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## How student beliefs related to mathematics are influenced by students' past experiences

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**Abstract.** The importance of belief in learning mathematics has now been widely recognized. Some researchers point out that success in learning mathematics, particularly in problem solving, is influenced by students' beliefs related to mathematics and their self-perception as mathematics learners. The aim of this study is to investigate the connection between prior experience and student beliefs related to mathematics. The study uses a qualitative method, conducted through the use of a questionnaire, a mathematics test, and interviews. A questionnaire was randomly distributed to the students of the State Polytechnic of Malang attending mathematics lessons in the 2021/2022 academic year; 46 students, consisting of 32 males and 14 females, filled it out. An interview was conducted with seven randomly selected students out of the 46 who had filled out questionnaires. The results showed that met-before students' Polytechnic influenced belief about: (1) understanding mathematics; (2) learning mathematics; (3) steps and time in solving mathematics problem; (4) teaching mathematics; (5) self; and (6) usefulness mathematics.

**Keywords.** met-before, belief, belief related mathematics

### Introduction

Belief is quite interesting to the attention of mathematics education researchers, especially in relation to behavior, performance and ability to mathematical problems solving. The Importance of belief in learning mathematics now has been widely recognized. Some researchers pointed out, that success in learning mathematics influenced by students' belief about mathematics [1]. Several studies state that beliefs are influenced by social context [2] [3][4], curriculum [5], self [6][7], three construction base motivation that is expectations, values and affective [8][9], and met-before [10][11].

The idea met-before was introduced by [12] to describe how learning this moment influenced by experience who have at meeting past previous student. Term of met-before applies to all current knowledge emerging through previous experience, including supportive met-before (past experiences that support learning moment) and problematic met-before (experiences that don't support or bringing up problem in learning this moment). Met-before is a mental structure we have now as result of experience ever we meet before [11]. Met-before

give enhancement not only for positive effect and negative on learning, but also cause reaction emotional to the learning situation. Supportive met-before give trust in handing everywhere context they work. On the other hand, problematic met-before hinder learning and can delay student in compile new ideas. [13] confirmed that in goal-oriented learning theory, goal associated with joy (when achieved) and frustrated when they hard to understand, next emotional effect happened. The emotional effect relates to students' beliefs.

Belief is personal judgment or opinion which is knowledge subjective someone which not need justification formal [14]. [15] stated that students' beliefs related to mathematics are subjective conceptions that are held implicitly or explicitly students perceive to be true about mathematics education, about themselves as learner mathematics, and about social context related mathematics learning. Belief related mathematics can have positive effect on the learning process mathematics and there can negative effect to the learning process mathematics. [16] differentiates belief about mathematics become two. First, "availing" belief is profitable belief or support the learning process. Second, "nonavailing" beliefs is belief that is not own influence or influential negative on the learning process.

Based on a number of research above, it is known that met-before (prior experience) and students' belief related to mathematics is very influential to mathematics performance. In this paper we tried to put out linkages between met-before with students' belief related mathematics.

### **Method**

This Study uses qualitative method, done with method spread questionnaire, test mathematics and interviews. Questionnaire students' belief related mathematics spread through online media randomly to student State Polytechnic of Malang batch in 2021/2022. Questionnaire contains entries that includes identity student including background behind school, as well a number of question concerns belief related to mathematics. Amount students was questionnaire filling with complete as many as 46 students consisting of 32 boys and 14 girls. Also known that 12 female students originate from vocational school, 30 students from senior high school and 4 female students from islamic high school.

Students' met-before related to mathematics was traced through interviews that referred to the results of the mathematics test that had been taken before and combined with the results of the completed questionnaire. Interviews were conducted with 7 subjects who were randomly selected from 46 participants who had filled out a questionnaire.

### **Discussion**

Based on the results of data collection through interviews and questionnaires, the met-before of Polytechnic students was obtained and can be grouped into the following categories: (1) met-before related to mathematics content, (2) met-before related to teachers, (3) met-before related to learning methods, (4) met-before related to teaching methods, (5) met-before related to assessment system, and (6) met-before related to work experience.

