

Determinants of Self Efficacy in Mathematical Communication Elementary School Students

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ARTICLE INFO

Keywords:

Mathematics self efficacy;
Mathematical; communication;
Elementary school
student

Article history:

Received 2022-02-13

Revised 2022-04-30

Accepted 2022-08-19

ABSTRACT

The tendency of cognitive formal mathematics learning brings some students into the perception that mathematics tends to be cognitive. Meanwhile, there is another perception which states that students enjoy learning mathematics. It is related to students' self-efficacy in students' mathematical processes, especially mathematical communication. The study aims to explain the determination of self-efficacy in mathematical communication. The research method used is a literature study from 2010 to 2021. Data obtained from databases include ScienceDirect, ProQuest, Google Scholar, and Wiley Online with the keywords self-efficacy, mathematics self-efficacy, mathematics communication, primary school learning. This literature study found 39 articles that matched the inclusion and exclusion criteria. From the review of the article, it is known that there are: (1) the role of mathematical communication in solving elementary school mathematics problems, (2) there is a relationship between self-efficacy and mathematical communication, and (3) there are factors that influence self-efficacy in mathematical communication. Conclusion: There is a determinant of self-efficacy in students' mathematical communication, namely student creativity and high initial ability, in the form of previous mathematics learning experiences.

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1. INTRODUCTION

Mathematics learning outcomes for elementary school students in the current era of society 5.0 still need to be emphasized again that it is not only determined by cognitive factors but also other factors related to self-efficacy. Refers to the skills needed by students in facing the challenges of the 21st century, namely: critical thinking, collaboration, communication, and creativity. Learning success can be

get if it can achieve educational goals that can be seen from 3 domains, namely cognitive, affective, and skill capacities (Skagerlund et al., 2020). The need for this affective domain is stated in the general goals of mathematics education described by the National Council for Mathematics Teachers. The National Council of Teachers of Mathematics is the largest mathematics education organization globally known as NCTM (National Council of Teachers of Mathematics) NCTM states that learning mathematics means that students can learn to appreciate mathematics are more confident in their skills in mathematics, are better able to solve mathematical problems they face, communicate mathematically, and learn to think mathematically. But unfortunately, the focus or central issue in mathematics education research is still focused on the cognitive domain. The evaluation of mathematics learning outcomes is still based on the value of the cognitive domain. The research results focused on the cognitive domain will be stronger if the researcher integrates affective issues in research on cognition and teaching (Skagerlund et al., 2020). Self-efficacy is one of the affective aspects that can influence students in choosing activities to be carried out and even directly affect student achievement (Alam, 2015). A study was conducted by the International Association for Evaluation of Educational Achievement (IEA). This international association assesses mathematics education achievement and is still assessing mathematics learning outcomes from the realm of educational achievement through an activity entitled TIMSS (Trends In International Mathematics and Science Study). The TIMSS measurement includes two dimensions, namely the content dimension and the cognitive dimension.

The content dimension is a measurement of the appropriateness/appropriateness of the material presented in the implementation of the lesson. In contrast, the cognitive dimension is a measurement evaluation of the skills of teaching participants, which includes the domains of knowledge, application, and reasoning. The survey results from TIMSS 2015 show that Indonesian students' achievement in mathematics skills from 51 countries is ranked 46th with 397 points (Rahmad, 2019). On the other hand, in Indonesia, student learning outcomes are also determined from the National Examination. By the Ministerial Regulation, it is stated that the purpose of the National Examination is as a measurement of the achievement of learning outcomes of teaching participants by passing examinations or tests at all levels of education, namely Elementary School, Junior High School, and Senior High School.

An international organization that routinely organizes Student Mathematical Literacy Measurement activities which also measures students' ability and competency levels known as PISA (Program for International Student Assessment), released the results of the 2018 PISA implementation (OECD, 2019), which showed that Indonesia was ranked 72 out of 78 countries. with the acquisition of 379 points/mathematical scores. This score has decreased compared to 2015, where Indonesia currently has a score of 386. Besides PISA, the Survey conducted by Trends in International Mathematics and Science Study (TIMSS) shows low proficiency in Mathematics. Meanwhile, students' level of mathematical literacy is said to be good if students are able/proficient in analyzing/studying, reasoning. It can convey their mathematical knowledge and skills on target and complete and provide interpretations of mathematical solutions carried out. So that understanding and knowledge related to mathematical literacy can be applied in students' daily lives (Wardani et al., 2017). It is also stated in government regulations in Indonesia (2006) which explains that one of the goals of mathematics lessons is for students to have the skills to communicate ideas or ideas by using diagrams, tables, symbols, and or other media to make the situation or problems faced clearer. This implementation and process are in line with the general objectives of mathematics lessons formulated by the NCTM (National Council of Teachers of Mathematics) in 2014 (Marsigit, 2016) that there are two types of mathematics competencies in schools, namely Mathematics Content Competencies, which include: data analysis and probability, numbers and operations, algebra, geometry, and measurement. The second competence is Mathematical Process which includes: problem-solving, reasoning and proof, mathematical communication, mathematical connection, and mathematical representation. Some of these studies concentrate on mathematical communication as a method for optimizing students' mathematical thinking (Walle, 2013; Paul Ernest, 2004; Walle, 2013; Pei et al., 2018) When students interact and communicate mathematical

each other, skills such as understanding, meta-cognition, and motivation are most likely to develop (Vandecandelaere et al., 2012).

