P-ISSN 2527-5615
E-ISSN 2527-5607

Kalamatika: Jurnal Pendidikan Matematika
Volume 7, No. 2, November 2022, pages 207-218

STUDENTS' EPISTEMOLOGICAL BELIEFS IN SOLVING GEOMETRY TRANSLATION PROBLEMS

Syafruddin Kaliky[1], Patma Sopamena[2], Arya Putra[3]

[1]IAIN, Jln. Dr. H. Tarmizi Taher Kebun Cengkeh Batu Merah Atas, Ambon, Indonesia.
kalikysyafruddin@iainambon.ac.id
[2]IAIN, Jln. Dr. H. Tarmizi Taher Kebun Cengkeh Batu Merah Atas, Ambon, Indonesia.
patmasopamena@iainambon.ac.id
[3]IAIN, Jln. Dr. H. Tarmizi Taher Kebun Cengkeh Batu Merah Atas, Ambon, Indonesia.
aryaznf@gmail.com

ABSTRACT

The 2018 PISA results show that Indonesian students' numeracy and literacy skills are poor. Epistemological beliefs, beliefs in mathematical knowledge, are one of the factors contributing to poor student literacy skills. This study analyzes epistemological beliefs in solving translation problems of Year 9 students in one of the junior high schools in Manipa Islands, Indonesia. This research employed a descriptive a qualitative approach. The subjects in this study were students who tend to meet the indicators of epistemological beliefs. Data collection techniques were observation, tests, interviews, and documentation. The results showed that students' epistemological beliefs in completing the translation met the requirements. First is being able to solve mathematical problems by taking time, where students needed time to solve the problem. This is because students are not sure that they can solve them. Second, students can solve problems that cannot be solved with simple, step-by-step procedures, where students solve problems using their rules/settlement procedures. The third is understanding essential concepts in mathematics, where students understand and work on translation problems using mathematical concepts well. Fourth, word problems are essential in mathematics, with word problems, students can improve critical thinking skill. Finally, efforts can improve mathematical abilities, where students can try to solve problems to improve their math skills. Efforts include reviewing the lesson and increasing practice questions.

ARTICLE INFORMATION

Keywords

Epistemological Beliefs
Problem-solving
Translation

Article History

Submitted *Aug 17, 2022*
Revised *Nov 13, 2022*
Accepted *Nov 17, 2022*

Corresponding Author

Syafruddin Kaliky
IAIN Ambon
Jln. Dr. H. Tarmizi Taher, Kebun Cengkeh Batu Merah Atas Ambon
Email: kalikysyafruddin@iainambon.ac.id

How to Cite

Kaliky, S., Sopamena, P., & Putra, A. (2022). Students' Epistemological Beliefs in Solving Geometry Translation Problems. *Kalamatika: Jurnal Pendidikan Matematika*, *7*(2), 207-218.

https://doi.org/10.22236/KALAMATIKA.vol7no2.2022pp207-218

INTRODUCTION

PISA (Programme for International Student Assessment) 2018 assessed 600,000 15-year-olds from 79 countries. Based on this survey, the reading literacy, mathematics, ans science scores of Indonesian students was 371, 379, and 396 respectively. Indonesia is ranked in the bottom 10 (Tohir, 2019). This shows that the mathematical ability of Indonesian students is problematic. Learning mathematics is undoubtedly inseparable from problems because the success or failure of a person in learning can be seen by his ability to solve a problem. Generally, a problem encountered requires a solution. The resulting solution necessitates student beliefs to encourage reflection or re-check the answers.

Schomer (in Ghufron et al., 2013) defined epistemological beliefs as beliefs about knowledge and knowing. Sebayang & Silalahi (2018) argued that Epistemological beliefs may differ from one person to another, where one person may believe that science is specific and cannot change, while another may believe that science may change as new facts are discovered in the future. So, epistemological beliefs are personal understandings, judgments, views, and assumptions perceived as truth based on the nature and source of knowledge.