Met-before related to mathematics contents. An interview with a student showed that when solving differential equation, the student unable to add logarithms, which the student should have mastered before going to college. Based on the results of interviews and tests, it is known that the errors that occur in solving differential equation problems are not due to not understanding the differential equation material, but because the student do not understand the addition operation on logarithms. Also, the student does not realize that their work is wrong because they believe that their work is right. This misunderstanding turned out to be supported

by the tests' habit when high school used multiple choice; if the student did not memorize the formula, then they answered by doing "trial and error" on the available answers. This shows that when high school students believe that it is important in mathematics to get the right answer, not understanding. [17] stated that the single most important factor influencing learning is what students already know. The idea of "met-before" was introduced by [12] to focus on how new learning is affected by prior experiences that students have encountered. In this case, more precisely, it is the "problematic met-before". So it is clear that the problematic met-before about logarithm material and the multiple choice test system during high school (before college) influenced students' beliefs related mathematics, especially beliefs about understanding mathematics. Precisely the problematic met-before influenced to nonavailing beliefs about understanding mathematics. On the contrary, the supportive met-before will influence students' availing beliefs. In addition, the results of the questionnaire revealed that one of the reasons for changing beliefs about the usefulness of mathematics were the content. They stated "Before college, complex mathematics seemed useless in everyday life, but after college it turned out that mathematics had something to do with other courses that were also related to the major I was taking".

Met-before related to mathematics teachers. The study results revealed that the teacher greatly influenced beliefs about learning and teaching mathematics, also of course influences mathematics performance. Not only teacher character or the teaching method would influence students' learning mathematics, even the habits of teachers when teaching also affect students' learning mathematics. The character or habits of a good teacher (supportive met-before) would make a student like mathematics, which in turn will affect the availing beliefs (especially belief about understanding mathematics). On the contrary, bad character/habits during teaching (problematic met-before) make a student stay away from mathematics, which will turn affect the nonavailing beliefs (belief about understanding mathematics). In addition, teachers who teach mathematics explain the benefits or uses of mathematics from the material being taught will also influenced students' beliefs about the usefulness mathematics (teachers who explain the uses of mathematics were the supportive met-before).

Met-before related to learning method. Interviews with several students showed that beliefs about the complexity of mathematics (beliefs about the step in solving mathematics problems) affect the way students learn. For example, students who believe that there are always procedures or steps that must be followed to solve math problems have a way of learning mathematics by memorizing formulas. There are various ways to memorize formulas, for example by doing lots of questions while looking at formulas, memorizing formulas first and then doing lots of questions to keep memorizing formulas, and so on. In addition, based on interviews it was also found that solving mathematical problems using formulas would be faster than using reason or logic. This shows that the met-before related to learning methods had an effect on students' beliefs about steps, then influenced beliefs about time in solving mathematics problems.

Met-before related to teaching method. Students' experience of teaching methods experienced before college (elementary - senior high school) influenced students' beliefs about teaching mathematics. Beliefs about teaching mathematics will affect (1) beliefs about social context, (2) beliefs about self, (3) beliefs about steps (complexity of mathematics), and (4) beliefs about learning mathematics.

Met-before related to assessment system. The results of interviews with students showed that the assessment system in senior high school of using multiple choice tests made students think that what was important was the correct answer. This shows that the assessment

system experienced before has an effect on students' views that in mathematics the important thing is to get the correct answer (beliefs about understanding mathematics). The met-before regarding the assessment system (multiple choice) during high school (before college) influenced beliefs about understanding mathematics.

Met-before related to work experience. The work experience of a student before college influenced beliefs about mathematics, especially beliefs about the usefulness of mathematics. The results of the interviews show that students believe mathematics is useful in everyday life after they work in an industry, that's when they begin to realize the use of mathematics. Also, this belief is supported by the fact that mathematics is widely used in various other courses at the Polytechnic, especially in practical courses. It is clear that work experience influences students' beliefs about the usefulness of mathematics.

### **Conclusion**

Students' Polytechnic met-befores can be grouped into: met-befores related mathematics contents, teachers, learning methods, teaching methods, assessment systems, and work experience. (1) Met-befores related to mathematics contents during senior high school (before college) influence students' beliefs about understanding mathematics. (2) Met-before related to mathematics teachers influenced students' beliefs about learning and teaching mathematics, beliefs about understanding mathematics, and students' beliefs about the usefulness of mathematics. (3) Met-befores related to learning methods influence students' beliefs about steps in solving mathematical problems, then influences beliefs about time in solving mathematical problems. (4) Met-befores related to teaching methods experienced before college (elementary school – senior high school) influence students' beliefs about teaching mathematics. Beliefs about teaching mathematics will influence (a) beliefs about social context, (b) beliefs about self, (c) beliefs about steps, and (d) beliefs about learning mathematics. (5) Met-befores related to the assessment system before college influence beliefs about understanding mathematics. (6) Met-befores related to work experience before college influence students' beliefs about the usefulness of mathematics.

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