

***Realistic Mathematics Education: An Approach for Overcoming Math Anxiety of Junior High School Students in Semarang, Indonesia***

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**Abstract**

There are some different levels of students' achievement in Mathematics across various skills such as understanding, communication, critical thinking, and problem solving. It implies that the low-achieving students get the most consideration to be evaluated what the factors affecting it. This study focused on analysing the nature of maths anxiety that is suffered by junior high school students in Indonesia. Subsequently, it investigated the coherence between the strategies to overcome maths anxiety and the characteristics of Realistic Mathematics Education (RME). Essentially, research has shown that mathematics achievement can be influenced by psychological factors in which math anxiety is one of it (Zakaria *et al.*, 2012).

A research indicates that some factors such as mathematics myths, teaching-learning process, and motivation become a complexity prompting students' math anxiety (Wicaksana & Saufi, 2013). Besides, there are two findings from my teaching-learning experiences which are: (1) students' failures in mathematics either in the learning process or the test are not always due to cognitive factors; (2) two possible significant factors triggering to the low-achieving students are maths anxiety and less meaningful learning. The findings reveal that the RME approach confirmed to overcome math anxiety based on the analysis of five notions, which are the positive atmosphere of teaching-learning process, making sense mathematics, more practice for students, students' collaboration, and process-led rather than content-led objectives. Additionally, the implementation of RME needs some considerations concerning time allotment, math topic and teacher's skills.

Keyword: Math Anxiety, Realistic Mathematics Education, Junior High School

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## **Introduction**

The Indonesia's curriculum was cultivated relatively abruptly because within ten years there have been three times of transformations. These curriculum changes included the objectives and indicators of learning achievement in which later implicated in the matter and burden of teaching and learning process. Consequently, mathematics as one of the main subject has considerable burden and weight of matters then conveying a significant responsibility for teachers and indirectly forcing students to learn more until attaining the marks passing standards.

The situations resulted a significant differences of students' achievement in mathematics across various skills such as understanding, communication, critical thinking, and problem solving. It implies that the low-achieving students get the most consideration to be evaluated what the factors affecting it. Essentially, research has shown that mathematics achievement can be influenced by psychological factors in which math anxiety is one of it (Zakaria *et al.*, 2012). A research indicates that some factors such as mathematics myths, teaching-learning process, and motivation become a complexity prompting students' math anxiety (Wicaksana & Saufi, 2013). Besides, there are three findings from my teaching-learning experiences in Semarang area, which are: (1) students' failures in mathematics either in the learning process or the test are not always due to cognitive factors; (2) two possible significant factors triggering to the low-achieving students are maths anxiety and less meaningful learning; and (3) students need a meaningful learning which connect them with a real-life so that mathematics becomes not abstract subject. Those three things are closely associated to how teachers organize the teaching-learning process. Muir, Beswick, and Williamson (2008) underpin that mathematics learning process depends on the learning approaches that are used.

Therefore, this study investigates this issue justifying in finding the nature of maths anxiety and students with maths anxiety. Furthermore, an advanced analyses of this study includes the appropriate teaching-learning approach for overcoming math anxiety.

## **Discussion**

### ***Limitation***

The analysis about the math anxiety that is possessed by a junior high school students in Semarang. Selecting junior high school students because the formal operation should be conducted in early 11 years old which is Junior High School stage involving abstraction and symbolization thinking (Ojose, 2008). Generally, sociocultural environment is change when students move to junior high school. Therefore, they need an early treatment for their math anxiety. The scope of analysis is also justified in Semarang region of Indonesia because the different regions might have different factors and levels of mathematics anxiety for example students in Semarang and in Papua where there are differences in facilities, infrastructures, cultures and human resources.