Mathematical investigation is also crucial for mathematical thinking skills developed in reflective classroom communication (Stoetzel & Shedrow, 2020). Therefore, it is important to explore matters related to elementary school students' mathematical communication, one of which is to achieve students' mathematical abilities in the world. It can be seen through the average absorption of elementary school students for mathematics subjects we should consider. The achievement of this low Mathematics Achievement should be a shared thought and evaluation. We should consider that the cognitive goal of learning Mathematics is not the main goal of learning because, in essence, school mathematics is an activity (Marsigit, 2016). In detail, it is explained that Marsigit (2011) that school mathematics is defined as problem-solving patterns and relationships; creative activities involve imagination, intuition, discovery, and; also problem-solving the points. At least realizing mathematics as a subject that is of interest to elementary school students; also, students' points can be obtained by students from learning outcomes in the affective domain. However, contrary to the desired goal, it refers to the. It is for some students most dislike in elementary school students today (Markovits & Forgasz, 2017). Mathematics is the subject that is most disliked by some students, this is evidenced from the results of a survey in the field regarding students' perceptions of the subjects and teaching materials of mathematics obtained by students, that mathematics is terrible, confusing, annoying, also makes headaches and stress (Intisari, 2017). In addition, most students assume mathematics lessons as learning that horrible, creates pressure, and creates stress; this can be reduced, even eliminated by the students themselves with high self-efficacy (Riyanto et al., 2019). Some studies mention that students' perceptions of mathematics, including the belief that the size and quantity of numbers contribute to the difficulty level of math problems (Walle, 2013). Students believe that ordinary students cannot understand mathematics but only memorize and apply what they learn mechanically. The belief that doing math means following the rules given by the teacher, and knowing math means remembering and applying the rules correctly (Schunk, 2012). The tendency of cognitive formal mathematics learning brings students into the perception that mathematics tends to be cognitive.

It is a dilemma that all students do not fully feel the students' perceptions mentioned above because of the opposite perception. Students' beliefs as mathematics learners, particularly belief in the possibility of improving their mathematical abilities by working hard and believing in the usefulness of mathematics in everyday life, are assumed to be related to the motivation to learn to solve mathematical problems (Reys, 2004). Another opinion also stated that students feel that learning mathematics is a creative, helpful, and disciplined way of teaching thinking (Schoenfeld, 2020). A study by Forgasz & Leder, 1996 stated that students enjoy learning mathematics, find it interesting, useful and express greater confidence in their mathematical abilities. Such a situation can be related to Mathematics Self Efficacy, namely the ability to self-skill to manifest enthusiasm, self-confidence, confidence in oneself, and capable of introspection (Sari, 2020). Self-efficacy is a vital element in influencing students' mathematics learning outcomes (Ningsih & Hayati, 2020). Another study showed a significant impact of self-efficacy on mathematical problem solving (Somawati, 2018). Mathematical self-efficacy becomes essential for students because it triggers self-confidence and as a student's self-evaluation in overcoming various tasks ranging from understanding concepts to solving mathematical problems (Alam, 2015). Another study revealed that the elements of high school students' reading comprehension skills and Mathematics self-efficacy perceptions contributed to improving their problem-solving skills (Nur Fitriyana, 2018). Some studies show that the elements that influence self-efficacy are a thing that is widely discussed to see competence in mathematics lessons, including students' mathematical communication in class. Determining the importance of students' mathematical communication skills in achieving mathematics learning outcomes is necessary to examine further the determinants of self-efficacy in mathematical communication in elementary school students.

2. METHODS

This study is based on an analysis of the literature on mathematics self-efficacy in mathematical communication. The developed procedure relates to identifying, selecting, analyzing, and classifying articles to answer research questions. This study uses literature analysis to analyze research data. The research questions that are following the research topic and refer to the background of the research problem are: (1) What is the role of mathematical communication in solving mathematical problems for elementary school students? (2) What is the contribution of self-efficacy in elementary school students' mathematical communication? (3) What are the factors that influence self-efficacy in elementary school students' mathematical communication? Keywords used in English or Indonesian in research questions include self-efficacy, mathematics self-efficacy, mathematical communication, primary school learning.

