

# AN INVESTIGATION OF STUDENTS' UNDERSTANDING AND BELIEF ON MATHEMATICAL PROBLEM SOLVING IN THE CONTEXT STRUGGLE MONUMENT

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## Abstract

This research is a qualitative research that aims to describe students' understanding of problems solving the problem and also to describe students' belief about their solution to problems solving. The subjects of this study were 6 students in SMP Palembang that consisting of 2 high-ability students, 2 medium-skilled students, and 2 low-ability students. Data obtained through written test and interview. The results of this study indicate that only high-ability and medium-skilled students are able to understand the problem. This is illustrated by the verbal arguments given by the students when asked to explain the problem situation and to represent it in non-formal form. If viewed from the aspect of students' beliefs about their solution in problem-solving, seen almost all students are not sure with the answer he wrote. This is due to the limited ability of mathematical students and the lack of knowledge of students in writing mathematical models or confusion in using appropriate strategies to solve the problem.

## INTRODUCTION

In learning, students' achievement is strongly influenced by several factors. There are factors that are from within the student and there are factors that come from outside the student. External factors include teachers, infrastructure, curriculum, and costs. Whereas those that are from within include attitudes, interests, motivation [1]. Based on the results of earlier studies, in addition to the two factors above, there is still one other reason that also influences student learning prestige, namely belief.

Belief is a state of mind in which someone thinks [2] about being something with or without empirical evidence to prove that something has factual certainty [3]. Belief is also defined as a mental representation of an attitude [4] that is positively oriented towards the possibility of something right, referring to personal attitudes related to ideas or concepts that are true or false. In mathematics education and learning, there are still many false beliefs, such as considering mathematics as a very difficult lesson, very abstract, full of formulas, and can only be "mastered" by genius children. [5] suggest that beliefs consist of several types, namely:

Existence such as belief in God Almighty. If we realize that what we feel is an internal conclusion about what is happening in the outside world, then our first belief is that what we feel really exists. Such beliefs are often regarded as meta-beliefs that are interpreted as beliefs about beliefs.

Associations or other terms are defined as understanding things in other matters. Thus when we say A is like B or is related to B in several ways. This belief is often called

perception. Perception is defined as a belief about how the world seems, based on the evidence I have.

Opinions are interpreted as beliefs about how I should interpret reality

Predictions are defined as beliefs about how I think everything will end in the future based on what I know now. Therefore, these beliefs are often interpreted as a theory that I interpret through perception. The best beliefs are not the closest to evidence but believe that make the boldest predictions that seem most unlikely.

However, teachers play an important role in building students' belief in mathematics. What students believe depends on the amount of experience gained during learning mathematics [6]. To provide experience to students about mathematics lessons is easy, not everything is abstract, not only contains formulas, and can be followed by all students, of course special skills are needed from the teacher. The teacher is not only able to choose the right approach, strategy, or method of learning mathematics but also wants to teach it.

Belief can be illustrated as follows. When students are given questions they have never known before, such as there are problems that are not clear, such as problems that are not clear goals, the solution path and do not know the form of the expected solution later, then all students must agree to say that the problem they are do it hard We called it as problem-solving. In the case of problem-solving, there are many possibilities to speculate both about ideas, the nature of mathematics, as well as ways or solutions sought [7]. For example, every student will have the opportunity to get their unique solution [8]. They can respond to problems in a significant way with many different solutions. Students will also have more opportunities to comprehensively use their mathematical knowledge and skills to solve problems. They will also choose their favorite strategies to get answers and create their unique solutions.

They tend to be pessimistic and think what they are doing is not true. But on the contrary, when students are faced with problems that are often encountered, students have a tendency to solve it well, because students know what the main problems are and what strategies must be done to solve them.

Representation of mathematical problems in formal form makes the reason that mathematics is dry, difficult, and unattractive, and is not related to human activities [9]. Therefore, it is necessary to find and add context to mathematical problems [10]. The use of local context can help students understand mathematical phenomena from the perspective of their own life experiences [11]. One context that can be used in making questions is the context of the struggle monument (Monpera).

