

Self-Efficacy of Prospective Mathematics Teacher on Numerical Literacy Based on Lesson Study

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ABSTRACT

One of the instruments used in National Assessment is Minimum Competency Assessment. In this assessment, there are two types of competencies that are measured, they are reading literacy and numeracy literacy. In the process of developing numeracy literacy skills for students, one of the determining factors is the teacher. The purpose of this study was to describe the self-efficacy of prospective mathematics teacher students towards numeracy literacy in lesson study-based learning activities. This research was conducted at Mathematics Education Study Program, PGRI University of Ronggolawe in 2021/2022 academic year. The subjects in this study were 28 students who were taking Ethnomathematics courses. The instrument used is an observation sheet and a self-efficacy scale on numeracy literacy. The research method used is lesson research with lesson study which has three stages in each cycle, namely plan, do and see. The research was carried out in 3 cycles. Based on the data analysis, it was found that the students' self-efficacy towards numeracy literacy was mostly in the medium category.

Keywords: Lesson Study, Numeracy Literacy, Self-Efficacy

ABSTRAK

Salah satu instrumen yang digunakan dalam Asesmen Nasional adalah Asesmen Kompetensi Minimum (AKM). Dalam AKM, ada dua jenis kompetensi yang diukur, yaitu literasi membaca dan literasi numerasi. Dalam proses mengembangkan kemampuan literasi numerasi bagi siswa, salah satu faktor yang menentukan adalah guru. Tujuan penelitian ini adalah untuk menggambarkan *self-efficacy* mahasiswa calon guru matematika terhadap literasi numerasi dalam kegiatan pembelajaran yang berbasis lesson study. Penelitian ini dilaksanakan pada Program Studi Pendidikan Matematika Universitas PGRI Ronggolawe pada tahun ajaran 2021/2022. Subjek dalam penelitian ini adalah mahasiswa yang sedang menempuh mata kuliah Etnomatematika sebanyak 28 orang mahasiswa. Instrumen yang digunakan adalah lembar observasi dan skala *self-efficacy* terhadap literasi numerasi. Metode penelitian yang digunakan adalah *lesson research* dengan *lesson study* yang mempunyai tiga tahap dalam setiap siklusnya yaitu *plan*, *do* dan *see*. Pelaksanaan penelitian dilakukan sebanyak 3 siklus. Berdasarkan analisis data diperoleh hasil bahwa *self-efficacy* mahasiswa terhadap literasi numerasi sebagian besar berada pada kategori sedang.

Kata kunci: Efikasi Diri, *Lesson Study*, Literasi Numerasi

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Introduction

National assessment is a program to assess the quality of each education unit in primary and secondary schools, including schools, madrasahs, and equality programs in Indonesia. Assessment of the quality of each educational unit is based on student learning outcomes, quality of the learning process, and climate of the educational unit that supports learning (Andiani et al., 2020). In general, the purpose of national assessment is to show what is the main goal of the school, which is to develop all student competencies and character. The results of national assessment will provide an overview of important characteristics of an effective school to achieve the aforementioned main objectives (Novita et al., 2021). The assessment process in national assessment is obtained from three main instruments: minimum competency assessment, character survey, and learning environment survey (Kemdikbud, 2021).

One of the instruments used in national assessment is minimum competency assessment. Minimum competency assessment is an assessment of basic ability needed by all students to be able to develop self-capacity and participate positively in society (Kemdikbud, 2021). In minimum competency assessment, there are two types of competencies that are measured, reading literacy and numerical literacy. The details of the skills measured from the two types of competencies are systematic logical thinking skills, reasoning skills using concepts and knowledge that they already have, and skills in sorting and processing information (Novita et al., 2021)

From the two types of abilities tested in the minimum competency assessment, it appears that literacy skills are very important to develop. This ability is considered important because the performance of Indonesian students in the international arena for literacy skills that are shown on PISA (Program for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study) is still low (Nuro et al., 2020). For scientific literacy, the 2018 PISA results show the average science score for OECD countries is 489, while Indonesia has only achieved a score of 389 (Kurniawan & Susanti, 2020). As for mathematical literacy, the results of the PISA and TIMSS tests, two organizations under the OECD (Organization for Economic Cooperation and Development) show that Indonesia is still below the average score of OECD countries. The results of the mathematical literacy test of Indonesian students at PISA 2018 were 379 where the average score of OECD countries was 487 (Ekowati et al., 2019). Meanwhile, from the 2016 TIMSS results, Indonesia got a score of 395 out of an average score of 500. The highest score was obtained by Singapore with a score of 618 (50% higher than Indonesia) (Kurniawan & Susanti, 2020). The low PISA and TIMSS results achieved by Indonesian students make literacy skills a competency that will be measured in the minimum competency assessment, focused on reading literacy and numeracy literacy. Numerical literacy is one of the abilities measured in minimum competency assessment. Numerical literacy is defined as daily life and (b) analyzing the information displayed in various forms (graphs, tables, charts, etc.) and then using the interpretation of the results of the analysis to predict and make decisions (Kemdikbud, 2021).