Epistemological beliefs are fundamental for students to solve a problem (Tamba et al., 2020) because it is the basis for humans to act in everyday life, as a basis for developing wisdom in knowledge, and also as a means to know about variations in the truth of knowledge. Therefore, it can be concluded that when we desire knowledge, we must understand how to get it properly. We have to think about the knowledge we want, not only knowing but also understanding how knowledge exists.

Several researchers, including Fatimah and Agung (2017), have researched epistemological beliefs. Their research found that a group of students had a high ability to solve story problems on a difficult scale. In contrast, on the second problem, the subjects had confidence that they could solve complex word problems that took a long time to complete. In addition, a similar study was conducted by Muhtarom et al. (2017) to the results of the study obtained that there are three types of beliefs in problem-solving and learning of prospective mathematics teachers. In line with this research, Tamba et al. (2020) studied the epistemological belief in mathematics and the belief in teaching and learning mathematics of prospective elementary school teachers. They found that prospective elementary school teachers were more likely to believe that mathematics was static knowledge. This research

provides practical implications in education, especially for primary school teacher education. This finding implies that to change the practice of teaching and learning mathematics, it is necessary to start by testing or changing the beliefs of prospective elementary school teachers about the epistemology of mathematics.

One of the concepts that can be used as a reference to measure epistemological beliefs is translational transformation. Translation or shift is a transformation that moves every point on the plane according to a certain distance and direction. Let *x*, *y*, *a*, and *b* be real numbers. The translation of the point *A(x,y)* by shifting the abscissa *a* distance and shifting the *y* ordinate by *a* distance *b*, such that the point $A'(x + a, y + b)$ is denoted by: $A(x,y) \rightarrow T(a,b) = A'(x + a, y + b)$. So, translation is when each point in a figure is moved by the same distance and direction.

One of the public schools in West Seram, Maluku was the location of this research because the initial observations made during learning showed students solving problems sometimes pass the allotted time. In addition, they tended not to use a more straightforward method but is more likely to use an analytic method. This is due to the student's lack of confidence in making decisions. According to Kurnia (in Werdiana, 2004), epistemological beliefs always encourage humans to think, be creative, and find and create something new. The epistemological beliefs is necessary so that students' time and decision-making in solving a problem can be minimized.

What distinguishes this research from previous research is that previous research conducted by Fatimah and Agung (2017) differentiated students in terms of their level of ability. Meanwhile, research by Muhtarom et al. (2017) and Tamba et al. (2020) focused on the epistemological beliefs of prospective elementary school teachers. In this study, the researchers focused on students with traces of epistemological beliefs using the P. Kloosterman and F. K. (2002) Stage indicators. Based on these criteria, this study explores students' thinking related to epistemological beliefs. This study aims to analyze students' epistemological beliefs in solving geometry translation problems for Year 9 of a junior high school in Manipa Islands, Indonesia.

METHOD

The method used was the descriptive qualitative approach, drawing the data obtained

using detailed sentences (Fadli, 2021). This study included 20 Year 9 students. All students were given a pre-test as part of selecting subjects. The initial test results were obtained from 12 people who tended to meet the epistemological belief indicator and then given the second test. Two subjects were consistent in meeting the indicators (SP and FK). They were then followed up through an interview process, and saturated data was obtained so that one student could be selected to be presented on behalf of the other (SP). The indicators of epistemological belief, according to P. Kloosterman & F. K. Stage (Fatimah, Agung, 2017), include being able to solve time-consuming math problems; being able to solve problems that simple and step-by-step procedures cannot solve; being able to understand important concepts in mathematics; Word problems are essential in mathematics, and effort can improve math skills. The instruments used in this study were test questions and interview guidelines. Data analysis techniques include data reduction, data presentation, and concluding. To examine the validity of the data, triangulation techniques were used, namely comparing the test result data with interview data (Masfingatin & Murtafi'ah, 2011).

RESULT AND DISCUSSION

Based on the analysis of student answers, epistemological beliefs can be identified in solving translation problems by referring to indicators based on (P. Kloosterman & F. K. Stage, 2022) The analysis results of the SP students' answer are as follows.