## ***Math Anxiety in Junior High School Students in Semarang, Indonesia***

*The teacher begins the classroom activity with some clarifications about learning objectives which students should engage in that day. After that, the teacher continues to make sense of notations, representation, terms and formula. The students only listen and sometimes take notes what teacher is explaining without any participation spaces.*

Imagine the illustration above to evoke on how mathematics class is frequently just in the form of listening and writing and teacher's authority is dominant now then. In some cases, the teacher often comes into the class and intends to teach with a lesson plan containing learning objectives, materials, and even assessment guide as if the day would be a joyful learning for students. Inversely, there are also common negative responses from students as a kind of rejection or low self-esteem to enjoy the activities of such things. One of the general factors is a negative stigma attached to mathematics educators, subject matter or mathematics learning process (Siswono, 2014). Those negative stigma which is overshadowing students might trigger a psychological symptoms called math anxiety. Federici, Skaalvik and Tangen (2015) conceptualize math anxiety as an affective variable comprised with uneasiness and fear when working with math later constructing negative responses of math from students. Additionally, math anxiety is also defined as loosely regarded of feelings of fear, avoidance and dread when dealing with any situations relating to mathematics (Zakaria et al., 2012).

According to Ruffins (2007), math anxiety has some symptoms including feeling nervous before a math class, flustering, feeling defenseless while doing homework or going blank during a test. Based on my experiences, the junior high school students in Indonesia particularly in Semarang region are also experiencing the same thing. First, they feel nervous before entering math classes especially for new students. The students began to worry when they heard various negative stigma that later proved by the existence of different lesson material and more abstract than what they got in elementary school. For instance, the negative voices about so many formula should be memorized by them and the amount of materials should be mastered as the condition to achieve the high marks in math class.

Second, students feel increasing panic when following the lessons. It could impact them become more passive. In some my observations, this is often because the teachers who employ inappropriate learning approaches and unexpected behaviors. Finlayson (2014) argues that students face math anxiety in schools because teacher behaviors like focusing on repetition and students rote memorization. These lack of compliances can be understood because there are some changes in achievement standards from the process standard of mathematics education in junior high school level in Indonesia which has been stated in Ministerial Regulation No. 65 year 2013. Besides, teachers are also under pressure by the regulation that they should employ some learning approaches to enhance students' math achievement as well. Although, it sounds like easy to be applied by teachers but, these changes have not occurred in a comprehensive manner so that the subject matter is still explained by the teacher traditionally as repressive as the students have to memorize all of the material (Wicaksono & Saufi, 2013). Whereas, based on the regulations, teachers should

involve active participations of students in teaching-learning process. Taylor and Fraser (2013) also suggest to teachers for creating a positive classroom environment to reduce students' math anxiety.

Thirdly, the worst experienced by students is high anxiety while working on assignment and math test. At the moment, students may feel blanks simultaneously fearing the results obtained. According to Roth and Washlaw (2015) profess the view that the anxiety before math examinations is the indication of a possible loss of control over the task condition resulting failure rather than success. Generally, students probably feel nervous in math test because: (1) the lack of understanding and exercises implies the unpreparedness of math test indicators; and (2) some pressures from their environment particularly their parents who expect them to gain the highest achievements and they could get some punishments for the contrast. In Indonesia, there are three kinds of mathematics test which are routine exam, semester exam and national exam in which its passing grade is increasingly rising. The prime notion of the anxiety in math exam is national exam that still becomes a scourge for students because they only have 'one day test' that decide whether they graduate or not and later it will be one of requirement for enrolling in the university level. Consequently, students undergo the higher anxiety.

Those three cases are generally suffered by junior high school students in Semarang, Indonesia. Nevertheless, Ruffins (2007) clarifies that people who fear math does not mean they are bad at it but there is a dense relationship between math ability and anxiety. It can be affirmed that people who already had math anxiety would have a tendency to avoid math-related classes and later imply in decreasing their achievement. Thus, an effort to create a positive teaching-learning process of mathematics could be a significant suggestion.

### ***Realistic Mathematics Education***

Several studies have been conducted to analyze how to overcome the students' math anxiety. Based on Finlayson (2014), math anxiety is usually linked on teaching style so, the discussion of the strategies to overcome math anxiety is dwelled with teaching-learning process. In a short, math anxiety has caused by three main factors that come from students-self, mathematics stigma and the teacher' behaviors. Yet, the main actor both as major factor and the one who can devote to counter math anxiety is the teacher. McGraner, VanderHeyden dan Holdheide (2011) also assert that teacher plays important role in teaching-learning process so they have to create an effective learning approach.