In simple terms, numerical literacy can be defined as the ability to apply number concepts and arithmetic operations skills in everyday life (for example, at home, work, and participation in community life and as citizens) and the ability to interpret quantitative information in our surroundings (Kemdikbud, 2021). In line with this definition, Pusmenjar (2020a), also defines numeracy literacy as a thinking ability to use concepts, procedures, facts, and mathematical tools to solve everyday problems in various types of situations that are suitable for individuals as citizens of Indonesia and citizens of the world. Meanwhile, referring to the OECD as the organizer of PISA, for PISA 2021 Mathematical literacy is defined as an individual's ability to reason mathematically and to formulate, use, and interpret mathematics to solve problems in real world contexts (Nuro et al., 2020). From the three definitions above, all lead to one key sentence, it is how a student is able to use mathematics they have learned in solving various mathematical problems in the real world (Fadiana, 2009).

In the process of developing numerical literacy skills for students, one of the determining factors is the teacher. From several sources on educational psychology, it is stated that teachers are included in the factors that affect student achievement (Arrosyad & Nugroho, 2021; Habibi & Suparman, 2020; Pratiwi et al., 2020). Because of the importance of the teacher's participation in improving students' abilities, one of the important things for us to pay attention to is the prospective teacher that will become teachers later (Warli & Fadiana, 2015). It is

important to look at the knowledge of prospective mathematics teachers about numerical literacy because in the future they will be part of the numerical literacy learning process for students at various levels. Prospective teachers who have knowledge of numerical literacy certainly have more value because they are earlier in understanding numerical literacy. Furthermore, they need reinforcement to be able to integrate numerical literacy in various mathematics learning topics (Fadiana et al., 2021).

In addition to numerical literacy, it is also important to see how confident the prospective mathematics teacher students are in mastering numeracy literacy skills. Belief or confidence in self-ability to be able to achieve a goal is known as self-efficacy (Ayotola & Adedeji, 2009). In this context, the assessment of self-ability to be able to master numeracy literacy is called self-efficacy of numeracy literacy. The results showed that there was a positive relationship between math self-efficacy and math performance (Elstad & Christophersen, 2017; Herizal, 2021). Research from (Herizal, 2018) also shows the same results, Herizal said students who have high self-efficacy tend to have good mathematical performance, in this case their mathematical communication is also high. From the results of some of these studies, it is important to review the self-efficacy of numerical literacy of prospective mathematics teachers. Increasing students' self-efficacy towards numerical literacy can be done through learning activities in the classroom. The application of appropriate learning activities can raise students' confidence about their abilities. Efforts to increase student self-efficacy towards numerical literacy can be pursued through lesson study-based learning activities (Risnanosanti, 2016).

Lesson study is a learning activity developed in Japan and has been implemented for more than one hundred years. The results of lesson study implementation in Japan have been proven to improve the quality of learning which in turn can improve the quality of education. According to (Wang-Iverson & Yoshida, 2005) learning based on lesson study activities is an effective way as an effort to improve the quality of teacher learning and student learning activities. In addition, (Koh & Chai, 2014) also suggests that one of the reasons why lesson study needs to be implemented in learning activities is so that students have quality learning and the main focus of learning activities is the achievement of competencies that students must possess.

In addition, the benefits of lesson study-based learning activities according to (Wang-Iverson & Yoshida, 2005) include helping teachers to focus on their assistance to all student learning activities and creating an exchange of knowledge about understanding of thinking and learning from students. This means that in lesson study activities, students are given the opportunity to discuss and exchange understanding of the learning material. Through group discussions, students are not afraid to express their opinions. So, learning through lesson study can make students have the view that they have the same abilities as other friends. The existence of this positive view will ultimately increase students' self-efficacy towards mathematics. Therefore, the purpose of this study is to describe self-efficacy towards numerical literacy of students of Mathematics Education Study Program of Faculty of Teacher Training and Education of PGRI Ronggolawe University after participating in lesson study-based learning activities.