The selected articles are articles that have titles and content that are relevant to the purpose, in English or in Indonesian, and full text and published in 2011-2021. Search Process: Searching for literature according to research questions through indexed electronic databases including ScienceDirect, ProQuest, Google Scholar, and Wiley Online with the keywords self-efficacy, mathematics self-efficacy, mathematics communication, primary school learning. Quality assessment is carried out based on identifying inclusion and exclusion criteria to see the feasibility of the selected literature. The identification of the feasibility of the literature is carried out through questions compiled based on inclusion and exclusion criteria, including: (1) Does the literature presented have titles and content relevant to the research objectives? (2) Is the literature presented in English or Indonesian? (3) Was the literature used as the data source published in 2010 – 2021? (4) Does the literature presented to discuss and examine self-efficacy in elementary school students' mathematical communication?

Data Analysis Process based on the keywords entered in the database, the researcher obtained 90,060 articles. Then the researchers chose articles that were relevant to the title, abstract, and questions on the quality of the assessment. Unsuitable articles were removed so that 71 articles relevant to the research title were obtained, with 45 English sources and 22 Indonesian sources. While the sources published between 2010-2021 are 32 sources. Twenty-five articles examine self-efficacy and mathematics self-efficacy, while those related to mathematical communication consist of 14 sources. Other sources discuss elementary school mathematics and other matters related to learning mathematics. The articles that have been selected are then read carefully from the abstracts, objectives, data analysis of the researchers' initial questions to collect information about discriminant self-efficacy in elementary school students' mathematical communication.

3. FINDINGS AND DISCUSSION

In a classroom environment where mathematical communication is used, students are expected to listen, comment, and reflect on their friends' mathematical thinking (Taat & De Rozario, 2014). Mathematical communication can help students get knowledge into their minds and develop, express mathematical ideas and strategies correctly, and interact with others (Schunk, 2012). Mathematical communication is a method for students to express and provide interpretations of mathematical ideas verbally or in writing, in the format of diagrams, tables, and figures, formulas, or through demonstrations (Ahmad Dzulfikar, 2013). A broader definition of mathematical communication is put forward by Romberg and Chair (Stacey & Turner, 2015), namely: linking concrete objects, diagrams, and pictures into mathematical ideas; explain ideas, situations, and mathematical relationships verbally or in writing using pictures, graphs, and algebra as well as concrete objects, express everyday events through mathematical language or symbols, listen, dialogue, and write about mathematics, make conjectures, can understand a mathematical presentation that writing, compiling arguments, reformulating a definition and generalization, explaining and making a list of questions about mathematics that has been studied. Mathematical communication is a standard that must be developed in mathematics

education. This standard emphasizes that students can use the language of mathematics to express mathematical ideas, organize and consolidate the communication of their thoughts (Butz & Askim-lovseth, 2015).

Mathematical communication has two aspects: written and oral communication (Ramdhani et al., 2020). Oral communication can be in the form of student arguments in solving a problem. Written communication can be realized in student work in solving a problem. Various forms of communication are considered essential elements for exploring and deepening students' understanding of mathematical ideas and making connections between mathematical concepts and other areas of knowledge. Facilitating students to talk about math problems, concepts, and procedures can increase students' understanding to make deeper and clearer connections. Mathematical communication is essential by describing thinking as a case of communication. In other words, thinking of mathematics as a dialogical endeavor in which students ask questions, investigate possible solutions, and reflect on mathematics.

Communication is one of the focuses of attention in mathematics because of two essential things (Baroody, 1998). First, mathematics is a language for mathematics itself. Mathematics is not just a tool for thinking students to solve problems, helping students find patterns, then concluding only, but also as a means to communicate students' thoughts about various ideas clearly and concisely. In addition, mathematics is also a universal language because although the native language of each person in the world is different, people worldwide can communicate through symbols and unique structures and are understood by people worldwide even though their native language is different. Second, teaching and learning activities in mathematics are social activities that involve at least two parties, namely teachers and students; the interaction of these two parties is a process of social activity that needs to be carried out in a harmonious dialogue between the two parties. Learning should help students communicate mathematical ideas through five aspects of communication, namely listening, reading, writing, representing, and discussing.

Communication indicators for elementary school students (Somawati, 2018) include: linking concrete objects, diagrams, and pictures into mathematical ideas; explain mathematical ideas, situations, and relationships verbally or in writing using concrete objects, algebra, pictures, and graphs; express everyday events in the language of mathematical symbols, dialogue and write about mathematics. Based on some of the opinions above, it can be concluded that mathematical communication is the ability to discuss, explain, express mathematical ideas through pictures, tables, mathematical sentences, and mathematical equations. School mathematics is not just a series of formulas and problems that are obtained and then solved. However, mathematics also has a deep meaning that students should understand what is being studied; therefore, students should understand mathematical communication to be applied in real life.