There are very few researchers who explore the influence of context in problem solving and why students' problem solving abilities are still low. Is there a connection to problem solving ability with an understanding of the problem itself, and how students' belief in the solution they have given? Based on this, researchers are interested in examining students' beliefs about problem solving problems that are modified with an environment that is familiar to students. Based on the description above, the researcher is interested in studying the students' understanding and beliefs in solving the problem of solving the context of the struggle monument (Monpera).

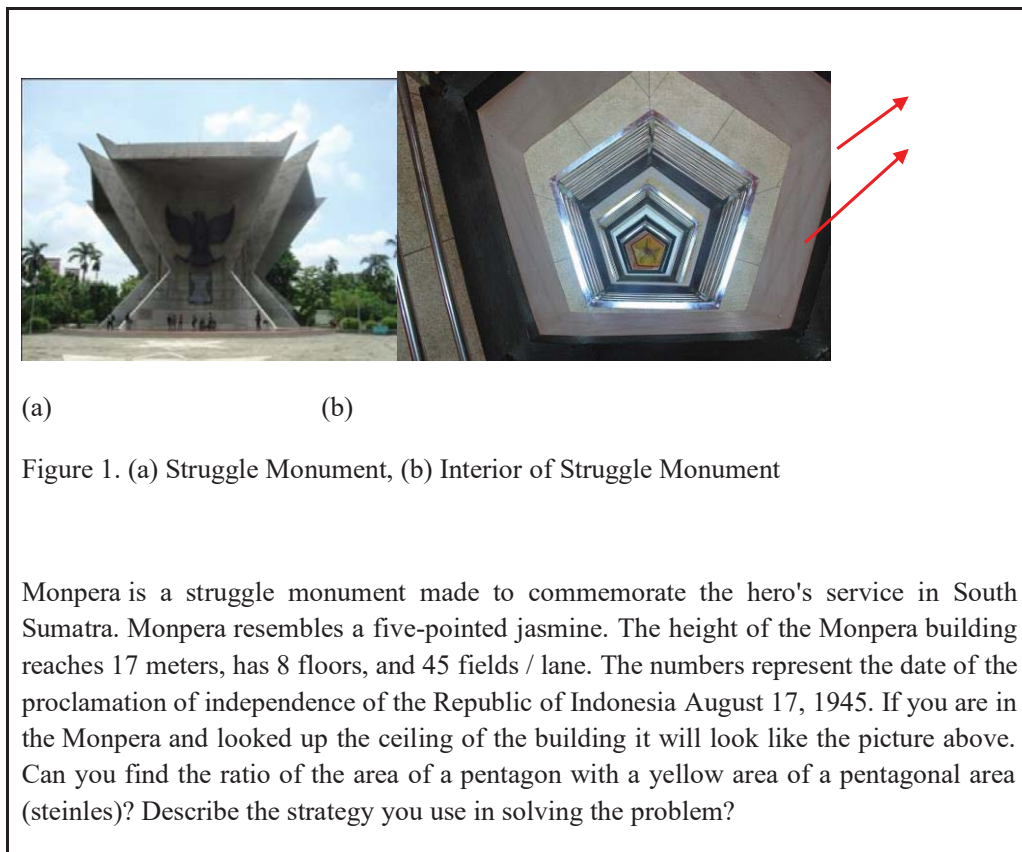
## RESEARCH METHODS

The subject of this study consisted of 6 students consisting of 2 high categorized students, 2 moderate categorized students, and 2 low categorized students. This research is a qualitative research. Qualitative research aims to get a complete picture of students' ideas, perceptions, opinions, and beliefs about problem-solving problems. All of them cannot be measured by numbers [12]. Based on this theory, the focus of this research is to get a complete picture of ideas, perceptions, and opinions of students on the problem of solving the problem of the monument's context of struggle, as well as its belief in the solution given.