Being able to solve math problems with time-consuming

When SP was given a question, he immediately read the question carefully. Next, SP seemed to think about what should be done before continuing his activities by working on the questions within the allotted time. The results of SP's work can be seen in Figure 1.

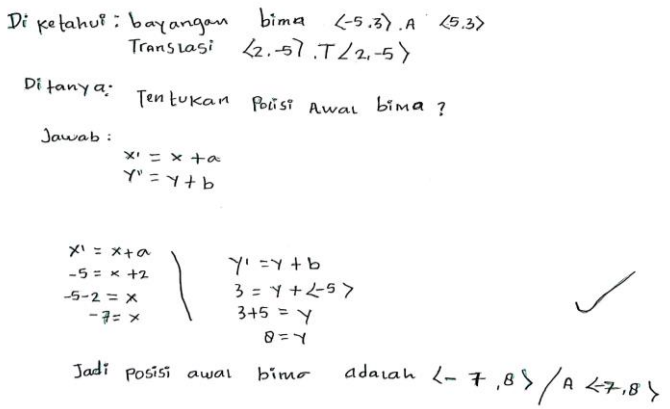

Figure 1. SP's work

The results of SP's work in Figure 1 show that SP tends to be able to solve problems by producing the correct answers. This is indicated by the SP writing down all the information from the problem and then solving the problem by referring to the known information being asked, the formula used, and then writing the final answer to the problem being solved. However, SP seems to take time to solve the questions given. This is indicated by the time obtained by SP in solving the problem, which is 5 minutes 15 seconds. This time is beyond the specified time target, whereas solving the given translation problem takes 2.5 minutes of the time set by the question. This is following what SP stated during the interview as follows.

Table 1. Excerpts from the interview

P	: From the questions, can you complete it?
SP	: Yes, I can finish it, but it took me a long time to get it done
P	: Why are you late in submitting your answers?
SP	: Because I understand the problem before completing it and then think about what strategy to use in solving the problem. Then I went into details for each step and double-checked the answers I got!

Based on Table 1, related to the results of the researcher's interview with the subject, SP is not sure that he can solve the problem given. The uncertainty experienced by SP has an impact on the length of time it takes to solve the problem. Students who do not have the motivation to solve problems cannot solve quickly and will have difficulty (Rahmah et al., 2020). Therefore, students need to be able to control their thinking processes by assuming it is easy for each problem to be solved. Subaidi (in Agustina et al., 2018) expressed a similar opinion that students with good self-confidence will better survive facing math problems, quickly solving math problems, and failure to solve math problems is considered to be due to a lack of effort or learning.

On the other hand, students who do not have self-confidence tend to give up easily facing math problems and have difficulty solving them. The failure to solve them is considered to be due to their lack of mathematical ability. In line with this, Musdalifah (2020) stated that if the problem is considered necessary in the brain process, the memory will be stored in the long term. On the other hand, if it is not vital, the stimulus will only leave a weak memory trace. So, students in solving a problem in a fast time according to a predetermined time or can take time depending on the initial beliefs of previous students.

Being able to solve problems that cannot be solved by simple, step-by-step procedures

At this stage, SP is expected to solve the problem simply. However, the results

obtained by SP are not as expected. SP could not provide simple answers; for example, SP looked for the initial position of the shifting process in Cartesian coordinates. When the researcher asked, "*why not use a simpler way*?" SP revealed, "*I'm confused about how to solve it, all I remember is the translation formula, so I try to solve it that way*." The SP expression shows that the resulting answer tends to be more procedural step by step (SP's answer looks like in Figure 1). SP's beliefs can affect him in solving problems. Simatupang & Napitupulu (2020) stated that students' confidence in solving problems would affect students in every step of problem-solving. In Figure 1, SP solved the problem in stages, starting from writing the formula, substituting the known information, and going through the operational process to get the final result correctly. In operation, SP tended to use mathematical rules and algebraic properties of real numbers. According to Kloosterman and Stage (in Fatimah, Agung, 2017), "*There is always a rule to follow in mathematics*," meaning there are always rules that must be followed in doing math. Similarly, Sholichah & Savira (2021) found that students believe that all math problems can only be solved by following the existing rules.

