have been developed can be used to improve students' mathematical connection abilities.

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