It has been a persisted discussion that a teaching-learning process of mathematics often potentially promotes student stress instead of creating a meaningful learning. Thus, the notion of learning approach is the second prominent in the teaching-learning process which is also essential in reducing math anxiety because it talks about on how teachers planning, action and evaluation. Moreover, teachers should arrange the lesson plan by regarding to the characteristics of students self, the learning objectives, the burden of materials and time allocation then counterweighing with the positive attitude from the teacher.

Realistic Mathematics Education (RME) is one of learning approach concerning the strategy that would be analyzed for conquering math anxiety. It was a learning approach which has been developed by Heuvel-Panhuizen (1996) because the Dutch reform movement in education encourage to prevail home-grown mechanistic approach to arithmetic education. Moreover, RME approach has also already employed by some teachers in mathematics class in Indonesia including my research experiment in applying RME approach with some math teachers in Semarang. Negara, Sujadi and Pangadi (2013) investigated the comparison analysis of applying RME in elementary school which is denoted that RME is not a strange notion for teachers.

According to Heuvel-Panhuizen (2003), a learning approach of RME allows students to learn mathematics by developing and applying mathematical concept linking to tools in the daily life problem situation that make sense to them. In addition, Stephan (2009) underpin the idea of Heuvel-Panhuizen by articulating that the teaching-learning process should design the instructions reinforcing students' reasoning from concrete to the abstract notion with imagery. The concept of real-life context means that teacher cannot urge students to master and think of mathematics in the abstract ways by magic because every students have their own level of understanding and ways of thinking. Therefore, teacher should organize the instructions intentionally convey student thinking gradually toward more mathematically abstract.

*Teacher wants to explain about the concept of positive and negative values and she take a daily life story before starting math class.*

*'Yesterday, I climbed mountain Ungaran in Semarang with some friends. I felt that it was sunny day with the air temperature was about 32 degrees. However there was a difference of weather extremely when we reached the top of the mountain. Surprisingly, it was (-2) degrees when I checked the temperature then.*

*Anyone know what is the difference of the air temperature I experienced yesterday?*

The illustration above is the example of stories which could be delivered to students so that they are interested then imagine how it was. The story can be supported by using any tools like when the teacher want to deliver geometrical material. Heuvel-Panhuizen (2003) claims that mathematics aid tools (models) are beneficial to ease students' imagination of the reality and understanding of the other formal system. The next, teacher may continue to some questions guiding students to construct their preliminary knowledge bridging to the core material.

In a brief, Üzel and Uyangör (2006) state that there are three guiding heuristics of RME approach: (1) *reinvention through progressive mathematization* in which students should be provided a series of instructional activities using real-life context and informal solution strategies to invent more formal mathematical concepts; (2) *didactical phenomenology* refers to students' engagement in class discussions related with progressive mathematization so that students can renegotiate sophisticated solutions toward some real-life context problems individually or in group discussions; and (3) *informal to formal mathematics* means that students are guided to explore a model-of a situational problem activities later altering it to more mathematical reasoning using symbolizations. Based on those heuristics, Realistic Mathematics Education is not just a learning approach to overcome math anxiety potentially but

also enhance other math abilities such as reasoning, critical thinking, problem solving and communication.

### ***Overcoming Math Anxiety with Realistic Mathematics Education***

The discussions of a conformity of RME approach for reducing math anxiety are going to be demonstrated by analyzing between the strategies to conquer math anxiety and the characteristics of RME.

#### *Positive atmosphere of teaching-learning process*

The motivation to study can be encouraged by creating a well-being learning environment. This first notion concerns to what J. Martinez & N. Martinez (2003) recommend that the teachers should accentuate their positive experience of mathematics and obstruct the knowledge gap to conquer math anxiety. The positive experiences of mathematics could be delivered by sharing some stories telling like on how in the past, the teacher can achieve the best mark in math test after feeling enjoy to study math, or what amazing part of math which is triggering to problem solving in daily life. The positive experiences might stimulate the spirit of students to enjoy math and realize that a negative stigma about math is not always true. In this regard, teachers also need to provide stories related to daily life as the beginning of teaching-learning process within the framework of the RME approach (Heuvel-Panhuizen, 2003). Additionally, teacher could introduce some historical value of mathematics including the mathematicians and their inventions to motivate students (Ruffins, 2007). The way of telling some stories could emerge students' interest of math and their engagement toward teachers' stories. Besides, teachers would not be considered as a strange who have to be feared or avoided in math class. If the positive atmosphere which may be in the form of math team could be generated then all students will relieve in engaging with math class.