Research Methods

This research activity was carried out at the Mathematics Education Study Program of Faculty of Teacher Training and Education of PGRI Ronggolawe University. The research was carried out in the 2021/2022 academic year. The subjects in this study amounted to 28 students who were taking Ethnomathematics courses. The instruments used in this activity are observation sheets and self-efficacy scales. The steps of this research using lesson research method with

lesson study model by Lewis (2002). The implementation takes place in 4 cycles. Each cycle consists of 3 activities, namely: 1) Plan (Planning); 2) Do (Implementation and Observation); and 3) See (Reflection).

The questionnaire for measuring the numerical literacy self-efficacy of prospective mathematics teachers was measured using a Likert Scale. The answer choices are Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). As for the negative statement items, the opposite applies. The number of initial items before validation is 24 statement items for 4 indicators of self-efficacy. Before being used for research, the Self-efficacy questionnaire was validated in terms of language by colleagues and then the questionnaire was tested on students to see validity and reliability. The results show that out of 24 statement items, only three items are invalid, they are items 4, 11, and 19. These three items were not used in the study. For reliability, the calculation results show the number 0.812. This value is included in the category of high reliability. The data analysis technique used descriptive data analysis by determining the percentage of prospective mathematics teacher responses to each statement from the self-efficacy questionnaire and the results were displayed in tabular form (Herizal, 2018).

Result and Discussions

The ethnomathematics course was given in the seventh semester of Mathematics Education Study Program of Faculty of Teacher Training and Education of PGRI Ronggolawe University, which was attended by 28 students. Lecture design uses a problem-based learning model with lesson study-based learning activities. At the beginning of the lesson the lecturer gives a student worksheet which contains ethnomathematical problems that must be solved. Students are first asked to work individually and then the results are discussed in groups. Each group consists of 4 members. Besides being measured from a self-efficacy questionnaire, a description of students' self-efficacy towards numerical literacy was obtained through the observations of the observers from three lecture activities and the self-efficacy scale given at the end of the lecture. In the first meeting, the material discussed was an ethnomathematical exploration of Tuban traditional food. The lecture begins by giving student worksheets containing contextual problems about Tuban traditional food. These contextual problems are presented in the form of literacy texts. From the contextual problems presented, students were asked to solve the questions contained in the worksheets. The questions are presented in the form of inquiry and there are types of questions to measure numeracy skills.

The self-efficacy seen in students is trying to understand problems in the worksheets, looking for and reading from various existing references, both books and sources from the internet. At this stage, it is seen that students have quite good self-efficacy by believing in their abilities to complete individually. Furthermore, students are asked to discuss with their fellow group members about the results of their respective work. The results of the observations showed that most of the students were actively involved in discussions, and defended their opinions with logical reasons or arguments. After finishing working on the worksheets, students present the results of their discussion in front of the class, and share their opinions with other group members. During class discussions, students' self-efficacy is more clearly seen through differences of opinion in problem solving about ethnomathematics. Each opinion is based on findings from the typical food of each village. Among them there are those who think that the surface of ketan salak cake is rectangular, there are also those who think that it is a rhombus and some others said that it is a parallelogram. By seeing a group of presenters express their opinion, it motivates other groups to share their opinion. The results of this observation show

that students' self-efficacy towards numerical literacy begins to develop. Even though at the first meeting it was still dominated by a few students.

The learning design for second and third meetings is the same as the learning design for the first meeting, it is problem-based learning. The material at the second meeting was about ethnomathematical exploration in Javanese calendar calculations which are still a culture or tradition of the people in Tuban. Meanwhile, the third meeting discussed the ethnomathematical exploration of the "toak" drinking culture for men in Tuban. The presentation of the problems contained in the worksheets is in the form of literacy texts, while some of the questions contained in the worksheets are about numeracy content related to the ethnomathematical material being studied.

Learning in group discussions which are given contextual and challenging problems optimizes students' confidence. By learning through personal experience, or from friends, and getting support from lecturers, students' self-efficacy is getting better. This is in line with the opinion of (Sujarwo, 2020) which says that several important factors that influence a person's self-efficacy are the experience of success, the experience of others, verbal persuasion and also physiological and affective states.

In lesson study-based learning activities carried out in this study, the experience of success carried out by students in completing assignments individually increases their self-efficacy. Therefore, students should be given individual assignments first. If students have difficulty completing assignments individually, they are given the opportunity to discuss with their group friends. This shows that other successful experience factors will also increase student self-efficacy. The success of one student in the group is an example to other members that they can also succeed. This is supported by the opinion of Weinberg who argues that seeing the success of others can lead to a strong belief in oneself to succeed.

