Improving self-efficacy in the teaching of prospective mathematics teachers by involving them in the online teacher community

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Abstract. Self-efficacy in teaching is very important for prospective teachers. Prospective teachers who have good self-efficacy in teaching can carry out the profession as a teacher well in the future. This study aims to improve the self-efficacy in teaching of prospective mathematics teachers by involving them in the online teacher community. A total of 58 prospective mathematics teachers were included as samples. They were divided into two groups. The experimental group attended micro teaching courses while involved in the online teacher community, on the other hand the control group attended a micro teaching course while assisting the model teacher. Self-efficacy in teaching was measured by a questionnaire at the beginning of the semester as a pre-test and at the end of the semester as a post-test. The results showed that prospective mathematics teacher who took micro teaching courses while involved in the online teacher community experienced a higher increase in self-efficacy compared to those who attended micro teaching courses while assisting the model teacher. These results indicate that the association of prospective mathematics teachers in the online teacher community has a positive effect on increasing their self-efficacy in teaching. In-depth interviews indicate that a combination of synchronous and asynchronous communication plays a role in increasing their self-efficacy. Computer-mediated communication that is context-free and not too bound by social conventions greatly helps increase the self-efficacy of prospective teachers.

1. Introduction

Teachers have a very strategic role in education. The quality of the teacher really determines the quality of learning [1]. While teachers are referred to as the center of the education process [2], so teachers become a very important part of any community for various reasons [3]. Republic of Indonesia Law No. 20 of 2003 concerning the national education system that establishes educators as professionals who discuss the implementation process, evaluate learning outcomes, conduct coaching and training, and conduct research and community service. In accordance with Indonesian law number 19 of 2005 teacher educators must have four competencies, namely pedagogical, personal, professional, and social. Pedagogical competence is the ability to manage learning given an understanding of students, the design and implementation of learning, evaluation of learning outcomes, and the development of students to actualize the various potentials they have. Personality competence is a personality ability that is steady, stable, mature, wise, and authoritative, be an example for students, and noble. Professional competence is the ability to master extensive and in-depth learning material that enables students to meet specified competency standards. Social
competence is the ability of educators as part of the community to communicate and mingle with students, educators, educators, parents/guardians of students, and surrounding communities.

The four teacher competencies above are expected to produce 21st century graduate education competencies, namely mastering core academic content, having critical thinking skills and solving complex problems, having competency to work together, being able to communicate effectively, mastering learning skills in learning, and being able to develop academic mindset [4]. Some competencies may involve more knowledge than skills or attitudes, whereas, some competencies may be more skill or performance based [5]. Therefore, although these four competencies constitute a totality that builds the teacher's figure as an educator, each competency can be partially assessed to increase the sharpness and depth of insight of prospective teachers. Thus, teacher competence can develop dynamically to anticipate the development of competencies that students must possess.

One of the factors that determine the success of teachers in carrying out highly complex tasks is self-efficacy. Self-efficacy refers to the level of trust individuals have in themselves to achieve the desired results [6,7,8], complete tasks [9], realize one goal [10], so self-efficacy is a good predictor of performance behavior [11] If self efficacy is combined with specific goals and understanding of achievement, then it becomes a determinant of behavior in the future [12]. Individuals with high self efficacy are able to do many and varied tasks, whereas individuals with low self efficacy tend to avoid difficult and challenging tasks [7]. Self efficacy consists of three dimensions, namely magnitude, strength, and generality [13]. The magnitude dimension can be observed from the selection of behavior based on the level of difficulty of the perceived task. Someone will try to do certain tasks that he perceives he can do and he will avoid situations and behaviors that he perceives are difficult to do.

The magnitude dimension in learning can be seen from one's belief in learning decision making and its ability to overcome learning problems. The generality dimension measures the extent to which individuals are confident in their abilities in a variety of task situations, ranging from the usual activities carried out to the activities that have never been done. This indicates the extent to which a person is confident in his ability to carry out several different tasks, from specific tasks to various task groups. In matters of learning, the generality dimension can be observed from one's belief in addressing various alternative learning decisions with a positive attitude and a sense of curiosity. The strength dimension indicates the confidence possessed by someone who can be realized in carrying out certain tasks. Individuals who have high confidence in their own abilities will increasingly enjoy tasks that are full of challenges and have a strong determination of their ability to carry out tasks and continue to survive in their business despite many difficulties and obstacles. When it comes to learning, the strength dimension appears from self-confidence to succeed in handling learning problems and having a high commitment in planning and implementing learning.