There are four types of data collected in this study, namely: opinion data, behavioral data, fact data, and knowledge data. Opinion and knowledge data related to students' understanding of problem-solving problems. Behavioral data are related to what students have done when solving problems and what they plan for the next solution. Fact data related to students' beliefs about the results that have been done.

There are two data collection instruments used in this study namely tests and interviews. All data that has been obtained is then analyzed qualitatively by reducing it, presenting it and finally making conclusions. The following questions were asked during the interview.

The test is used to see the process of work on problem-solving questions conducted by students. The following is a problem solving problem used in this study.



The interviews are used to explore students' understanding and beliefs. Belief is also often regarded as a rather vague statement and often reflects the inner uncertainty of people who speak this way. Belief often limits one's self. [13] frequent limiting beliefs about someone's self and identity. Words such as "not my field", "not my hobbies", "I do not deserve", "I cannot", "I do not have time", "I am not smart", "he is better than me", and "I afraid". Belief can be grown from experience, 'infected' by other people's beliefs, a reason, and courage. These questions used in interviews.

Table 1. Questions Were Asked During The Interview

Aspect of Understanding [14]	Aspect of Belief [15]
Do you understand all the words that have problems?	Do you know the monument of the people's struggle (Monpera)
Do you know the main sentence of the problem?	Do you like math?
Do you know the scope discussed in the problem?	Do you often practice solving math problems?
Do you know what the main problem is?	Is the time given enough to solve the problem?
Can you express the problem in your own words?	Have you ever solved a problem like this?
What elements are known from the problem?	Does the context of monpera help you in solving problems?
In your opinion, is the information provided is enough to solve the problem?	Have you ever seen a problem like this?
Is there anything else you need to solve it?	Do you know the concepts or theorems that can be used to solve problems?
What is unknown about this problem?	What strategies are used in solving problems?
Are conditions enough to find the unknown?	Are you trying to solve the problem completely?
	Do you feel challenged to solve the problem?
	Do you solve the problem seriously?
	Do you do it yourself without help from others?

Aspect of Understanding [14]	Aspect of Belief [15]
	Are you sure the answer you gave?

## RESULTS AND DISCUSSION

### Understanding and Belief of Low-Ability Students

The study began by giving problem-solving problems to 6 students namely MI, NA, SiW, SrW, FH, CM. Students are given 30 minutes to complete one problem-solving problem. Here are the answers from MI and NA (students with low abilities).

Konvensional:  
 Dik: Tinggi bangunan Monpera mencapai 17 cm, memiliki 8 lantai, dan 45 bidang/jalur.  
 Dit: Jelaskan strategi yang ada guna dalam menyelesaikan soal tersebut?  
 Jawab: Perbandingan yang akan digunakan dalam menyelesaikan soal;  
 Perbandingannya adalah 1:5 //

Gambar yang terlihat pada gambar diatas.  
 Perbandingan luas pada bagian atas Monpera antara  
 Lapis kuning dan Lapis stainless adalah berdasarkan jumlah lantai/  
 tingginya yang terlihat pada gambar.  
 Jadi perbandingannya sebesar 1:6 karena stainless terletak  
 pada lantai 6 dan kuning terdapat pada lantai 1.

(a)

(b)

Figure 2. (a) Answer of MI dan (b) Answer of NA

To check the validity of the data related to students' understanding and beliefs in problem-solving, researchers conducted interviews with MI and NA. Following are excerpts from an interview with MI:

Researcher : "Do you understand all the words that are problematic?"  
 MI : "Yes sir".  
 Researcher : "Do you know the main sentence of the problem?"  
 MI : "Yes sir. The main sentence is the figures of the monpera building representing the date of the proclamation of Indonesian independence, namely August 17, 1945."  
 Researcher : "Do you know the scope discussed in the problem?"  
 MI : Yes, Monpera isn't it sir  
 Researcher : "Do you know what the main problem is?"  
 MI : Yes sir, about the comparison of stainless and yellow wake.  
 Researcher : "Can you express the problem in your own words?"  
 MI : "Yes sir. This problem is a math problem about Monpera sir

Researcher : "What elements are known from the problem?  
 MI : "In the written matter that Monpera is 17 meters high, has 8 floors and 45 lines.  
 Researcher : "In your opinion, is the information provided is enough to solve the problem? and Is there anything else you need to solve it?  
 MI : "Yes sir, it's enough"  
 Researcher : What is unknown about this problem?  
 MI : the strategy used to solve this problem  
 Researcher : "Are conditions enough to find the unknown?"  
 MI : "Yes enough sir.