Self-efficacy refers to the student's belief in his ability to control and perform a series of actions to achieve the specified result. The theory of self-efficacy Dofková & Kvintová (2017) states that self-efficacy is the primary basis of our every action. Furthermore Somawati (2018), adds that self-efficacy is the confidence that a person has regarding how the person exerts all his skills in carrying out a task or the extent to which actions will be required to take it. Self-efficacy is one of the most critical supporting aspects in implementing learning because it will influence student achievement or the achievement of learning outcomes (Setiawan et al., 2020).

Self-efficacy determines the choice of one's attitude; the effort expended, our emotional experience when facing problems and how persistent we are in dealing with problems (Nur Fitriyana, 2018). Bandura said that there is a link between self-efficacy and student learning outcomes; he stated that students with high self-efficacy would have confidence that they can cope with all existing tasks even though they receive assignments with a high level of difficulty. Bandura revealed that the right positive feeling about self-efficacy could increase achievement because believing in the skills possessed and maximizing internal enthusiasm (from within oneself) will allow students to achieve more challenging goals (Bergmann & Sams A, 2011). This is one of the supporting elements for students to do something to achieve their success. Self-efficacy is generally positively correlated with academic performance

(Roberta Bern, 2020). Meanwhile, if students have low self-efficacy, thoughts and feelings will arise that they do not have the skills to do all the teacher's tasks in the student learning process.

Self-efficacy is not an innate factor, and this self-efficacy can be pursued, learned, and developed from the elements that influence self-efficacy. Bandura mentions that there are four (4) elements that influence self-efficacy; the four elements are (1) physiological and psychological conditions, (2) verbal/verbal persuasion, (3) experiences of success and achievement, and (4) experiences of others. Bandura also states that the difference in self-efficacy possessed by each individual is determined by three (3) dimensions, namely:

- 1) The magnitude or degree of difficulty of the task. It is related to the situation where the individual will choose a task according to the degree of difficulty, meaning that if a task is considered too difficult, students tend not to choose the task.
- 2) Generality is related to beliefs and behavior based on experience, where someone who feels confident about his abilities is based on his experience.
- 3) Strength or power, this power is related to the belief about the extent to which he believes that his strength will be able to do the job as well as possible. The important thing that needs to be underlined here is reminding that self-efficacy is not related to the abilities possessed by a person but is related to the individual's feeling of confidence in what he can do with the abilities he has, no matter how big. Self-efficacy can be positively related to academic performance.

Mathematics self-efficacy has been studied by many different concentrations, including Bandura, which suggests that mathematics self-efficacy is an individual's belief or perception of that individual's proficiency in mathematics. Bandura's view follows the opinion (Villavicencio & Bernardo, 2016), which reveals that mathematics self-efficacy is usually defined as an individual's belief or perception of their mathematics proficiency. At the same time, Schunk revealed that mathematical self-efficacy is a feeling of confidence from the individual himself that he can succeed in solving mathematical tasks given to him at a certain level/level (Villavicencio & Bernardo, 2016). Such views explain that mathematical self-efficacy is the belief possessed by a student that he can do a mathematical task according to his abilities.

To be able to convey solutions to problems, sometimes students feel unsure of communicating their work. They worry if they make a mistake and doubt whether their answer is correct or not. Some students know the final result of the problem but do not write down the solving steps. That's what makes them feel they will get low math scores, and this is what is described as low self-efficacy, which causes students' low mathematical communication (Imania & Bariah, 2020). Affective aspects influence student learning success, one of which is self-efficacy and a positive effect on understanding mathematics (Riyanto et al., 2019; Dofková & Kvintová, 2017). Self-efficacy makes a difference in the way people act in response to feelings and thoughts. An individual who believes that he can do something that can change his environment has a higher chance of success than those who are unsure or have low self-efficacy (Kundu & Ghose, 2016). Based on this opinion, we can conclude that students who have high self-efficacy in mathematics will affect their mathematical communication skills because the higher the student's self-efficacy, the higher his self-confidence in his abilities in mathematics.