Numerical literacy self-efficacy as a person's assessment of his or her ability to be able to understand numerical literacy and to teach it. To measure the numerical literacy self-efficacy of prospective mathematics teachers, a questionnaire with a total of 21 statements was given to prospective mathematics teacher students. There are four sources that are measured, namely: (1) mastery experiences (personal experience); (2) vicarious experiences (experiences of others); (3) verbal persuasion (social or verbal approach); and (4) psychological states (psychological index). Many questions for mastery experiences (personal experience) have 7 questions, vicarious experiences (experiences of others) have 3 questions, verbal persuasion (social or verbal approach) has 4 questions and psychological states (psychological index) has 7 questions.

The percentage of student responses for prospective mathematics teachers for the four sources can be seen in the Table 1.

Table 1. Percentage of Prospective Mathematics Teacher Responses to the Self-efficacy Questionnaire

Sumber	Item ke-	Presentase Respon Siswa (%)			
		STS	TS	S	SS
<i>Mastery experiences</i> (personal experience)	Item 1	2,4	11,3	62	24,3
	Item 2 (-)	3,3	44,7	41,7	10,3
	Item 3 (-)	8,3	42	42,4	7,3

	Item 4 (-)	7,7	42	43,3	7
	Item 5	1,7	6,3	57	35
	Item 6	1,7	3,3	25	70
	Item 7 (-)	45,3	44	8	2,7
<i>vicarious experiences</i> (experiences of others)	Item 8 (-)	44,5	42,5	10	3
	Item 9	4	24	49,3	22,7
	Item 10 (-)	9,7	61,3	25	4
<i>verbal persuasion</i> (social or verbal approach)	Item 11 (-)	14,3	35,3	38,4	12
	Item 12 (-)	9,3	21,3	50,7	18,7
	Item 13	1,7	4	33,3	61
	Item 14 (-)	21,9	53,1	16,7	8,3
<i>Psychological states</i> (psychological index)	Item 15	1,3	2,4	55,7	40,6
	Item 16	0,8	8,3	57,2	33,7
	Item 17 (-)	24,3	44,7	24	7
	Item 18 (-)	23,4	57,3	15	4,3
	Item 19	5,3	22,7	56	16
	Item 20 (-)	12,7	27,2	50,8	9,3
	Item 21 (-)	9,8	40,7	43,2	6,3

Self-efficacy is very important for prospective mathematics teachers to have. Someone who has self-efficacy means having confidence in his ability to be able to succeed in completing a task. More specifically, prospective mathematics teachers who have self-efficacy in numeracy literacy mean that these students have confidence that they are capable of numerical literacy. In this study, it was found that 17,9 % of prospective mathematics teachers have high self-efficacy, meaning they have a strong belief that they can succeed in learning numerical literacy. This is because prospective teachers who have high self-efficacy tend to do a task, even though the task is difficult and consider it a challenge that must be achieved. They will also try to prevent failures, because individuals with high self-efficacy will assume that the failures that arise are the result of their lack of effort.

Meanwhile, students with moderate self-efficacy were dominant in this study. More than half of students fall into the category of moderate self-efficacy. This means that their level of confidence when faced with mathematical proof questions is moderate. They will not shy away and despair when given mathematical proof questions. This is in accordance with the results of (Hajjina & Retnawati, 2022; Herizal, 2021) which says that students with moderate levels of self-efficacy in principle will not easily give up when the teacher gives assignments, only if they have tried seriously but cannot be completed then they give up. Good results were obtained from filling out the questionnaire, there were no prospective teachers who had low self-efficacy. This is an important basic capital for prospective mathematics teachers to have, because if their self-efficacy is weak, then the tendency that arises is that they will also find it difficult to learn numeracy literacy. That's because they already have the view that they are not able to master numerical literacy and especially to teach it.

The results of previous studies have shown that there is a relationship between mathematical performance and a person's self-efficacy (Hajjina & Retnawati, 2022; Herizal, 2018). Therefore, the dominant self-efficacy at a moderate level is a good start for prospective mathematics teacher to continue learning the material and to cultivate confidence that they will be able to teach/integrate numerical literacy in mathematics learning later.

Conclusion

The importance of student self-efficacy in learning needs to be the attention of lecturers in developing learning activities. The self-efficacy of prospective mathematics teachers in numerical literacy is still dominant at the moderate level, meaning that the level of confidence of prospective mathematics teachers when faced with mathematical literacy questions or conditions that require the need for numerical concepts is moderate. One of the learning activities that can be done to improve student self-efficacy is lesson study-based learning activities. With lesson study students will feel comfortable, reduce student stress levels, and reduce negative emotional tendencies. As a result, a comfortable learning environment will make students increase their confidence, have a high level of persistence in completing difficult tasks and never give up in completing the assigned tasks.

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