

Research Article

Bringing Compassion to Mathematics Learning in Elementary School

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Abstract.

Poor instructional design is alleged to be the cause of the low ability and poor mathematical attitude of students. The preparation of learning design focuses too much on academic intellectual barriers and tends to override psychological-emotional barriers. Without overcoming cognitive and emotional barriers at the same time, a student will not achieve optimal results in learning mathematics. This study aims to analyze the needs of learning mathematics in elementary schools and especially analyze the existence of social emotional barriers in learning mathematics. The results of the learning needs analysis are used as the basis for developing a more comprehensive mathematics learning design. This study uses a qualitative - descriptive method. The study was conducted in 10 elementary schools in East Java involving 30 students and 10 mathematics teachers. The results showed that students who had difficulty in learning mathematics were not always due to the student's academic capacity, but were also influenced by their ability to focus, struggle, and their involvement in learning. The teachers so far only focus on overcoming academic obstacles and tend to override social emotional barriers in learning mathematics. The purpose of learning mathematics will be achieved when the teacher succeeds in overcoming both intellectual and emotional problems. The implications of the research findings show the urgency to include the value of compassion in mathematics learning, especially at the elementary school. Compassionate mathematics is an idea to collaborate on social emotional learning, joyful learning and realistic education in learning mathematics.

Keywords: compassion, elementary school, mathematics learning.

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1. INTRODUCTION

The previous scientists not only considered mathematics as a field of scientific study which was a product of thought, but more than that they saw mathematics as a masterpiece of God manifested in the universe [1, 2]. Galileo even called mathematics as the language of God when writing the universe. The beauty of mathematics in the universe can be found in the structure of the human body, DNA composition, mountains, shells, flower petal structures and so on [3, 4]. Unfortunately, the beauty of mathematics seems invisible to most of today's generation. Several studies confirm that mathematics is an unwelcome subject [5, 6]. Students from various levels of formal education, from elementary to high levels tend to dislike mathematics [7]. Not a few of the students associate mathematics with a less pleasant learning experience. Mathematics is even considered synonymous with negative feelings [8].

Students' attitudes towards mathematics affect their performance in mathematics. In Indonesia, students' mathematical ability in mathematics is relatively low. Both when referring to the results of research by domestic researchers, as well as the results of research or tests conducted by researchers/international institutions. A study conducted by TIMSS (the Trends in International Mathematics and Science Study), which measures the achievement of grades 4 and 8 students in mathematics and science, exposes how low the level of understanding of students in Indonesia is in the field of mathematics. The ranking of Indonesian students' mathematical abilities has even been consistent in the distended order in several years of implementation. This achievement is in contrast to the results achieved by other Asian countries such as Singapore, Chinese Taipei and Japan, which top the list. Similar results were also obtained by Indonesian students based on the test conducted by PISA [9, 10].

TABLE 1: Indonesian ranking based on TIMSS.

Timss Results			
Year	Rank	Average Score of Indonesia	Average International Score
2003	35	411	467
2007	36	397	500
2011	38	386	500
2015	44	397	500

The poor mathematical ability of Indonesian students is categorized into a big problem. Mathematics has played a major role in all technological advances and modern scientific endeavors [11]. Studying mathematics will not only develop more engineers and scientists, but also produce more citizens who have the ability to problem solving,

think creatively and critically regardless of their career field [12]. Improving mathematical proficiency means investing in improving human resources that will have an impact on the progress of a country. Therefore, the poor mathematical ability of students in Indonesia is a serious problem which then, a solution needs to be found immediately. The best step in this effort is to involve both students and teachers. From the teachers, they will get what obstacles they have encountered in learning activities. Meanwhile, students will get information about what they really need in order to understand mathematics better.

Many studies examine the low ability of students and barriers to learning mathematics in Indonesia. Some researchers even provide recommendations on approaches, models and or media for learning mathematics that they claim can improve student learning outcomes and understanding [13–16]. Several other studies focus on studying learning constraints in certain contexts, such as learning mathematics during the COVID-19 pandemic [17, 18]. However, the research that has been done so far tends to focus on overcoming the cognitive-intellectual barriers of students in learning mathematics [19] and tends to rule out the possibility of emotional-psychological barriers in learning mathematics. This study analyzes the need for learning mathematics and identifies cognitive and emotional obstacles to learning mathematics in elementary schools.

