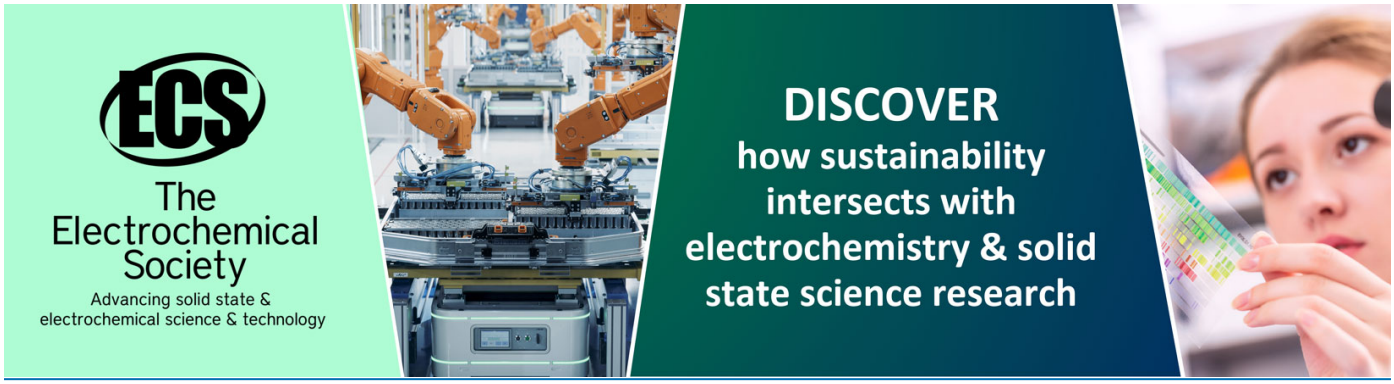
Effectiveness of scaffolding-based interactive teaching materials: reflective thinking ability in prospective teacher mathematics



Effectiveness of scaffolding-based interactive teaching materials: reflective thinking ability in prospective teacher mathematics

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Abstract. This research is motivated by the importance of reflective thinking skills in prospective teacher students. This ability is felt to be lacking especially in prospective teacher students at one of the state universities in Banten Province, even though they need this ability to train their students. One of the efforts given is interactive scaffolding-based teaching materials. Teaching materials are developed by using computer technology. This study uses a quasi-experimental research method. The population of this study is a student candidate for mathematics teacher at a state university in Banten with a sample of 2 classes taken by students who are taking courses related to learning. The instrument used was a test of reflective thinking ability in the form of a matter of description. Processing data using non-parametric U-Mann Whitney statistical tests. The results of this study concluded that the reflective thinking ability of pre-service mathematics teachers of students with the application of learning through interactive Scaffolding teaching materials is better than that applied in learning with teaching materials in the form of PPT. This conclusion is indicated by the data value of Asym. Sig = 0.278 is greater than $1 / 2\propto = 0.025$

1. Introduction

Thinking is an ability that needs to be developed by students. One of the thinking abilities in question is mathematical reflective thinking. This ability includes thinking ability which is the goal of the 2013 curriculum. Reflective thinking skills include higher order thinking skills [1,2]. Reflective thinking ability is the basis for critical thinking skills and other mathematical abilities [3,4]. Someone who already has the ability to think critically must also be able to have reflective thinking abilities, this is what makes reflective thinking skills the basis for critical thinking skills [5,6].

The importance of this reflective thinking ability has not been touched by the teachers and educators at LPTK. The ability of reflective thinking for middle school students is the ability to interpret cases based on the mathematical concepts involved, can evaluate the truth of an argument, can draw analogies from two similar cases, can analyze and clarify questions and answers, can generalize, can distinguish between relevant and unrelated data relevant [7]. Meanwhile, there are seven stages of mathematical reflective thinking ability namely, stage 1 observing, stage 2 understanding the problem, stage 3 collecting data, stage 4 conducting an assessment of the data collected, stage 5 choosing strategies to solve the problem, conceptualizing stage 6, and monitoring solutions stage 7 [8]. Seven stages turned out for low category schools, students were still at the data collection stage.

