The Implication of E-Scaffolding in Mathematical Physics
Students Achievement and Motivation

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Abstract: The aim of this research was to study the effect of e-scaffolding on motivation and achievement of students. This study used quasi experimental design with post-test control group design the data analysis technique used was a one-way analysis of variance. The results are as follows. H1) Students under different teaching methods were significantly different in terms of student's achievement (F =6.23, p=0.013). H2) Students under different teaching methods were significantly different in terms of student's motivation (F =15.23, p=0.001). Finally, according to the results, we found e-scaffolding can help student to learn Mathematical physics more effective and easy at their own place and flexible with their times. It means that the e-scaffolding is more appropriate learning to improve motivation and achievement of students than traditional teaching.

1 INTRODUCTION

Mathematical physics is one of difficult subject for students of the physical sciences. This subject has important role in applied physics. Students have a perception that mathematical physics course are a very difficult and complicated course, unpleasant, less varied teacher in presenting the material so that students are unmotivated to learn it. Mathematical physics contains Mathematics, that is consisting of many interconnecting parts or elements and hierarchical concepts and deductive reasoning So, the material or ideas/concepts of mathematics at the previous level related to understanding the concept of mathematics in the next level. This causes not all learning methods can be used in this course. The learning media used is also very limited. Although traditional learning or direct learning has shown a pattern of interaction between teachers with learners or a group of students Reiser (2004) this learning model causes students be fed up and unmotivated in learning. Motivation could affect the learning achievement of the person. In general, someone who has a high motivation will have a good learning achievement as well (Chen et al., 2016). Hence, identifying the means to learning motivation is important. Without motivation, students will only engage in superficial learning thus depriving them the essence of learning. With high motivation, students will be able to carry out their work diligently and strive persistently to achieve learning goals as achievement (Cohen, 2016). Achievement of students out as the indicator to evaluate students' learning results and the major item to evaluate teaching quality. Student's achievement and motivation would be affected by teaching methods, learning behaviours and curriculum design. In this respect, teachers and instructors must fully understand the vital role of motivation in learning. Generally, a teacher could merely teach students with the average standards. Some low-achievement students present low learning motivation and appear helplessness to become "guests" in the class (Qiang, 2018). On the other hand, those with excellent academic might be familiar with most contents in textbooks to become "systematically demotivated" as they consider the lessons in classes being too easy. it's why teacher need teaching by scaffolding. Nonetheless, teachers could hardly satisfy each student's needs in school education, due to teaching time and schedule. This problem can be solved by using e-scaffolding, because learning based on ICT (e-learning) has become indispensable to making learning become efficient (Hanafi et al., 2017).

Scaffolding as a metaphor for the way teacher can support student's progress and achievement

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through a relatively difficult task depend on Zone of Proximal Development (ZPD) (Fernández et al., 2001). Wass et al (2011) has proposed that a ZPD useful for understanding how that interpersonal communication can conceptual development and aid learning in which the interactive process of teaching and learning rest on the maintenance of dynamic learning between teacher and learner. The creation of such learning environment relies on both pedagogical and technological factors. These two main factors, such as appropriate feedback and scaffolds. E-scaffolding is a product of online learning aids (e-learning) using website and scaffolding facilities (Ayu et al, 2017). Used e-scaffolding can help inspire students to partake in learning activities, which reinforce their desire to achieve learning goals as their achievement. Ayu et al (2017) prove that E-scaffolding can increases the quality of process and learning outcomes.

From the literature review, there have been unidentified e-scaffolding effect on Mathematical physics learning especially on student's achievement and motivation. In addition, motivation may influence student's achievement. Therefore, motivation and achievement variables were included in this study to investigate the effect of blended learning using e-scaffolding and traditional teaching. The relationships between teaching method, motivation, and achievement were explored. Taking the main purpose of this study into consideration, the following research hypotheses were developed;

H1: A difference exists between the experimental group and the control group in the student's achievement.

H2: A difference exists between the experimental group and the control group in the student's motivation.