Understanding important concepts in mathematics

In the third indicator, to understand important concepts in mathematics, students are more required to be able to reveal the information contained in the given problem. After solving the given problem, the SP has met these indicators. This can be shown by the fragment of SP's work as follows.

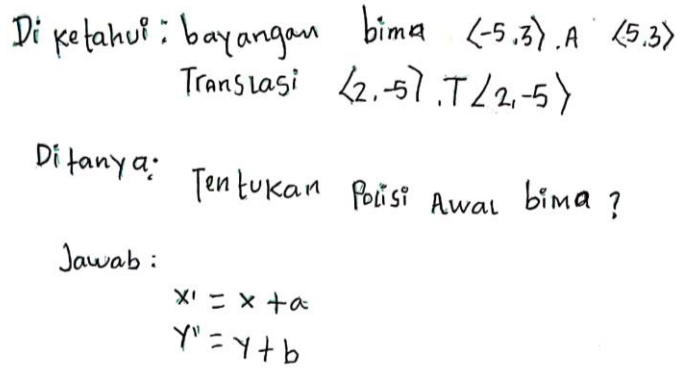

Figure 2. Understanding the Problem

Based on Figure 2, it appears that SP can understand the given problem. This is indicated by SP's ability to write down all the information in the problem entirely in the form of knowing the image of Bima (-5.3), the translation that occurs is (5.3). In addition, SP also wrote down what was asked about Bima's initial position. SP can formulate the right formula

to find Bima's initial position based on this information. The expression of the subject of SP at the time of the interview with the researcher is as follows.

Table 2. Understanding important concepts in mathematics

P	: What information did you get from this question?
SP	: After reading the questions, I discovered that Bima's image (-5.3) and translation magnitude (5.3) was known, so what was asked was Bima's initial position.
P	: Next step: What do you do
SP	: I began to write down the translation formula according to what had been taught
P	: Are you sure about this concept?
SP	: Ummm, yes, I'm sure, because, in the question, there was a shift from the initial position to the new position

Based on the results of the interviews in Table 2, it appears that SP understood the problem by smoothly disclosing information. SP also understood the concepts in the problem so that he can confidently wrote a formula to solve the problem. As stated by the Ministry of National Education (in Syafti, 2020), Concept understanding is one of the mathematical skills that are expected to be achieved in learning mathematics, namely by showing understanding of the mathematical concepts they are studying, explaining the linkages between concepts, and applying concepts or algorithms in a flexible, accurate, efficient, and precise manner in solving problems. This is because, concept understanding has a vital role in mathematical knowledge (Puspita, 2018). Emphasis on concepts can make students obtain permanent concepts obtained through experience so that students can connect one concept with other concepts.

Word problems are essential in mathematics (importance of story problems)

Word problems in mathematics are questions that use verbal language and are generally related to daily activities. To be more contextual, story questions are also important to learn to improve students' knowledge and understanding skills in solving mathematical problems. Figure 1 shows that SP can solve the problem coherently by obtaining the correct final result. In addition, story questions can also improve students' critical thinking because students must interpret all the information in the questions and can relate the problem to concepts that can be used to solve a problem. This follows SP's expression at the interview, namely, *"word problems can make me think more critically to understand the meaning of the problem so that I can think of a solution strategy and then solve it*." In addition, SP added, "*word problems can also improve my ability to be able to solve problems experienced in everyday life*." This shows that SP has confidence in the importance of word problems in

mathematics. In line with Steinbrink's opinion (in Riska et al., 2013) that students' reading skills can help solve problems in the form of word problems. The existence of word problems in contextual form is to present situations that have been experienced by students (Mena, 2016).