2. RESEARCH method

This research is a descriptive qualitative research. Researchers investigated the learning experiences of students and teaching experiences of teachers in elementary schools. The subjects in this study were mathematics teachers and grade 5 elementary school students. This study involved 30 students and 10 teachers from 10 elementary schools in East Java province, who were selected using a purposive sampling technique. The selection of schools uses location considerations, namely 5 schools from urban/district areas that are considered advanced, while the other 5 schools are schools originating from suburban areas. Three students selected from each school represent students who are considered to have good math and communication skills. Meanwhile, one teacher selected from each school is a mathematics teacher or classroom teacher who has more than 3 years of experience teaching mathematics in primary schools. Data was collected through interviews about the experience of learning mathematics in elementary schools, including approaches, methods, media, learning outcomes and design of learning mathematics that are considered ideal.

3. result and discussion

The results showed that mistake in designing mathematics learning in elementary schools were often caused by errors in formulating mathematics learning objectives. The purpose of learning mathematics which is believed by many people is so that students have good computing (counting) skills. To arrive at this goal, students need to memorize formulas and procedures (stages/algorithmic) for solving mathematical problems. 7 out of 10 respondents in this study admitted that they used the repetitive practice method as the learning method they used the most. They believe that this method is effective in improving students' skills in mathematics.

Mathematics should be taught to students not only to practice computational skills. Formally mathematics is taught with the aim of organizing reasoning and shaping students' personalities. While materially students are expected to have the ability to solve problems and apply mathematics in various situations [20, 21]. Mathematics is taught to build mental discipline and logical reasoning [22]. Mathematics trains a person to have the ability to propose hypotheses, test and find evidence, draw conclusions while remaining open to new information [23]. With this ability, a person will have the opportunity to have a better quality of life. In addition, mathematics gives a person the critical ability to learn and think logically in any field of endeavor [24, 25]. Designing mathematics learning which only trains numeracy and procedural skills, means that it has narrowed the objectives of learning mathematics.

Another finding from the analysis of the needs for learning mathematics in elementary schools is the importance of realistic mathematics learning. So far, the planting of concepts in learning mathematics in elementary schools is mostly conveyed in the abstract, not using concrete objects or things that can be imagined by students. In fact, this has happened since the students were in the early grades (1, 2 and 3). Students in the early grades experience a very drastic change in learning style from the previous level (pre-school). Some teachers even use example questions or even formula introductions. The examples presented also do not use concepts or things that are commonly encountered by students in their daily lives.

Another important finding in this study relates to the selection of methods or approaches to learning mathematics. Teachers in primary schools often explain mathematics to students using abstract concepts. The teachers argue that mathematics is a science that studies abstract objects [26, 27], so introducing mathematics to students using symbols or mathematical notation is a natural thing. In fact, the important thing that teachers should not ignore is the fact that children in elementary school are not yet

skilled at abstract thinking. Based on Jean Piaget's theory about the stages of cognitive development [28–30], children who are in the age range 7-11/12 years are in the concrete operational stage. At this point they need a realistic approach to learning mathematics. The RME approach means presenting mathematics by starting from realistic objects, namely objects that can be felt or imagined by students [31, 32]. Realistic mathematics learning will not only increase student involvement in learning, but will also increase student understanding.

Another finding that is no less important related to learning mathematics in elementary schools is the urgency of designing mathematics learning that also facilitates the development of students' social emotional abilities. Bringing socio-emotional value to mathematics learning means training students to be able to effectively apply the knowledge, attitudes, and skills necessary to understand and manage emotions; setting and achieving goals and being able to make effective decisions [33, 34]. Mathematics learning so far is considered dry and over-cognitive. Learning mathematics is an intellectual and emotional challenge, and so far most teachers and researchers focus too much on the cognitive only. Without overcoming negative emotions, a student will not progress academically intellectually. Learning that uses and manages emotions is known as social emotional learning (SEL) [35–38].

It is not without reason that mathematics has been a subject that is disliked and considered difficult by many students around the world [19, 39]. Not only that, mathematics is also always associated with negative feelings [8, 40, 41]. The explanation why mathematics is considered difficult is that solving a mathematical problem requires extra effort, time and energy [5, 19, 39]. The students consider math difficult because math requires perseverance and patience. Not a few who allege that mathematical ability is something genetic [42], only those who are born carrying the "mathematical" gene will become experts in this field. Mathematics only belongs to intelligent people [43]. In fact, often the difficulties people have with math are due to endurance and persistence. Everyone has the opportunity to study mathematics to the highest level [44].

