RME Approach and Mind Map Method to Enhance Mathematical Cognition of Elementary School Students

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Abstract. Early mathematics achievement has been found to be important for later mathematical development. Intelligence and other cognitive factors typically explain no more than half of the variability in mathematical variation. This study aimed to investigate the effect of applying a Realistic Mathematics Education approach and mind map method to enhance mathematical cognition at elementary school students. The participants were recruited from elementary schools in Bukittinggi, West Sumatra, Indonesia. The constant comparative and grounded theory techniques were used for data analysis. The theoretical contribution of this study is a very detailed diagnosis of increasing at mathematical cognition resulting in a profile rather than in a single score. Practically, this profile enabled efficient intervention that resulted in students’ high mathematical cognition and achievement in students’ learning achievement.

1. Introduction

The implementation of the Kurikulum 2013, new Indonesian educational curriculum has faced various challenges and problems. The main challenge is the lack of teacher mastery in implementing the curriculum, making it increasingly difficult to apply in schools. Other common problems include learning approaches used in the curriculum, evaluation systems for student learning outcomes, and teacher training for the curriculum [1]. In the Kurikulum 2013 the teaching of mathematics was carried out separately, starting from grades 4, 5 and 6, starting with concrete material to abstract concepts, then easy to difficult ones. Mathematics learning requires students to be able to think critically, creatively and logically. So, students must actively develop their own knowledge. It is hoped that by learning mathematics students can solve problems in their daily lives related to mathematics.

In practice, mathematics learning usually starts with an explanation of concepts accompanied by examples, followed by practice questions. This learning approach is dominated by the presentation of closed problems or highly structured problems, namely mathematical problems that are formulated in such a way. Learning approaches like this tend to only practice basic mathematical skills in a limited and isolated manner [2]. Mathematics learning in elementary school needs to get serious attention from various parties, namely educators, the government, parents, and the community because learning mathematics in elementary school is the foundation of the basic concepts used as the basis for learning at the next level.

The learning process so far still uses a teacher-centered learning system using the lecture method and the approach used is still textual. All of this old method must change and the changes should followed by the teacher who is responsible for the organizer of learning in the school. At the school where the writer taught, SDN 03 Pakan Kurai, a phenomenon was found in which students could not
capture the concept correctly. Students have not reached the process of abstraction and are still in the concrete world. He hasn't come to an understanding that only knows examples, but can't describe it. There are many ways that teachers can use to overcome these problems. One interesting innovation to accompany the change in learning that is all teacher-centered is switching to student-centered is the discovery and application of innovative, creative, and constructive learning models or more precisely in developing and exploring students in a concrete and independent manner in academic and social fields, election the right learning strategy, one of which is mathematics learning with the RME approach and the application of mind mapping strategies.

RME has the characteristics, among others, that in the learning process students must be given the opportunity to reinvent mathematics through teacher guidance [3] and reinvention of mathematical ideas and concepts must begin with exploring various "real world" situations and problems [4]. The real world is everything outside mathematics. It can be a subject other than mathematics, or a field of science that is different from mathematics, or everyday life and the environment around us [5]. The use of RME in the learning process has an important role. The learning route where students are able to find their own mathematical concepts and ideas, must be mapped [6].

Besides applying the RME approach to learning, interesting mathematical learning can also be done by applying learning strategies using mind mapping. The method of mind mapping learning is one of the innovative learning methods that are expected to be able to actively involve students in learning. "The method of mind mapping learning is a learning method that asks students to create mind maps, so that students can clearly and creatively identify what has been learned or what is being planned" [7]. RME has the unique characteristics, among others, that in the learning process students must be given the opportunity to reinvent mathematics through teacher guidance [5] and the guided reinvention process provides an opportunity for students to experience a process similar to the creation of mathematics, namely building their own mathematical tools and ideas, finding their own results, and formalizing their understanding and informational strategies supported by teacher guidance [2].

There are two kinds of RME mathematical processes, namely horizontal and vertical mathematical [6]. The principles of RME are (1) the use of real-life contexts, (2) the use of models used, (3) free production of students, (4) interactions, (5) intertwining [8]; [9]. The characteristic used as a basis in the theory of RME is “(a) using contextual problems, as applications and starting points from which mathematics wants to be raised, (b) using models or bridges with vertical instruments. Attention is directed to the development of models, schemes, and symbols rather than simply transferring formulas directly, (c) using student contributions where students are given the opportunity to develop informal strategies to solve problems that can lead them to contribute to solving procedures, with guidance from teachers expected by students can find, (d) interactivity, occurring between teachers and students is a fundamental thing in RME, the forms are negotiation, explanation, justification of cooperative reflection, and questions where informal strategies are used as the heart to achieve formal strategies, and (e) integrated with topics other learning, the relevance of learning units in the problem solving process” [5].