Efforts to improve math skills

In this aspect, students are expected to have the effort to improve their mathematical abilities. Therefore, students must believe that they have mathematical abilities. When students believe they do not have a mathematical mind, they are not expected to excel in mathematics (Fardani et al., 2021). In contrast to the results of SP's work, SP can show effort in solving the given problem to get the correct answer. As shown in Figure 1, SP has shown his efforts by solving problems using mathematical concepts well and mathematical procedures even though he has to work on questions for a long time. However, SP tried to work on the problem by getting the final result correctly, and with this effort, SP solved the word problem given. According to Winarso (2019), self-confidence will determine a person's effort and persistence when taking action in pursuit of goals. Students who have high self-confidence generally feel competent, so they have the will to be involved in an activity/action. SP was also sure that the answer he got was correct. Following SP's expression at the time of the interview, namely, "*Efforts that I can do to improve my math skills are by repeating what I have learned and increasing practice questions."* This shows that SP realized that when someone review the lesson and increase their practice in solving problems, they can improve their mathematical abilities. It is in line with Firliani et al. (2019) arguing that through practicing and trying math problems, students can understand and can solve problems quickly.

CONCLUSION

This study found that students in solving translation problems can meet all indicators of epistemological beliefs, namely: (1) being able to solve mathematical problems by taking time, where students need time to be able to solve the problem. This is because students are not sure to solve them, (2) being able to solve problems that cannot be solved in a simple, step-by-step procedure, where students solving cannot give simple answers but tend to be more procedural step-by-step, (3) understanding important concepts in mathematics, where students can understand and work on translation problems using mathematical concepts well, and (4) word problems are important in mathematics, where word problems are critical for

students to improve critical thinking skills. Efforts can improve mathematical abilities; students can try to be able to solve problems to improve mathematical abilities. Efforts are made by reviewing lesson and increasing practice questions. Further research may pay moe attention to gender because gender differences can affect the decision-making process to solve a problem.

ACKNOWLEDGMENTS

I would like to thank the principal and staff of the school involved who have provided the opportunity for researchers to collect data, and Year 9 students for their willingness to participate in this study.

REFERENCES

Agustina, C. A., Rahayuningsih, S., & Ngatiman, N. (2018). Analisis Keyakinan Diri (Self Efficacy) Siswa SMA dalam Memecahkan Masalah Matematika Ditinjau dari Perbedaan Gender. *MAJAMATH: Jurnal Matematika Dan Pendidikan Matematika*, *1*(2), 103. https://doi.org/10.36815/majamath.v1i2.292

Fadli, M. R. (2021). Memahami desain metode penelitian kualitatif. *Humanika*, *21*(1), 33–54. https://doi.org/10.21831/hum.v21i1.38075

Fardani, Z., Surya, E., & Mulyono, M. (2021). Analisis Kepercayaan Diri (Self-Confidence) Siswa Dalam Pembelajaran Matematika Melalui Model Problem Based Learning. *Paradikma: Jurnal Pendidikan Matematika*, *14*(1), 39–51. https://doi.org/10.24114/paradikma.v14i1.24809

Fatimah, Agung, A. (2017). *Analisis keyakinan matematis siswa dalam menyelesaikan soal cerita materi persamaan linear satu variabel*. 1–8.

Firliani, Ibad, N., Nauval, & Nurhikmayati, I. (2019). Teori Throndike dan Implikasinya dalam Pembelajaran Matematika. *Prosiding Seminar Nasional Pendidikan FKIP UNMA*, 823–838.

Ghufron, M., Alsa, A., & Wirawan, Y. (2013). Kepercayaan Epistemologis Dan Faktor-faktor

Yang Memengaruhinya. *Jurnal Psikologi UGM*. https://doi.org/10.22146/jpsi

Kloosterman, P. (2002). Beliefs about mathematics and mathematics learning in the secondary school: Measurement and implications for motivation. In G. C. Leder, E. Pehkonen, & G. Torner (Eds), Beliefs: A hidden variable in mathematics education? (pp. 13-37). Norwell, MA: Kluwer Masfingatin,

