Research Article

The Effect of Self-regulated Learning on Mathematical Communication Ability in Prospective Elementary School Teachers

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Abstract.
Every mathematics teacher, especially those teaching in elementary school should have mathematical communication ability. If the teacher do not have good mathematical communication ability, then the students may not understand mathematical concepts. In addition, being a teacher will always learn new things every day. Therefore, self-regulated learning is needed to have by elementary school teachers. This study will explain how self-regulated learning affects mathematical communication ability on prospective elementary schools teachers. To do so, we used quantitative method with correlational design. Forty-seven prospective elementary school teachers participated in this study. Data analysis was carried out quantitatively by using correlation and regressions analyses. The research results provide an overview of correlation and regression that can be used as a reference for future research on this topic.

Keywords: mathematical communication ability, self-regulated learning, prospective elementary schools teachers

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1. INTRODUCTION

Mathematical communication ability includes ability to use mathematics language, ability to represent something into mathematics model, also ability to express and explain mathematics ideas that easy to understand (1). Mathematical communication ability is an ability to explain problem solving algorithm in unique way (2). Mathematical communication ability is an ability to express, understand, interpretation, evaluate or response mathematical ideas (1,3). Mathematical communication ability also can be defined by a way to communicate mathematical knowledge properly and effectively, also connecting mathematical thinking between one and another concepts (4,5). So, we can conclude that mathematical communication ability is an ability to express mathematical ideas in form of picture, graph, or diagram, also provide mathematical solving problem with rational reason.

There are some indicators of mathematical communication ability from researchers. National Council of Teachers of Mathematics said that the indicators of mathematical communication ability are 1) ability to express mathematical ideas through verbal, written, demonstration and visual explanations; 2) ability to understand, interpret, and evaluate mathematical ideas; 3) ability to use terms, notation, and mathematics structure to provide ideas and relationships in mathematical models (6). Another researcher state that some indicators of mathematical communication ability are 1) ability to express mathematical ideas through writing and treatment; 2) ability to deliver mathematical ideas and relationships into models that easier to understand; 3) ability to evaluate mathematical ideas and transform into another form (1).

There are still many problems on mathematical communication ability, such as students still find difficulty to understand and communicate their mathematics ideas (1,7). In elementary school, students' mathematical communication ability still relatively low, it's because they have difficulty to express mathematics ideas, not understanding basic mathematical concept, and transform daily problems into mathematics model (8–11). Furthermore, prospective elementary school teachers' mathematics communication ability still relatively low (12,13). Those two things make public assumption that mathematics is difficult. This assumption supported too with Cockcroft research that said teaching and learning mathematics are difficult (14). Therefore, elementary school teachers should have a good mathematical communication ability to make their students understand mathematics properly.

Many factors influence mathematical communication ability, including self-regulated learning and self-efficacy. Based on Gafoor & Kurukkan research, they found that self-regulated learning can influence mathematical communication ability (15). Good self-regulated learning makes someone initiate learning process, plan learning schedule, identification learning needs, formulate learning goals, choosing proper learning strategies and evaluate learning outcomes (16). So, prospective teachers also should have a good self-regulated learning to support them in dealing with their students.

Self-regulated learning can be defined as self-planning and self-monitoring process to their cognitive and affective in solving some tasks (17). Self-regulated learning includes determining their learning goals, choosing proper information to achieve their goals, creating proper strategies and reflecting their learning outcome (18). So, we can conclude that self-regulated learning is a person's awareness of the need to learn to gain new knowledge by making learning plans independently and being responsible for what they have planned.

Dalimunthe said that there were significant differences in mathematical communication ability between students with low, medium, and high self-regulated learning categories (19). Students with high self-regulated learning have higher mathematical communication ability than students with medium and low self-regulated learning (20–24). Sari said that self-regulated learning affecting mathematical communication ability with coefficient of determination in 21% (25). On elementary school teachers, Kramarski & Revach found that self-regulated learning will affect teachers' mathematical communication ability (26).