#### *Making sense mathematics*

The next exploration relates to the investigation of Jain and Dowson (2009) that one of strategy to overcome math anxiety is by increasing the self-regulation referring to self-directed cognitive and metacognitive activities. Thus, the correlation appears between the concept of making sense and self-regulation. When students really understand either the concept or the application for every part of math lesson, it means that they can more elaborate students' self-regulatory capacities. As a result, students' math anxiety are gradually reduced. In the step of making sense mathematics, Hough and Gough (2007) suggest some of the key features: (1) the use of informal strategies; (2) informal to formal progression; and (4) the use of models. Those key features actually are a series of representing mathematics to be more concrete with a logical justification toward the students. They might hold their own prior knowledge so that they can only represent their voice in the informal methods. Therefore, teacher could begin the class with informal strategies providing a space for students participatory. Some contextual stories like in the previous explanation or using the models underpin the stage of teaching-learning process. It is also delivered by Ruffins (2007) who claims that it is required to employ some visualization of math problem in more concrete terms like using real-life context.

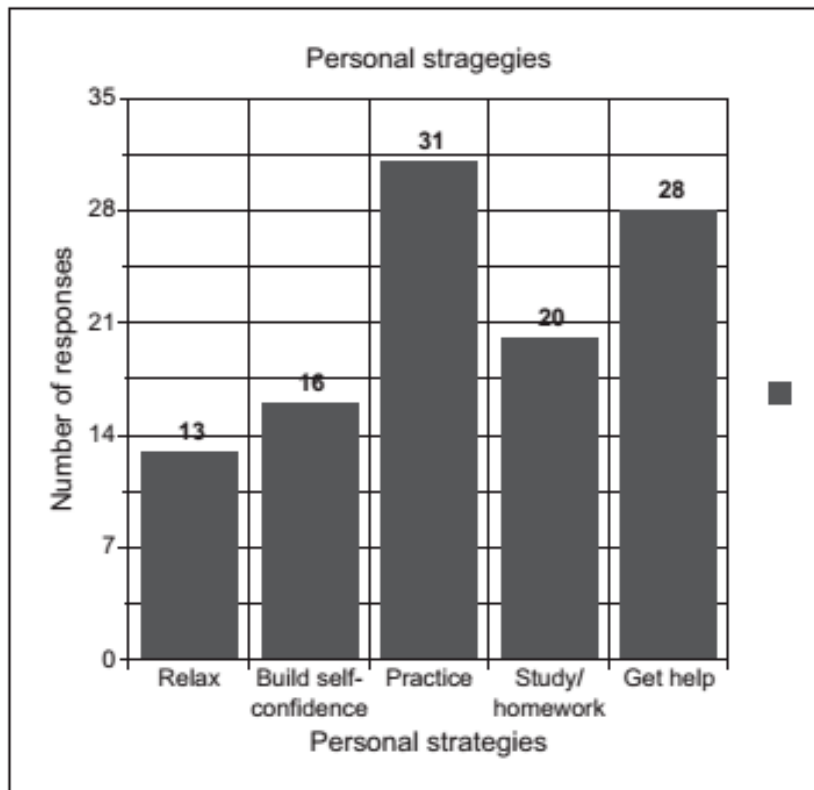


Figure 1. Personal Strategies (Finlayson, 2014)

The next two notions are a consideration of what Finlayson (2014) discovered in his experiment about the personal strategies employed by students to lessen math anxiety. From the bar chart, it is obvious that students tend to choose the strategies of practice and get help as their strategies for overcoming their mathematics anxiety.

#### *More practice for students*

Thorndike strengthened the existence of practice by his theory “the law of exercise” emphasizing that exercise can reinforce the connection between stimulus and action (Mulyati, 2005). Similarly in the teaching-learning process, where students should often have some mathematics problem exercises to improve their mathematics ability so that they could feel more organized in joining math class. In the notion of practice, Stephen (2009) affirms that one of heuristics in RME approach also underscores a set of tasks consisting of word problems, in which students are expected to show progression involving presenting the problems both with words and symbols. In this phase, teachers plays important role in guiding students’ confidence to demonstrate their strategies of problem solving. Teachers need to give positive attitude embracing students’ questions when they got stuck.