Transfer of mathematical knowledge in school mathematics learning should include mathematical communication. Through mathematical communication between students, they will be able to explain ideas or understanding between students. Communication also helps students construct meaning in a series of mathematical ways of working and make generalizations. By carrying out mathematical communication, students can apply their mathematical skills and transfer them into real-life Ceylan (2017), in line with the statement from the National Council of Teachers of Mathematics (Allen et al., 2020) that communication is an essential component in mathematics and mathematics teaching. Through the communication process, students can: 1. exchange ideas and clarify the understanding and knowledge they find in the lesson; 2. convey thoughts and ideas in the field of mathematics logically

and systematically to fellow students, teachers, or other people; 3. examine and evaluate other people's mathematical thoughts/ideas and tactics; 4. apply the use of mathematical language to express mathematical ideas ideally. The success or failure of communication in the classroom depends on the opportunities offered in the classroom to understand the meaning of the whole by knowing the meaning of simple parts, the semantic significance of a limited number of syntactic compositions, and recognizing the whole, which is built from simple parts (Walle, 2013). In this way, teachers can create meaningful interactions by creating successful communication in the classroom. Suppose the student knows the meaning of simple parts, the semantic significance of a finite number of syntactic compositions, and recognizes that they are constructed from simple parts. In that case, they can understand the meaning of the whole.

To explore and develop students' mathematical communication skills, teachers should expose students to various contextual problems and invite students to communicate their respective ideas (Walle, 2013). In the 2013 curriculum applied in Indonesia, learning mathematics, both hard skills and soft skills, including the values of mathematics education in character and culture, must be developed in a balanced and simultaneous manner through a scientific approach. One of the soft skills in mathematics is self-efficacy. Self-efficacy is a form of belief that students need to succeed in the mathematics learning process, including mathematical communication. Mathematical communication has a relationship with mathematical self-efficacy (Yildiz Durak, 2018). This relationship shows that self-efficacy affects mathematical communication skills. If a student has a positive or high self-efficacy, we can ascertain that the student's mathematical communication is also good (Walle, 2013). When the students' perception of mathematics self-efficacy increases, their problem-solving achievement also increases significantly (Basu et al., 2016). Self-efficacy is directly related to intelligence, while the relationship between self-efficacy and problem-solving achievement serves as a mediator variable that connects intelligence (Shute et al., 2017). Mathematical self-efficacy is important for students in dealing with and also solving mathematical (Alam, 2015) because:

(1) Students' self-efficacy will form students' mathematical skills in solving mathematical problems (Mauliyda, 2020), (2) with high self-efficacy, the assumption that learning mathematics is difficult, stressful and stressful, and tedious, will be able to reduced or even eliminated by the students themselves. (3) the implementation of mathematics lessons in class is influenced by students' self-efficacy for learning mathematics itself (Ningsih & Hayati, 2020). Self-efficacy also has a decisive role in mediating student achievement (Pajares & Kranzler, 1995; Randhawa et al., 1993). In various contexts, someone who has high self-efficacy has been shown to (1) experience increased motivation, participation, and resistance to adversity; (2) shows an increase in strategic thinking; (3) better time management; more persistent; and (4) most likely agree with the correct solution (Zimmerman, 2000; Regier & Savic, 2019). Furthermore, self-efficacy has been identified as a better predictor of mathematical performance than previous ability or experience in mathematics (Pajares & Kranzler, 1995).

Factors that contribute to the construction of self-efficacy in mathematical communication include student creativity (Pajares & Kranzler, 1995). It can be explained that when students believe in their creative potential, self-efficacy constructs are affected, which can have a long-term effect on students' mathematical trajectories. A study states that students' creativity related to increasing self-efficacy comes from two things: the Gestalt principle and the uncertainty principle through operational experience and the free-market principle and scientific principles through representative role modeling. Fostering creativity using Gestalt principles and uncertainty to build students' self-efficacy can help reduce students' difficulties in proving, such as failure to explore new ideas in proof, failure to restructure arguments in cases of alleged wrongdoing, and failure to validate complete evidence. Gestalt principles involve teachers providing opportunities for students to engage in appropriate challenges, leading students to create 'find' opportunities. The uncertainty principle gives birth to two typical students. Students tend to be frustrated because they think that exact science can't provide certainty; students find it difficult because they cannot understand/determine certainty. On the other

hand, the uncertainty principle gives birth to creative students because the uncertainty principle will give birth to many possibilities. Students will explore the process to explore the possibilities that can occur. The free-market principle involves creating a classroom environment that allows students to freely express ideas, thoughts, and solutions. Scientific principles encourage the role of students as scientific figures and allow them to build mathematics between students, in this case, related to the creation of a scientific classroom environment where students learn and build on the ideas of their peers. Furthermore, students are not afraid to contribute and build on other friends' ideas if they know that their contribution will be appreciated. Fostering creativity using free-market principles and scientific principles leads to creating a classroom environment where students are free to emerge opinions scientifically and dare to relate to other people without fear of being blamed. Furthermore, there is a more significant potential for students to gain self-efficacy from friends who are considered to have the same ability. These principles lead students to be more creative; in other words, this process will boost students' self-efficacy.