Based on description above, the purpose of this study is to describe the correlation between mathematical communication ability and self-regulated learning study case in prospective elementary school teachers. Furthermore, the title of this research is "The Effect of Self-Regulated Learning towards Mathematical Communication Ability on Prospective Elementary School Teachers".

2. METHODOLOGY

To do this research, we used mixed method with explanatory sequential design. This research used correlations method and phenomenology method. Correlations method used to describe correlation between mathematical communication ability, self-regulated learning and self-efficacy of prospective elementary school teachers. Phenomenology method used to describe about mathematical communication ability, self-regulated learning and self-efficacy of prospective elementary school teachers.

We used purposive sampling from first-year prospective elementary school teachers. There are 47 prospective elementary school teachers participated in this research. After quantitative data collected, we used SPSS 26 to analyze data to see correlation between mathematical communication ability, self-regulated learning and self-efficacy. From the data analyses, later we can see the bivariate regression equation between self-regulated learning and mathematical communication ability, also we can see bivariate regression equation between self-efficacy and mathematical communication ability. This regression equation will interpret how self-regulated learning affect mathematical communication ability and how self-efficacy affect mathematical communication ability. Finding conjecture in this research, we used axial paradigm which beginning with open coding, axial coding and last selective coding (27).

3. RESULTS AND DISCUSSIONS

We used Microsoft excel to see the descriptive data of self-regulated learning level as follow that 17 prospective elementary school teachers have low self-regulated learning, 15 have moderate self-regulated learning, and 15 have high self-regulated learning.

TABLE 1: Statistics Output.

Output	Score
Sig. F change	.003
R Square	.181
Constant Regression	25.165
Self-Regulated Learning Regression	.627

Based on Table 1, we can see that sig. F Change score is less than 0.05 (0.003), which means there is a significant positive correlation between mathematical communication ability and self-regulated learning on prospective elementary school teachers. Also, we can see on R Square (0.181) which means that 18.1% of mathematical communication ability can be explained by self-regulated learning. Then, we can see that coeficient of constant and self-regulated learning regression are 25.165 and 0.627, which means that coefficients from regression equation are significant. Based on Table 5, regression equation that connect self-regulated learning (X) and mathematical communication ability (Y) as on equation below:

$$y = 25.165 + 0.627X$$

This means that self-regulated learning (X) have positive effect on mathematical communication ability (Y), so that every self-regulated learning score increased by 1 unit, then mathematical communication ability score will increase by 0.627 unit. Previous research conducted by Saputra & Zulmaulida on the mapping of mathematical communication skills of prospective teachers showed that the majority of prospective teacher students were able to remember the forms in the modeling, prospective teachers were able to create mathematical symbols in the form of contrapositives and contradictions, and most students were able to prove the form of counterexamples (28). However, in contrast to Djali, Abdullah, & Suharna in their research concluded that the proof of polygon, trilateral, and quadrilateral material carried out by students was invalid, there was a misunderstanding in understanding the concept of the material, the habit of using routine symbols that caused misunderstandings in modeling according to mathematical

ideas (29). In fact, mathematical abilities are something that is important for every prospective elementary school teacher to have.

This is emphasized by Shurygin and Egara & Mosimega that it is important for prospective mathematics teachers to have mathematical communication skills in mathematics education and its function in professional life (30,31). Erayani revealed that through communication, mathematical ideas can be exploited from various perspectives, the way of thinking of prospective teachers can be sharpened, the growth of understanding can be measured, the thinking of prospective teachers can be consolidated and organized, and mathematical knowledge and problem development can be formed (32). According to Ekuri and Offiah to encourage prospective teachers to have productive learning skills, build self-efficacy in academic motivation in mathematics, prospective teachers must instill self-regulated learning (33). Seeing this, self-regulated learning is important to be developed by prospective teachers as a strategy in their learning. Self-regulated learning has been widely studied because it is considered interesting to explore. Research conducted by Ekuri & Offiah shows that students who have high levels of self-regulated learning have better critical thinking and communication skills than other students. Students with a moderate level of self-regulated learning have better mathematical thinking skills than students with a low level of self-regulated learning (33).