From the answers above, it can be seen that MI and NA are truly unable to understand the problem given. Although MI wrote there were elements that were known and asked, however, it was seen that between the elements that were known and those who were asked were not interrelated and still not relevant. MI not only cannot solve it, but also feels confused when reading and expressing problems in its own language. Based on the results of the interview, it was seen that MI answered the problem above only for development. Almost the same thing was found in NA. NA only translates the problem based on the image that is visible. NA does not associate information in the picture with the information contained in the problem, such as facts related to the Monpera written on the question.

Along with interviews about student understanding, researchers continued to interview about beliefs about problem solving. Based on the results of the interview, it can be concluded that MI and NA have similarities, for example they are both categorized as weak students in mathematical concepts. The difference is that NA prefers mathematics a little, while MI really doesn't like mathematics. Based on the results of the interview, it was also concluded that MI and NA knew about Monpera but were not detailed and had never entered Monpera. Their limitations make them rarely practice math problems. So it does not feel challenged to solve the problem seriously. MI also did not dare to ask from his friend. Because MI is categorized as lacking students, MI does not know what concepts or theorems are used. Even if the time given was more than 30 minutes, MI did not know how to solve the problem so MI was not sure of the answer.

MI and NA not only could not solve it but also felt confused when reading and expressing problems in their own language. There are several things that cause students not able to understand the problem, among them, is the students' verbal ability in digesting the question sentence is still low, the students' low ability to find a relationship between problems with prior knowledge, and low prior knowledge (previous concepts) [16].

### **Understanding and Belief of Moderate Students**

In this study, SiW and SrW were categorized as medium-capable students. Here are the answers of SiW and SrW.

Dik: tinggi monpera 17 meter, 8 lantai dan 45 bidang / jalur.  
 Dit: Perbandingan luas kuning dan luas stainless  
 Jawab: Perbandingan luas kuning dan luas stainless dapat dilihat dari banyak lantai yang ada di monpera. Sehingga perbandingan kuning dan stainless = 1 : 8

(a)

Jawab:  
 Perbandingan luas kuning dan luas stainless =  $\frac{1}{8}$   
 8 dilihat dari banyak lantai pada Monpera

(b)

Figure 3. SrW Answers and (b) SiW Answers

To check the validity of data about understanding and belief, researchers also conducted interviews with SrW and SiW. From the answers of SrW and SiW, it was concluded that they had many similarities. They did not really understand the problem. For example, they did not know what information was in the problem. Both SrW and SiW seem to be inclined to be able to distinguish between important information and which information is not important. From the results of the interview and the answer sheet, they both showed that they already knew what must students look for when solving the problem, but they both did not have the ability to solve the problem. They both thought that the comparison of the floor of the Monpera was a broad comparison of the two pentagons. The following is done about the belief in problem-solving in SiW and SrW. Based on the results of the interview, it was concluded that SiW and SrW knew about Monpera but were not detailed and had never entered Monpera.

SiW and SrW are categorized as students who like math, but rarely practice solving math problems. They tend to only solve problems that they think are easy. Before the question is resolved, SiW and SrW always see the problem carefully. What information is available, both in verbal and in the form of images. If they considered this problem as an easy problem, so they felt challenged to solve the problem seriously. But sometimes they often forget what concepts or theorems are used to solve the problem. According to the interview, they think just a little help from friends is very meaningful, because it will make them know what is starting point and what must find first when solving problems [17]. They think a little idea can inspire them. Based on interview too, the time to solve a problem is relative. SiW and SrW are sure of the answers they have given.