Another driving factor that contributes to self-efficacy in mathematical communication is the high initial mathematical ability of students. Students who have a high initial level of mathematical ability have more experience in solving complicated mathematical problems to present many mathematical ideas to their colleagues in their group (Marasabessy, 2020). Successful experiences in solving these complex problems are a source of increasing mathematical self-efficacy, which Hamilton & Ghatala (Sufyani Prabawanto, 2003) refer to as performance achievements, or Bandura calls them mastery experiences. Having high initial mathematical skills makes students confident in presenting group work results in front of other students, and having the right communication skills in mathematics lessons will foster self-efficacy (Prabawanto, 2013).

The description above further strengthens the opinion that the student's self-efficacy factor influences the level of students' mathematical communication skills, so it is necessary to pay attention to learning that must be designed and possible to increase each student's self-efficacy attitude (Rahayu, 2020). In learning mathematics, the teacher must facilitate students to play an active role in learning activities, namely involving students in small group activities and utilizing concrete manipulative objects to understand abstract lessons (Maulyda, 2020). The most crucial thing, in this case, is the teacher needs to foster student persistence in undergoing the learning process, especially for students who are lagging in lessons. Creative students will require teachers to provide free space for students so that they have the opportunity to explore and investigate all possibilities while still paying attention to the scientific frame in classroom activities.

4. CONCLUSION

The results of learning mathematics are points that need to be considered in learning mathematics. However, the learning process also needs to be considered so that students can analyze, reason, convey their understanding and skills in mathematics lessons appropriately, solve mathematical problems, and provide interpretations of mathematical solutions. Self-efficacy is one of the abilities that influence elementary school students' mathematical communication. Two factors determine self-efficacy in elementary school students' mathematical communication: students' creativity and high early mathematical abilities. These two factors have a strong influence on students' self-efficacy in learning mathematics in the classroom. Teachers and students can carry out more dialogical mathematics learning with this identification, boosting students' mathematical self-efficacy and subsequently affecting students' mathematical communication. Teachers play an essential role in growing students' persistence during mathematics learning in the classroom in order to build students' self-efficacy. For further researchers, this research can be continued by looking at the effect of self-efficacy on learning outcomes and students' problem-solving abilities.