We can see that prospective elementary school teachers who have high self-regulated learning gain all indicators of mathematical communication ability. From that, the following axial coding paradigm diagram obtained. Hypothetical conclusion 1 is obtained, namely the mathematical communication skills of students who have high self-regulated learning level can be described by the students' abilities: 1) who can provide rational reasons (giving excuse, writing solutions, convey ideas); 2) who can express mathematical ideas (making pictures); 3) who can evaluate mathematical ideas (evaluating pictures, evaluating mathematics ideas); 4) who can manipulate mathematical problems (manipulating picture); and 5) who can create mathematical models (solve problems).

We can see that prospective elementary school teachers who have moderate self-regulated learning gain four indicators of mathematical communication ability. From that, the following axial coding paradigm diagram obtained. Hypothetical conclusion 2 is obtained, namely the mathematical communication skills of students who have moderate self-regulated learning level can be described by the students' abilities: 1) who can provide rational reasons (giving excuse, convey ideas); 2) who can evaluate

mathematical ideas (evaluating mathematics ideas); 3) who can manipulate mathematical problems (manipulating picture); and 4) who can create mathematical models (solve problems).

We can see that prospective elementary school teachers who have low self-regulated learning gain four indicators of mathematical communication ability. From that, the following axial coding paradigm diagram obtained. Hypothetical conclusion 3 is obtained, namely the mathematical communication skills of students who have low self-regulated learning level can be described by the students' abilities: 1) who can provide rational reasons (giving excuse, convey ideas); 2) who can express mathematical ideas (making pictures); 3) who can evaluate mathematical ideas (evaluating mathematics ideas); 4) who can create mathematical models (solve problems).

Research conducted by Achmad concluded that prospective teachers can have the ability and desire independently without relying on others, are able to determine effective learning methods, and independent learning activities, namely by having a self-regulated learning character (34). Difficulty in learning mathematical material is caused by a lack of understanding of the function and definition of the use of letters and numbers in the material. According to Duru & Okeke learning outcomes differ in terms of how they assess knowledge and its representation in mental structures (35). In addition, Egara & Mosimega stated that the factors that influence mathematical communication skills the strongest are experience and the next factors are ability, time, attitude and motivation, and teacher factors (31).

This shows that in developing mathematical communication skills, self-regulated learning is used as a means to determine strategies in learning. In general, self-regulated learning as a predictor of mathematical communication skills of prospective mathematics teachers did not contribute to this study. This is because developing mathematical communication skills requires sufficient experience and knowledge to carry out proofs. Seeing the characteristics of this research material, namely abstract real analysis, makes it difficult for students if they are not guided by lecturers in learning. So self-regulated learning does not affect the mathematical communication skills of prospective mathematics teachers.

4. CONCLUSION

Based on the results found, it can be concluded that there is a positive influence between self-regulated learning and the mathematical communication skills of prospective elementary school teachers. Also, we can conclude that coefficient correlation is significant. Based on the findings, it was found that the mathematical communication skills of prospective teachers who have low, medium and high levels of self-regulated learning can be described from the abilities of prospective teachers which include rational reasoning, expression of mathematical ideas, evaluation of mathematical ideas, manipulation of mathematical problems and mathematical models. The mathematical communication skills of students who have low self-regulated learning level can be described by the students' abilities: 1) giving excuse and convey ideas; 2) making pictures; 3) evaluating mathematics ideas; 4) solve problems. The mathematical communication skills of students who have moderate self-regulated learning level can be described by the students' abilities: 1) giving excuse and convey ideas; 2) evaluating mathematics ideas; 3) manipulating picture; and 4) solve problems. And the mathematical communication skills of students who have high self-regulated learning level can be described by the students' abilities: 1) giving excuse, writing solutions and convey ideas; 2) making pictures; 3) evaluating pictures and evaluating mathematics ideas; 4) manipulating picture; and 5) solve problems. For this reason, the level of self-regulated learning can influence the communication skills of prospective teachers and is important for every individual to have.

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