### Understanding and Beliefs of High-ability Students

In this study categorized FH and CM as high-ability students. Here are the answers to FH and CM.

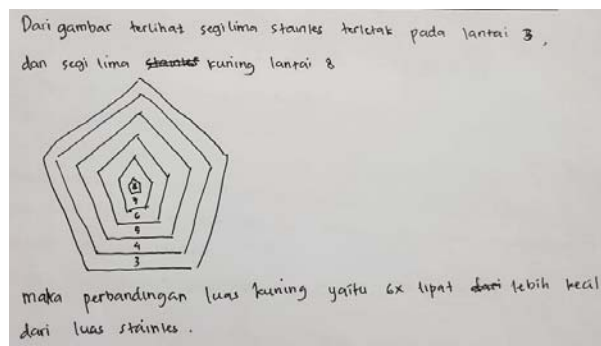


Figure 4. CM's Answer

In this study, researchers also interviewed FH and CM. Interviews are used to see their understanding of the problem and their belief in the solution given. FH and CM have many similarities. Both are very fond of math and often solve math problems, so it is not difficult for them to understand the problem in the problem. Besides that, both of them are also very belief in the answers they have written. According to FH and CM, to get a solution of ratio of two pentagons, it can be obtained by comparing the small pentagon with big one. FH and CM know and understand what is the focus of the problem that they are solving and what is information that known from the problem.

From the results of the interview, there are some information was obtained. FH and CM had never solved a problem like that especially the problem about the ratio of two pentagons. From this information, it can be concluded that FH and CM cannot integrate the concepts that they have learned before, or in other terms, they cannot connect a procedure to another procedure to solve other problems.

Many things that cause this situation, it include student habits [18]. Students who are only accustomed to completing routine problems and single rules, tend not to be able to solve problem-solving properly. Because they rarely meet problems like the above, they are confused about what concepts and ways to use in solving them. FH and CM remember that the teacher once gave a question about the ratio of two flat builds, but the problem was limited to the problem of the comparison of triangles, the comparison of square or rectangular comparison.

## DISCUSSION

Students' beliefs about mathematical problem solving depend on the beliefs held by the teachers [19]. Students believe the answer is correct if there is the same response from the teacher. Students are more convinced of computational questions than reasoning questions. In solving problem solving problems, students from higher levels are better able to articulate beliefs clearly [20]. Students who like math also have high belief. Students who are categorized as high and are more confident than students in the low category. Students who get support from the family are surer to succeed.

Students are more confident in the questions they already know or memorize. Students are sure if in solving problems using the rules or procedures they memorize. One of the things that reduces belief is if there is only one correct strategy and one right solution [21]. Problem solving is a scientific process that evolves from understanding



problems to evaluating solutions, and this process is influenced by several factors. Among other things, one of the most important is belief. In this case not only does belief affect the problem solving process, but also personal factors such as life experiences

Students only have belief in mathematics education in general, that is, student beliefs apply to themselves and about their academic potential related to low mathematics [22]. Both student self-belief and belief in the value of student assignments in mathematics education are low. This is caused by several factors, namely: students do not want to put in a lot of effort in solving problems. Students who tend to have high intrinsic motivation tend to use more effort and are more likely to survive with difficult tasks [23]. Students who want to be actively involved in working on math problems willing to handle new challenges tend to have high belief. The presence of talent and effort also influences students' beliefs [24]. Students also believe that learning mathematics requires special abilities that are not always within reach of everyone.

## CONCLUSION

The results of this study indicate that only high-ability and medium-skilled students are able to understand the problem. This is illustrated by the verbal arguments given by the students when asked to explain the problem situation and to represent it in non-formal form. If viewed from the aspect of students' beliefs about their solution in problem-solving, seen almost all students are not sure with the answer he wrote. This is due to the limited ability of mathematical students and the lack of knowledge of students in writing mathematical models or confusion in using appropriate strategies to solve the problem.

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