REFERENCES

- Ahmad Dzulfikar. (2013). Studi Literatur: Pembelajaran Kooperatif Dalam Mengatasi Kecemasan Matematika Dan Mengembangkan Self Efficacy Matematis Siswa. *Prosiding Seminar Nasional Pendidikan Matematika Dan Matematika. Penguatan Peran Matematika Dan Pendidikan Matematika Untuk Indonesia Yang Lebih Baik, September*, 41–45.
- Alam, S. (2015). Apa Itu Mathematics Self-Efficacy? *Prosiding Seminar Nasional*, 4(1), 269–277. <http://journal.uncp.ac.id/index.php/proceeding/article/view/1260/1082>
- Allen, C. E., Froustet, M. E., LeBlanc, J. F., Payne, J. N., Priest, A., Reed, J. F., Worth, J. E., Thomason, G. M., Robinson, B., & Payne, J. N. (2020). National Council of Teachers of Mathematics. *The Arithmetic Teacher*, 29(5), 59. <https://doi.org/10.5951/at.29.5.0059>
- Baroody, A. J. (1998). *Fostering Children ' s Mathematical Power : An Investigative Approach to K-8 Mathelllatics Instruction*. Lawrence erlbaum associates, publishers.
- Basu, S., Biswas, G., Sengupta, P., Dickes, A., Kinnebrew, J. S., & Clark, D. (2016). Identifying middle school students ' challenges in computational thinking-based science learning. *Research and Practice in Technology Enhanced Learning*. <https://doi.org/10.1186/s41039-016-0036-2>
- Bergmann, J., & Sams A. (2011). Flipped Your Classroom. In *Journal of Physics A: Mathematical and Theoretical* (Vol. 44, Issue 8). https://www.rcboe.org/cms/lib/GA01903614/Centricity/Domain/15451/Flip_Your_Classroom.pdf
- Butz, N. T., & Askim-lovseth, M. K. (2015). *Oral communication skills assessment in a synchronous hybrid MBA programme: does attending face-to-face matter for US and international students?* 40(4), 624–639.
- Ceylan, V. K. (2017). Effect of blended learning to academic achievement. *Journal of Human Sciences*. <https://doi.org/10.14687/jhs.v14i1.4141>
- Dofková, R., & Kvintová, J. (2017). Development of the Attitude To Mathematics in Future Primary School Teachers As a Determinant of Their Self-Efficacy. *EDULEARN17 Proceedings*, 1, 3360–3365. <https://doi.org/10.21125/edulearn.2017.1726>
- Imania, K. A., & Bariah, S. H. (2020). Pengembangan Flipped Classroom Dalam Pembelajaran Berbasis Mobile Learning Pada Mata Kuliah Strategi Pembelajaran. *Jurnal Petik*, 6(2), 45–50. <https://doi.org/10.31980/jpetik.v6i2.859>
- Intisari. (2017). Persepsi Siswa Terhadap Mata Pelajaran Matematika. *Jurnal Pendidikan Pascasarjana Magister PAI*, 1(1), 62–71.
- Kundu, A., & Ghose, A. (2016). *The Relationship Between Attitude And Self Efficacy In Mathematics Among Higher Secondary Students*. 21(4), 25–31. <https://doi.org/10.9790/0837-2104052531>
- Marasabessy, R. (2020). Kajian Kemampuan Self Efficacy Matematis Siswa Dalam Pemecahan Masalah Matematika. *JARTIKA Jurnal Riset Teknologi Dan Inovasi Pendidikan*, 3(2), 168–183. <https://doi.org/10.36765/jartika.v3i2.17>
- Markovits, Z., & Forgasz, H. (2017). “Mathematics is like a lion”: Elementary students’ beliefs about mathematics. *Educational Studies in Mathematics*, 96(1), 49–64. <https://doi.org/10.1007/s10649-017-9759-2>
- Marsigit. (2011). Pengembangan Nilai-nilai Matematika dan Pendidikan Matematika sebagai Pilar Pembangunan Karakter Bangsa. *Seminar Nasional Pengembangan Nilai-Nilai Dan Aplikasi Dalam Dunia Matematika Sebagai Pilar Pembangunan Karakter Bangsa*, 0–12.
- Marsigit, M. (2016). Pembelajaran matematika dalam perspektif kekinian. *Math Didactic: Jurnal Pendidikan Matematika*, 2(3), 132–141. <https://doi.org/10.33654/math.v2i3.40>
- Mauliyda, M. A. (2020). *Paradigma Pembelajaran Matematika Berbasis NCTM* (Issue 16 Januari 2020).
- Ningsih, W. F., & Hayati, I. R. (2020). Dampak Efikasi Diri Terhadap Proses & Hasil Belajar Matematika (The Impact Of Self-Efficacy On Mathematics Learning Processes and Outcomes). *Journal on Teacher Education*, 1(2), 26–32.
- Nur Fitriyana. (2018). The Profile Of Students’ Self-Efficacy On Hydrocarbon Hybrid Learning And Android- Based- Game. *International Journal on New Trends in Education and Their Implications April 2018 Volume: 9 Issue: 2 ISSN 1309-6249, April*.