Learning mathematics that facilitates the development of social emotional aspects is also a solution to the obstacles in the low quality of focus and concentration of students. Mathematics requires perseverance, thoroughness, and endurance. Those who fail to solve math problems are not always because they can't. Often these students are simply not patient enough to follow lengthy mathematical problem solving procedures that require precision [45]. Among them, which is indicated to be the cause of the low concentration ability of students is their habit of using multimedia devices such as gadgets [46, 47]. Students are accustomed to being treated to a variety of attractive

multimedia offerings (various colors, sounds and motion). So that when facing math problems in the form of text (letters and numbers), students get bored quickly.

Regarding the enthusiasm and involvement of students in learning mathematics, a fun learning approach is needed. Based on the findings from interviews with respondents, students showed enthusiasm for learning mathematics when the teacher used a humane learning approach and fun methods. Students are seen to be active in learning mathematics activities when the teacher succeeds in establishing humanistic relationships, regardless of their level of understanding of mathematics. Likewise, when teachers use fun methods such as quizzes, students scramble to answer and show joy in learning activities. Humanist learning approach makes students' involvement in mathematics learning increase.

A fun approach to learning mathematics is important to do because it is to refute the stigma that is already attached to mathematics [48]. The majority of students come to class with unpleasant experiences of learning mathematics at the previous level. In addition, many students do not like mathematics and associate mathematics with negative feelings. There is a considerable amount of research showing that the best conditions of learning for children as well as adults are in a happy situation [49]. Feeling happy when learning mathematics will boost children's motivation and potential [50, 51]. On the other hand, feelings of dislike and/or anxiety with mathematics have an impact on students' motivation and learning outcomes [52, 53]. For that, teachers need to create a pleasant atmosphere in learning mathematics.

Broadly spoken, from the results of the needs analysis in learning mathematics, realistic learning is needed (realistic mathematic education), learning that emphasizes the emotional aspects of students, and learning that is fun (Joyful Learning). Geillan Aly [54] calls learning mathematics that not only overcomes intellectual barriers but also emotional barriers as compassionate math.

Talking about compassion, the last subject that comes to mind is mathematics. So far, mathematics is more synonymous with negative feelings and compassion is the furthest thing from the mind when hearing the word mathematics. Even the academic sphere was first familiar with the term mathophobia [55, 56] which Lazarus defined as an uncomfortable feeling that comes when faced with math problems. Compassionate math is not something that comes to mind because too many math students are busy feeling sorry for themselves when they have difficulty studying math that can be solved by memorized procedures or algorithms [57, 58]. Compassionate math is the realization that in learning mathematics there are not only intellectual barriers, but also emotional

ones. Students will only move forward intellectually when they succeed in overcoming negative emotions [54].

Compassion is a value rooted in the teachings of many religions, beliefs and belief systems [59–61]. Bringing the values of compassion to mathematics learning means integrating not only social emotional learning, but also religious values with mathematics learning. Because it is in harmony with religious values, compassionate math will be easily accepted by various groups. In addition, compassionate math shares a vision with the goals of learning mathematics in the 2022 prototype curriculum.

4. CONCLUSION

The results of the study show that the low mathematical ability of elementary school students in Indonesia is an accumulation of several factors. From the learning aspect, the choice of approaches, methods, techniques, strategies and even mathematics learning media is often not in accordance with the stages of children's cognitive and emotional development, characteristics of mathematics, and the objectives of learning mathematics in general. Another important finding is that the low mathematical ability of students is not always caused by their low academic capacity, but can also be influenced by their ability to focus, struggle or resilience, and their involvement in learning. Students who consider math to be a difficult subject sometimes just need extra patience and persistence. This is because solving math problems requires more than just academic capacity, but also a lot of energy, thought and time. The purpose of learning mathematics will be achieved when the teacher succeeds in overcoming both intellectual and emotional problems. The implications of the research findings show the urgency to include the value of compassion in mathematics learning, especially at the elementary level. Compassionate math is an idea to collaborate on social emotional learning, joyful learning and realistic education in learning mathematics.

Limitations in this study include the limitations of research subjects and research locations. Respondents in this study were limited to elementary schools that were selected randomly and were limited, so they were not representative enough to make generalizations. In addition, more in-depth research is needed on the design of compassion-laden mathematics learning. Although there have been many studies that carry the theme of bringing the value of compassion in the context of education and training, there are no specific studies that have examined it in the scope of mathematics.

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