Someone who is able to develop reflective thinking, will be able to evaluate the problem solving process created, able to choose strategies in solving problems, able to monitor solutions so that they will

be able to develop other abilities. One of them is mathematical ability that can be supported by reflective mathematical thinking skills including problem solving ability, mathematical literacy ability, connection ability, and so on. The ability of reflective thinking can be given well if used to the lecturers in class by providing learning experiences towards the development of these thoughts.

Including prospective teacher students who need to be sharpened in their reflective abilities, bearing in mind that after graduating they must be able to provide reflective skills to their students. So since university, it needs to be sharpened and developed. Reflective thinking ability is important, this is in line with his study [1,9,10]. A more appropriate model for professional education is to equip students to become reflective practitioners to deal with multi-faceted issues [9]. Reflective thinking as an important element in the learning process [10]. The two main and necessary thinking skills in Higher Education are critical thinking and reflective thinking [1].

Prospective student-teachers at one of the state universities in Banten Province are still low in their ability to express their reflections, especially after obtaining material related to educational material or conducting peer-teaching activities. In addition, at the University there are no supporting media to improve reflective abilities and dispositions.

One effort that can improve the reflective thinking ability of prospective teacher students is given teaching material related to the development of reflective thinking skills, namely scaffolding-based teaching material. Scaffolding is help given to students, in the form of questions or actions to solve problems, help is gradually reduced when students have been seen able to solve it [11,12]. Scaffolding provisions are based on several research results that can improve learning outcomes [13]. Based on interactive scaffolding is a teaching material that will be developed, this choice so that students can establish two-way communication between teaching materials with students themselves. Currently students are still accustomed to using teaching materials in the form of Power Points (PPT). Teaching materials in the form of PPT are still one-way, not yet interactive, and usually need to be guided by lecturers.

There are five different scaffolding learning techniques, namely modeling desired behavior, giving explanations, inviting student participation, verifying and clarifying student understanding, and inviting students to provide instructions [14]. In practice, these techniques can be done simultaneously or each depends on the material being taught.

The interactive scaffolding referred to in this study is the scaffolding or assistance provided by the teacher or lecturer to students with the help of interactive computer-based media, which uses metacognitive scaffolding with interactive media [15]. The results showed that interactive media with scaffolding with mathematical literacy skills were better than direct learning. The difference is the absence of interactive scaffolding in improving the ability and disposition of students' reflective teacher prospective thinking.

Thus the problem formulation of this study is: How is the effectiveness of interactive scaffolding teaching materials on the reflective thinking ability of prospective mathematics teachers when compared to the reflective thinking ability of prospective teachers who receive PPT teaching materials?

2. Method

This study uses a quasi-experimental method, with a population of prospective mathematics teacher students at state universities in Banten Province. The sample of this study was taken two classes on students taking courses related to learning. In all two classes randomly selected to be an experimental group and a control group. Both groups have 30 students each. The experimental group applied interactive scaffolding (KEBS) teaching materials while the control group was applied with teaching materials in the form of power points (PPT) which we call KCPP. The instrument was given in the form of reflective thinking ability tests, and data processing using non-parametric statistical tests, namely the Mann-Whitney test because the two data are not normal.

3. Result and Discussion

This research is a series of previous studies that have designed interactive teaching materials for scaffolding teaching materials. This teaching material contains pedagogical competencies that need to be known by prospective teacher students including: Mathematical Learning Model; Media and

Learning Resources; Evaluation of Mathematics Learning; Learning Implementation Plan; Psychology of Mathematics Learning; and Screenshot of teaching material presented in Figure 1.

Figure 1. Screen Shoot of Interactive Teaching Materials

Figure 1 is the teaching material given to students in the experimental group. Students can choose a menu about pedagogical competencies to be developed. There are 5 pedagogical competencies developed, namely: (1) mathematics learning model, (2) Psychology of Mathematics Learning, (3) Evaluation of mathematics learning, (4) Media and Learning Resources, (5) Learning Implementation Plan.

Reflective thinking ability seen includes several indicators, namely: (1) identification of conclusions; (2) identify reasons and evidence; (3) identify valuable assumptions and conflicts; (3) identify descriptive assumptions; (4) evaluating reasons, (5) identifying missing information.

Data from the two groups namely KEBS and KCPT were processed using a non-parametric Mann Whitney U statistical test because the data from the two groups were not normal. Below are the results of the normality test using the Shapiro-Wilk test.