- OECD. (2019). Programme for international student assessment (PISA) results from PISA 2018. *Oecd*, 1–10. https://www.oecd.org/pisa/publications/PISA2018_CN_IDN.pdf
- Pajares & Kranzler. (1995). *Self Efficacy beliefs and general mental ability in Mathematical Problem Solving*. *Contemporary educational psychology*, 20(4), 426-443.
- Paul Ernest. (2004). *The Philosophy of Mathematics Education* (Vol. 148). The Taylor & Francis e-Library.
- Pei, C. (Yu), Weintrop, D., & Wilensky, U. (2018). Cultivating Computational Thinking Practices and Mathematical Habits of Mind in Lattice Land. *Mathematical Thinking and Learning*, 20(1), 75–89. <https://doi.org/10.1080/10986065.2018.1403543>
- Prabawanto, S. (2013). Peningkatan Kemampuan Pemecahan Masalah, Komunikasi, Dan Self- Efficacy Matematis Mahasiswa Melalui Pembelajaran Dengan Pendekatan Metacognitive. *Doctoral Dissertation, Universitas Pendidikan Indonesia*.
- Rahayu, G. D. S. (2020). Analysis of elementary school students ' mathematical resilience during learning during the covid 19 Pandemic Analysis of elementary school students ' mathematical resilience during learning during the covid 19 Pandemic. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/1657/1/012001>
- Ramdhani, T., Suharta, I. G. P., & Sudiarta, I. G. P. (2020). Pengaruh Model Pembelajaran Hybrid Learning Berbantuan Schoology Untuk Meningkatkan Prestasi Belajar Matematika Siswa Kelas Xi Sman 2 Singaraja. *Ejournal.Undiksha.Ac.Id*, 11(2), 2599–2600. <https://doi.org/http://dx.doi.org/10.23887/jjpm.v11i2.24967>
- Randhawa, B. S., Beamer, J. E., & Lundberg, I. (1993). *in the Structural Model of Mathematics Achievement*. 85(1).
- Regier, P., & Savic, M. (2019). How teaching to foster mathematical creativity may impact student self-efficacy for proving. *Journal of Mathematical Behavior*, September 2018, 100720. <https://doi.org/10.1016/j.jmathb.2019.100720>
- Reys, R. (2004). Helping Children Learn Mathematics. In *The Arithmetic Teacher* (Vol. 10, Issue 4). John Wiley & Sons, Inc.
- Riyanto, O. R., Waluya, S. B., & Mariani, S. (2019). Mathematics Critical Thinking Reviewed from Self-efficacy and Motivation of Learning in Arias Learning. *Journal of Primary Education*, 8(5), 243–250.
- Roberta Bern. (2020). Family, School, Community: Socialization and Support. In *Giants Among Us*. <https://doi.org/10.2307/j.ctv16h2nct.10>
- Sari, T. T. (2020). Self-Efficacy dan Dukungan Keluarga Dalam Keberhasilan Belajar Dari Rumah di Masa Pandemi Covid-19. *Education Journal : Journal Educational Research and Development*, 4(2), 127–136. <https://doi.org/10.31537/ej.v4i2.346>
- Schoenfeld, A. H. (2020). Explorations of Students' Mathematical Beliefs and Behavior. *Journal for Research in Mathematics Education*, 20(4), 338–355. <https://doi.org/10.5951/jresmetheduc.20.4.0338>
- Schunk, D. H. (2012). *Learning Theories. An educational Perspective* (6th ed.). Pearson Education.
- Setiawan, A., Suminar, T., Kurniawati, Y., & Pranoto, S. (2020). *Correlation Achievement Motivation With Learning Achievement of Street Children in Elementary School Subdistrict Kemranjen District of Banyumas*. 9(1), 92–100. <https://journal.unnes.ac.id/sju/index.php/eduman/article/view/37934>
- Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review*, 22(September), 142–158. <https://doi.org/10.1016/j.edurev.2017.09.003>
- Skagerlund, K., Forsblad, M., Slovic, P., & Västfjäll, D. (2020). The Affect Heuristic and Risk Perception – Stability Across Elicitation Methods and Individual Cognitive Abilities. *Frontiers in Psychology*, 11(June), 1–10. <https://doi.org/10.3389/fpsyg.2020.00970>
- Somawati, S. (2018). Peran Efikasi Diri (Self Efficacy) terhadap Kemampuan Pemecahan Masalah Matematika. *Jurnal Konseling Dan Pendidikan*, 6(1), 39. <https://doi.org/10.29210/118800>
- Stacey, K., & Turner, R. (2015). *Assessing Mathematical Literacy*.
- Stoetzel, L., & Shedrow, S. (2020). Coaching our coaches: How online learning can address the gap in preparing K-12 instructional coaches. *Teaching and Teacher Education*, 88, 102959.

- <https://doi.org/10.1016/j.tate.2019.102959>
- Sufyani Prabawanto. (2003). Konstruktivisme dalam Pembelajaran Matematika di Kelas Satu dan Dua Sekolah Dasar. *Makalah Disampaikan Dalam Rangka Kegiatan Magang Dosen IKIP PGRI SEMARANG Pada Program D-2 PGSD FIP UPI 20 – 27 Maret 2003.*
- Taat, M. S., & De Rozario, G. (2014). The Influence of Academic Attitude and Self-efficacy towards Students' Achievement in Private Higher Learning Institution, Malaysia. *International Journal of Arts and Commerce*, 3(4), 41–50.
- Vandecandelaere, M., Speybroeck, S., Vanlaar, G., De Fraine, B., & Van Damme, J. (2012). Learning environment and students' mathematics attitude. *Studies in Educational Evaluation*, 38(3–4), 107–120. <https://doi.org/10.1016/j.stueduc.2012.09.001>
- Villavicencio, F. T., & Bernardo, A. B. I. (2016). Beyond Math Anxiety: Positive Emotions Predict Mathematics Achievement, Self-Regulation, and Self-Efficacy. *Asia-Pacific Education Researcher*, 25(3), 415–422. <https://doi.org/10.1007/s40299-015-0251-4>
- Walle, V. De. (2013). *Elementary and Middle School mathematics Teaching Developmentally* (Vol. 148). Pearson Education.
- Wardani, A. K., Hartono, Y., & Sriwijaya, U. (2017). Pengembangan Soal Matematika Model Pisa Level 5. *Jurnal Pendidikan Matematika RAFA*, 3(1), 1–18.
- Yildiz Durak, H. (2018). Digital story design activities used for teaching programming effect on learning of programming concepts, programming self-efficacy, and participation and analysis of student experiences. *Journal of Computer Assisted Learning*, 34(6), 740–752. <https://doi.org/10.1111/jcal.12281>
- Zimmerman, B. J. (2000). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*, 25(1), 82–91. <https://doi.org/10.1006/ceps.1999.1016>