T., & Murtafi'ah, W. (2011). Kemampuan berpikir Logis dengan Adversity Tipe Climber dalam Pemecahan Masalah Geometri. *Jurnal Math Nusantara*, *2*(2), 19–29. https://ojs.unpkediri.ac.id/index.php/matematika/article/view/398

Mena, A. B. (2016). Literasi Matematis Siswa SMP dalam Menyelesaikan Masalah Kontekstual Ditinjau dari Adversity Quotient (AQ). *Kreano, Jurnal Matematika Kreatif-Inovatif*, *7*(2), 187–198. https://doi.org/10.15294/kreano.v7i2.6756

Muhtarom, M., Juniati, D., & Siswono, T. Y. E. (2017). Pengembangan Angket Keyakinan Terhadap Pemecahan Masalah Dan Pembelajaran Matematika. *JIPMat*. https://doi.org/10.26877/jipmat.v2i1.1481

Musdalifah, R. (2020). Pemrosesan dan Penyimpanan Informasi pada Otak Anak dalam Belajar: Short Term and Long Term Memory. *AL-ISHLAH: Jurnal Pendidikan Islam*, *17*(2), 217–235. https://doi.org/10.35905/alishlah.v17i2.1163

Puspita, F. M. (2018). Pembinaan Pemahaman Konsep Pembelajaran Matematika Kreatif Bagi Guru-Guru Sd Di Desa Sakatiga Kecamatan Indralaya. *Jurnal Pengabdian Sriwijaya*, *6*(2), 598–605. https://doi.org/10.37061/jps.v6i2.6136

Rahmah, A. T., Aniswita, A., & Fitri, H. (2020). Pengaruh Motivasi Belajar Siswa Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Di Kelas Viii Mtsn 3 Agam Tahun Pelajaran 2018/2019. *Jurnal Ilmiah Pendidikan Matematika Al Qalasadi*, *4*(1), 56–62. https://doi.org/10.32505/qalasadi.v4i1.1174

Riska, Yuli, T., & Siswono, E. (2013). Kemampuan siswa memecahkan masalah berbentuk soal cerita aljabar menggunakan tahapan analisis newman. *MathEdunesa*, *2*(2). https://jurnalmahasiswa.unesa.ac.id/index.php/mathedunesa/article/view/2705

Sebayang, F. A. A., & Silalahi, M. (2018). Keyakinan Epistemologis Dan Konsep Belajar Mengajar Mahasiswa Pendidikan Guru Anak Usia Dini Universitas Negeri Medan. *Jurnal Usia Dini*, *4*(2), 18–30.

Sholichah, S. N., & Savira, S. I. (2021). Hubungan antara self efficacy dengan academic stress saat pandemi. *Jurnal Penelitian Psikologi*, *8*(7), 166–177.

Simatupang, R., & Napitupulu, E. (2020). Matematis Dan Self-Efficacy Siswa Pada Pembelajaran Problem Based Learning. *PARADIKMA JURNAL PENDIDIKAN MATEMATIKA Vol. 13, No.1, Juni 2020 Pedagogik.*, *13*(1), 29–39.

Syafti, O. (2020). s. *Jurnal Kepemimpinan Dan Pengurusan Sekolah*, *5*(1), 57–64. https://doi.org/10.34125/kp.v5i1.468

Tamba, K. P., Cendana, W., & Pratiwi, J. (2020). Keyakinan Epistemologis dan Belajar-Mengajar Matematika Calon Guru Matematika Sekolah Dasar. *Jurnal Basicedu*, *5*(1), 65–76. https://doi.org/10.31004/basicedu.v5i1.573

Tohir, M. (2019). Hasil PISA Indonesia Tahun 2018. *Paper of Matematohir*.

Werdiana, I. K. (2004). *Keyakinan Epistemologis Siswa Lintas Level Akademik Terhadap Fisika*.

Winarso, W. (2019). Analisis Gender Terhadap Kecemasan Matematika dan Efikasi Diri Siswa. *Kalamatika Jurnal Pendidikan Matematika*, *4*(1), 23–36.