Self-efficacy is a major determinant because it influences behavior both directly and as a result of its influence on other determinants [14]. Therefore, self efficacy must receive special attention in the coaching of prospective teachers. Until now, coaching prospective teachers is done through microteaching programs. Technically, microteaching is minimized teaching [14], and has become an important innovation in teaching that helps improve teacher quality [16]. One of the goals of education is that students have competence in their fields and are able to teach themselves throughout life. The core skills of microteaching help beginner teachers to learn the art of teaching easily and to the maximum extent [17], in order to be able to grow competencies in students to learn themselves.

Microteaching as a practical training technique provides many opportunities for prospective teachers to design effective learning before they are involved in real class experiences as teachers [18]. It's no exaggeration to say that microteaching is a simulation of real learning in the field. In real learning in the field prospective teachers will confront students. As a result, they may be nervous, anxious, or lose control. Simulation of learning with peers in micoteaching can give them a good experience. Their familiarity has already occurred, so they will be able to provide input to each other to improve competence and reduce things that are destructive. Through communication between beginners and seniors, microteaching helps to promote real-time teaching experiences [17].
Mastery and arrangement of material is very important in the learning process. Indeed mastery of the material has been obtained in the lecture material, as well as the arrangement of the material has been obtained in pedagogy lectures. However, prospective teachers still need to be trained in preparing skills for learning, implementing learning, and conducting evaluations through microteaching programs. Media preparation skills, media use skills, questioning skills, evaluation skills, feedback skills, and several other skills are trained in microteaching. If all of these competencies have been mastered, then it is not difficult for prospective teachers to improvise in learning to improve the quality of learning. This is necessary because students can learn more effectively if the teacher is consistent with his teaching style [19].

Although the Microteaching session provides scope to improve their teaching competencies for real teaching sessions, there is room for some drastic changes in the transition to real learning [20]. This means that even after undergoing a microteaching program, efforts are still needed to be able to carry out real learning in the field properly. Microteaching program participants are sometimes not enthusiastic about participating in microteaching activities because of the unnatural classroom environment and limited training schedule [21]. Efforts are needed to bring the microteaching situation closer to the real teaching situation in the classroom. Several attempts have been made on micoteaching to improve teaching skills, such as using drill guide methods [22], practicing the skills in teaching and re-teaching sessions of microteaching [23], and microteaching treatment with video recording [24].

During this time, the microteaching program is conducted in a face-to-face pattern under the guidance of supporting lecturers and accompanied by senior teachers as consultants. This study seeks to improve the competency of prospective teachers by trying to involve microteaching program participants in the online teacher community. The microteaching program is conducted in a classroom with a face-to-face pattern, but participants are involved in online communication with the teacher community. The involvement of participants in the online teacher community is expected to be able to increase the insight of prospective teacher students by communicating to many teachers online. Communication is carried out unobstructed by time and place, so that communication can be done with a higher frequency. In addition, the communication made by prospective teachers and teachers is relatively context-free because they do not face-to-face. As a result, students can communicate more openly, so that their self-confidence can develop properly. Online communication in microteaching is carried out on a number of recommendations, that pedagogical guidance of prospective teachers should be more focused on developing skills to utilize technology in learning [24].

2. Methods

Research conducted on 58 prospective mathematics teacher students. They were randomly divided into two groups, one group being the experimental group and one group being the control group. The experimental group participated in microteaching lectures where consultations with the supervisors and consultant teachers were conducted online through the online teacher community. The online teacher community is intentionally formed for research purposes through a dynamic website, where communication can be done directly on the website so that it is open to all participants. On the other hand, the control group followed microteaching lectures, which consulted with supervisors and consultant teachers through face-to-face communication. In this case, communication is done face-to-face, both in the classroom and outside the classroom. Experiments using the pretest-posttest control group design [26].

Self-efficacy data were collected using a questionnaire with 35 items involving three dimensions, namely three dimensions, namely magnitude, strength, and generality [13]. The magnitude dimension is represented by two indicators, namely confidence to achieve better success through more optimal effort and confidence to be able to complete difficult tasks. Furthermore, the strength dimension is represented by two indicators, namely confidence to be able to face obstacles during lectures and confidence to be able to work hard, be diligent and adapt to the problems at hand. Finally, the generality dimension is also represented by two indicators, namely confidence to achieve good results
and confidence to be ready to accept new tasks. Self-efficacy institutions are arranged according to Likert rules with five choices, namely strongly agree, agree, betral, disagree, and strongly disagree.