Mind mapping is a technical graphic where it is possible to explore the brain's ability to think and learn [10]. The ability of the brain is very closely related to the concept of mind mapping that uses visual aids to present relationships between concepts to improve reading, remembering, understanding and thinking creatively [11,12]. Therefore mind mapping is an alternative thinking of the whole brain towards linear thinking that responds to all directions and various thoughts from all angles [13]. Mind map advantages include: can help "(1) plan, (2) communicate, (3) be more creative, (4) save time, (5) solve problems, (5) focus attention, (6) arrange and explain thoughts -thoughts, (7) remember better, (8) learning more quickly and efficiently” (Buzan, 2010). Steps for making mind maps: "(1) start from the middle of a blank paper whose contents are laid horizontally, (2) use images or photos for our central idea, (3) use colors, (4) connect the main branches of the image center and connect the level two and three branches to level one and two, and so on, (5) make a connecting line that is curved, not a straight line, (6) use one key for each line, (7) use a picture” [14].
Understanding is a translation of the term understanding which can be interpreted as the absorption of the meaning of a material being studied. Students can be said to understand if the student is able to absorb the material he learned, especially in mathematics learning. There are four things that can be considered in mathematical understanding: "(1) visualization integration, is a complex and diverse construct that relies on fine motor attention and coordination, and their integration, and is therefore very important to adjust to many aspects of school performance including mathematics, related closely with concurrent children and longitudinal mathematical achievement, (2) attention is a multidimensional construct that is considered a part of high function that is set with cognitive processes that help children coordinate their goal-directed responses to complex situations. Ability underlying the development of mathematical skills (3) fine fine motor coordination, including muscle movement, including coordination and agility in the fingers, motor sequencing, and fine motor speed and accuracy (4) mathematical skills" [15].

2. Method
Research carried out using the experimental method is a systematic method used to find the effect of a treatment. This study compares the effect of using Realistic Mathematic Education (RME) and Mind Mapping learning methods on mathematical cognition. This study uses a research design Correlation test designed to analyze the significant effect between two independent variables on the dependent variable [16].

The design of this study uses a correlation test where there are two research variables, this research variable consists of one independent variable and one dependent variable, the independent variable is the learning method consisting of Realistic Mathematic Education (RME) (X1) and mind mapping method (X2). Whereas, the dependent variable in this study is mathematical cognition (Y). In this study, the observations provided were several indicators including:

| Mathematical Cognitive Category |
|--------------------------------|
| Visio motor integration        |
| Attention                      |
| Fine motor coordination        |
| Math skills                    |

3. Results and Discussion

3.1. Results
The results of this study are:

| Table 1. Summary of Anava Regression Y and X₁ |
|----------------------------------------------|
| Sumber | JK   | dk | RJK | \(F_{\text{hitung}}\) | P   |
|--------|------|----|-----|-----------------|-----|
| Regr.Linear | 1819.544 | 1  | 1819.544 | 15.729 | 0.004 |
| Tuna Cocok    | 4.568   | 1  | 4.568  | 0.039  | 0.824 |
| Kekeliruan    | 8671.438 | 74 | 117.182 | 117.182 | 0.117 0.731 |
| Total          | 10495.550 | 76 |        |        |

| Table 2. Summary of Anava Regression Y and X₂ |
|----------------------------------------------|
| Sumber | JK   | dk | RJK | \(F_{\text{hitung}}\) | P   |
|--------|------|----|-----|-----------------|-----|
| Regr.Linear | 774.821 | 1  | 774.821 | 5.729 | 0.016 |
| Tuna Cocok    | 15.354  | 1  | 15.354  | 0.117  | 0.731 |
| Kekeliruan    | 9705374 | 74 | 131.154 | 131.154 |        |
| Total          | 10495.550 | 76 |        |        |
Table 3. Summary of Anava Regression Y and X

| Sumber     | JK   | dk  | RJK   | Fhitung | P       |
|------------|------|-----|-------|---------|---------|
| Regresi    | 2337.167 | 2   | 1168.583 | 10.600   | <0.001  |
| Residu     | 8158.383 | 74  | 110.248 |          |         |
| Total      | 10495.550 | 76  |       |         |         |

3.2. Discussion

The results of the analysis between the independent and bound variables have a positive and significant correlation. The RME variable correlation with Mind Mapping found a correlation coefficient ($r_{xy}$) of 0.416 with a false probability (p) of 0.000. The correlation between these two variables shows that RME has a very significant relationship with Student Mathematical Cognitivity. Correlation of Mind Mapping variables with Mathematical Cognitivity Students found correlation coefficient ($r_{xy}$) of 0.272 with erroneous Probability (p) of 0.016. The correlation between these two variables shows that the Mind Mapping variable also has a significant relationship with Student Mathematical Cognitivity.

Likewise with multiple correlations, multiple correlations between RME variables and Mind Mapping with Student Mathematical Cognitivity, found the magnitude of correlation coefficient (R) of 0.472 and the coefficient of determination is 0.223 with a false probability of 0.001. This means that the amount of the contribution of RME and Mind Mapping to Student Mathematical Cognitivity is 22.3%. Thus it can be revealed that the two predictors significantly contribute to the dependent variable.

The variable RME has a positive and significant contribution to the Mathematical Cognitivity of Students of SDN 17 Pakan Kurai, Bukittinggi City. The collected data can be explained that the variable mean of the RME is 99.753. While the ideal maximum score that might be achieved is 155. This reflects that the use of the RME approach is in the poor category.

4. Conclusion

RME and Mind Mapping have a significant effect on mathematical cognition of students in Bukittinggi Elementary School. Both of them affect both partially and jointly. From the results of testing the hypothesis it can be concluded that RME has an effect on students' mathematical cognition of 17.3%. Thus it can be clear that 17.3% of the variance that occurs in students' mathematical cognition is influenced by the RME learning approach. Furthermore, mind mapping has an effect on students 'sensitivity about 7.4% where the variance that occurs also affects students' mathematical cognition and students' learning achievement. Whereas together with RME and mind mapping, it affected 22.3% of the students' cognition. Based on this result, we can say that this profile enabled efficient intervention that resulted in students' high mathematical cognition and achievement in students' learning achievement.

5. Reference

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