#### *Students collaboration*

The other personal strategies to overcome math anxiety is students favoring to get help from peers and teachers. The notion of get help refers to the need of others to share and create a comfort zone to learn math. The need for sociocultural is also corroborated by Vygotsky who has said that students need help from others to provide a sense of comfort and strengthen the understanding obtained previously (Trianto,

2007). However, there are some factors causing math anxiety come from people around him/her. Therefore, the teacher as a main role in math class should learn on how to provide a good behavior then elaborate a class collaborations. For that case, teacher could harness one of the RME approach by making some groups of students to discuss about math problem tasks so that they can feel a meaningful investigation and comfortable atmosphere (Ruffins, 2007). This group is not only set up to discuss the ways of problem solving, but also be able to jointly understand the concept of a material that day. For instance, the teacher can promote a discussion to reinvent a certain mathematics formula by giving a series of team-work guide, and workbook as well. In this step, it should be emphasized that every students' participation can be harnessed as the contribution to help others looking at problem. Students could get a peer role models and social support that allowing correction without grading, showing alternative ways of problem solving and emphasizing residing with problem until it could be solved

#### *Process-led rather than content-led objectives*

The last notion denotes the theory from Hough and Gough (2007) emphasizing process-led rather than content-led objectives. This concept significantly relates to the recent paradigm of school mathematics in Indonesia ascribing to the results rather than the process. In fact, students tend to do all the efforts even not advisable ways like cheating to achieve the best mark. Toward math anxiety, the more pressure the more tensions students gain. Thus, teacher have to appreciate for every progression which students have demonstrated in the midst of their work. Students who get positive response for their work might feel that they have satisfied teachers' expectations prompting their enthusiasm to strive more. Inversely, students could only have result-oriented affecting in increasing their stage of math anxiety. Based on the research which is conducted by Yusuf (2013) has been shown that students will more easily memorize various types and steps when the teacher gives appreciation and confirmation for their working processes.

Unfortunately, there will be also some groups of students who demonstrate slow progression of their mathematics work. As the response, teacher should be keeping alive the sense for concerning the characteristics of every students and choosing treatments for them. Toward this last theory, the nature of junior high school students in Semarang, Indonesia particularly in math anxiety symptoms is afraid to attempt for solving the problem in their own way, so they prefer to keep quiet rather than participate. Accordingly, when teachers can employ this theory of RME approach properly, it could encourage students' confidence to participate more.

Departing from the question: *How are the significance of RME as teaching-learning approach toward the solutions for overcoming math anxiety?*, we found that there five main terms considerably constituting the answer of that question. Those five main terms include the positive atmosphere of teaching-learning process, making sense mathematics, more practice for students, student collaboration, and process-led rather than content-led objectives. Nevertheless, it strongly requires the roles and competence of teachers supporting every single steps for employing RME approach.



## **Conclusion**

The math anxiety is one of the psychological factors that can hinder the achievement of student learning. Based on the analysis, math anxiety belongs to the reasons why the interpersonal relationships are very important in understanding mathematics. This is because that anxiety itself can proliferate, has subjective characteristic and tends to be difficult for understanding. Students who are more anxious will attempt ever harder, but their understanding might be inferior, so that they got more anxieties. Several factors cause mathematics anxiety both externally and internally which are negative stigma about mathematics, teaching and learning process are less meaningful, the attitude of teachers who are less motivated and high standard of learning achievement.

A learning approach is significant suggested in case of conquering math anxiety. Realistic Mathematics Education is one of learning approach that has three main concept consisting of the real-life context, collaboration and cooperation, and guided reinvention. Based on the analysis of the things that need to be done to overcome math anxiety and characteristics of RME, and then obtained the conformity between the two. As we saw, Realistic Mathematics Education (RME) has some key features not only as a solution for reducing students' math anxiety but also enhancing math ability such as understanding, critical thinking, problem solving, and communication. Thus, teachers are encouraged to apply RME approach as one of the strategies, which certainly needed an understanding teacher beforehand about the procedures. It seems that an effort to implement RME as a teaching-learning approach need some considerations concerning time allotment, math topic and teacher's skills.

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