Table 1. Normality Test Results

Group	Statistic	df	*Sig.*

KEBS	0.892	30	0.005
KCPT	0.890	30	0.005

Based on Table 1, these two data are not normal because the sig value is 0.005 <0.05. Thus, it is continued with the average difference test with the Mann Whitney U test. This test uses the left side test, with the hypothesis put forward as follows:

H0: U1 ≥ U2 The reflective thinking ability of students who get teaching material Interactive scaffolding is better than the reflective thinking ability of students who get PPT teaching material.

H1: U1 <U2 The ability of reflective thinking of students who get teaching material Interactive scaffolding is lower than the ability of reflective thinking of students who get teaching material PPT.

The test results can be seen in the following Table 2

Table 2. Test Results for Differences in Reflective Thinking Ability

Group	Asymp.sig (2 -tailed)
KEBS dan KCPT	0.589

From the table above shows the ASymp-sig (2 tailed) value of 0.589. Because the test is a left-hand test, then P-Value = 0.278. This value is greater than 1/2 = 0.025. So that H0 is accepted, it means that at the 95% confidence level the ability of reflective thinking in students who are given interactive scaffolding teaching materials is better than students who use PPT teaching materials.

Interactive scaffolding teaching materials make students effective in reflective thinking skills compared to teaching materials with PPT. This is because interactive scaffolding teaching materials developed make it easier for students to find out pedagogical knowledge guided by questions. If students have difficulty completing assistance guided by students in the form of directives, information that reminds students of prior knowledge, this is interactive. Students can choose answers, if there are incorrect answers, students get help or scaffolding. As part of the teaching material contained in Figure 2.

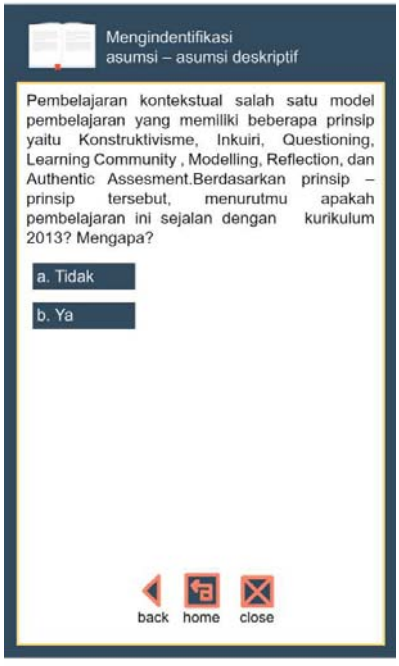

Figure 2. Part of the teaching material

Students if wrong in answering, will be guided with help or scaffolding in the form of direction questions to answer or remember previous knowledge in order to answer and understand the material submitted. Questions raised in this teaching material help students indirectly to understand the material. The assistance contained in Figure 3:

Figure 3. Assistance

Scaffolding in the interactive teaching materials developed among them can remind of previous knowledge, because it includes the help of questions to encourage students to think related to the answers asked. This scaffolding can improve learning achievement, [16]. Reflective abilities can be developed through scaffolding, and these abilities are very important to be given to prospective teacher students. [17].

Scaffolding-based interactive teaching materials are needed by students as stated that If you see the current rapid technological developments and the needs of the skills needed by students, the appropriate scaffolding is in the form of interactive teaching materials [18]. Because interactive teaching materials through technology users can interact. The interaction obtained in this teaching material is to choose the answer to the question posed if it has not been properly received direction related to supporting or prior knowledge. Use of interactive teaching materials is considered very relevant to help students improve their metacognitive abilities, thinking abilities and reflective mathematical dispositions [19].

Interactive media shows their strengths in the prospective teacher's reflective thinking skills, each of whom saw their strengths in increasing the ability of electric concepts to prospective teachers and students' critical thinking skills [19,20]. This illustrates that interactive media such as interactive teaching materials have a very important role in making effective various abilities.

4. Conclusion

Interactive scaffolding teaching materials can provide effectiveness in the reflective thinking ability of prospective mathematics teachers. Because the reflective thinking ability of prospective teacher students is better given interactive scaffolding teaching material compared to that given PPT material.

5. Acknowledgements

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