The content validity of the self-efficacy instrument was assessed by three experts and the results of the assessment were analyzed using the Gregory results formula [27]. The results of the analysis found an index of content validity of 0.78. The instrument was further tested in the field by involving 48 relevant respondents to find the internal consistency of the items and the reliability of the instruments. The internal consistency of the items was analyzed using the Pearson product moment correlation formula and the correlation coefficient (r) was obtained with a range from r = 0.32 to r = 0.72. Instrument reliability was analyzed by Cronbach's Alpha formula and an alpha coefficient (α) of 0.78 was obtained. In accordance with the guidelines, self-efficacy instruments are feasible.

Data were analyzed using descriptive statistics to obtain mean scores and standard deviations. Furthermore, for hypothesis testing, the data were analyzed by one-way ANCOVA statistics, which pretest scores were treated as covariable. The ANCOVA test requirements which include the test data normality test, variance homogeneity test, and linearity test and the significance of the regression direction between covariables and the dependent variable have been carried out first.

3. Results and Discussion
Analysis of quantitative descriptive data obtained a mean score of self-efficacy for the experimental group of 152 and for the control group of 132. The hypothesis testing requirement test found that the data from the two groups were normally distributed, the data of both groups were homogeneous, and there was a significant linear relationship between covariables with the dependent variable. Therefore, ANACOVA can be carried out and obtained the output as shown in Table 1. The results of the hypothesis test get an F* value of 46.66 with a significance of 0.000. These findings indicate a difference in self-efficacy between the experimental group and the control group. The mean of the experimental group's self-efficacy score of 152 outperformed the control group's average score of 132. The conclusion that can be drawn from these findings is that students who take microteaching with online communication have higher self-efficacy than students who take microteaching lectures with face-to-face communication.

| Table 1. Tests of Between-Subjects Effects. |
|--------------------------------------------|
| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|--------|--------------------------|----|-------------|---|-----|
| Corrected Model | 5856.963 | 2 | 2928.481 | 32.265 | .000 |
| Intercept | 17144.724 | 1 | 17144.724 | 188.893 | .000 |
| X | 76.945 | 1 | 76.945 | .848 | .361 |
| G | 4235.012 | 1 | 4235.012 | 46.660 | .000 |
| Error | 4992.020 | 55 | 90.764 |
| Total | 1180077.000 | 58 |
| Corrected Total | 10848.983 | 57 |

\[ ^a \text{R Squared} = .540 \text{ (Adjusted R Squared} = .523) \]

Limited but in-depth interviews with student representatives found that the asynchronous combination greatly helped improve their self-efficacy. Some students who initially have communication problems, such as embarrassment to ask questions, fear of being wrong and so on, are gradually trained to speak up. Initially they communicated without mentioning identity, but gradually they dared to communicate by including identity. Students who have difficulty asking or commenting
start communication by modifying the questions or comments of the theme. Over time they are able to ask questions or submit opinions in their own sentence.

The above findings show that online communication in the microteaching program has a positive impact on the development of student self-efficacy. These results are likely to occur among others due to the freedom to find learning resources and the flexibility to communicate with experts who are used as discussion partners. Prospective teacher students feel more confident after attending online microteaching lectures, even 82.68% of students agree that online microteaching programs increase their professional competence [28]. More specifically related to the self-efficacy of prospective teachers, Mergler & Tangen [29] found findings that were very similar to the findings above, that prospective student teachers who took the microteaching program via the internet had higher self-efficacy compared to prospective teacher students who took the microteaching program internally.

The influence of online communication for prospective teachers in an effort to improve their self-efficacy is acceptable and rational. The internet has more resources and can be used more flexibly. Online communication is more flexible than face-to-face communication, both in terms of context and social conventions. As a result, the internet has an influence on student attitudes toward research [30] and has an effect on increasing student learning achievement [31]. These findings indicate that the use of information technology in micoteaching programs must be improved. In addition to making communication more flexible, more accessible learning resources will be available. Thus, the microteaching program also acts as a self-learning media for the most part in order to be able to continuously improve pedagogical and academic competencies.

4. Conclusions and suggestions
The online teacher community is able to increase the self-efficacy of prospective teacher students. The involvement of prospective teacher students in online communication is able to develop their awareness of their abilities. Communication that is context free and relatively free of social conventions is able to bring them to a condition where they become more willing to ask questions, express opinions, or give consideration to the opinions of others. As a result, they are trained to convince themselves to be able to make decisions and be able to overcome problems in a variety of situations. In addition, they will be trained also in responding to various alternative decisions with a positive attitude and a sense of curiosity.

Going forward, the micoteaching program must be carried out in a richer technological environment. The variety of technologies used provide opportunities for prospective teacher students to find resources and communicate to various parties in various modes. The disclosure of information from various parties will make cross fertilization in the academic field more varied. This will foster the self-efficacy of prospective teacher students and will be followed by other impacts that demand competency of teacher candidates.

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