2 RESEARCH METODHOLOGY

This study used quasi experimental design with post-test control group design. The population was the college students of universitas Kanjuruhan Malang, who take mathematical physics courses. The samples in this research were 56 students who were randomly selected. This research used two classes as the experimental class (n = 28) and the control class (n = 28). The students in the experimental class were taught by blended learning using e-scaffolding, while the students in the control class were taught by using traditional teaching (direct instruction). The topic learned was about matrix and integral. Student's academic achievement were collected by test and questionnaire base on Intrinsic Motivation Inventory (IMI) used for student's motivation. That was conducted for 3 meetings. The test was carried out after the treatment was given. The data analysis technique used was a one-way analysis of variance with SPSS 21.0

3 RESULTS

According to Analysis of Variance in the level of significance of 5%. The difference of e-scaffolding in motivation and achievement of student is discussed. E-scaffolding appears significant differences from traditional teaching in motivation and achievement of student, which are higher with e-scaffolding than with traditional teaching that H1 and H2 are supported. Research results is given in Table 1. Table 2 summarizes the result of the analysis student's achievement and motivation based on learning method.

Table 1: Difference analysis of e-scaffolding in student's achievement dan motivation.

Variable	Achievement			Motivation		
	F	P	Scheffe post hoc	F	P	Scheffe post hoc
e-scaffolding	15,23	0,001	e-scaffolding > traditional teaching	6,23	0,013	e-scaffolding > traditional teaching

Table 2. Student's achievement and motivation based on learning method.

Variable	E-scaffolding			Traditional Teaching		
	Min	Max	Mean	Min	Max	Mean
Motivation	3	6	5,8	1	5	3,2
Achievement	64	85	75	52	75	63

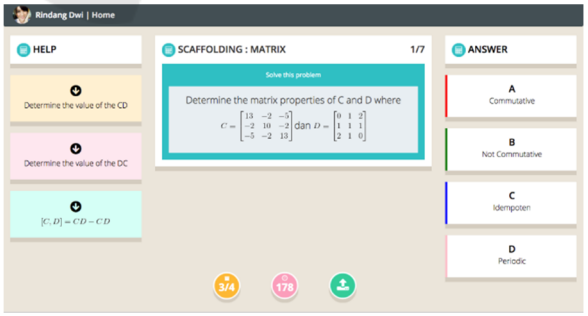

Figure 1. One of the part in e-scaffolding.

4 DISCUSSIONS

A number of interesting findings were revealed by the data analysis. Firstly, Effect of applied method

on the motivation of the students. A main effect attributed to teaching method was found, showing that, in general, e-scaffolding have relatively higher motivation than traditional teaching. That showing by table 1 dan table 2. The motivation and the learning are two things that affect each other. According to the research of Chen et al. (2016), students' learning motivation is measured with single dimensions in this study, including in regarding learning as interests and favour of challenging lessons, others' affirmation, hobby, passing examinations or evaluation, acquisition of better performance, showing off to others, acquiring appreciation, competing with classmates and notice from the elderly or the opposite gender, not having the shame of failure, not being punished and blamed. Using e-scaffolding student have a challenging experience in their lesson, because they will get appreciation if they didn't use the scaffold that given. student haven't the shame of failure, because e-scaffolding having privation content just between him/her and teacher. In the former setting, students can use their computer and mobile devices with greater flexibility and mobility to communicate and discuss with their peers and teacher. Reiser (2009) argue that two complementary mechanisms can explain how a diversity of scaffolding approaches in software (e-scaffolding) act to support learners. Figure 1 is One of the part in e-scaffolding. It's showing, how many scaffolds for student and what the consequent if they use the scaffold. E-scaffolding also showing how many times they have to solve all of the problem. E-scaffolding tools can help structure the learning task, guiding student through key components and supporting their strategy and performance. In addition, e-scaffolding can shape students' performance and understanding of the task in terms of key disciplinary content and planning and thus problematize this important content. E-scaffolding have implication to student's motivation because they didn't feel confused with the task. Arguably, the use of such e-scaffolding learning application can help create an effective learning environment in which students can work according to ZPD condition.

Secondly, findings showed that there was main effect attributed to teaching method, indicating that e-scaffolding were able to improve the achievement of students. It is proven by table 1 and table 2. Scaffolding is a significant component in facilitating students' learning. (Choi et al., 2005). Scaffolding involves providing scaffold to students on an ZPD, fading the assistance as learner competence increases (Reiser, 2004). Using the notion of scaffolding' and working within the child's Zone of Proximal Development, that can make meaning thought, Meaningful Tasks and good Adult Interaction (Budaeng et al, 2017). If scaffolding is designed based on the multiple levels of the student understanding found in a classroom as ZPD condition, it support to learning outcome. The results of the quality analysis of the learning process and achievement using E-scaffolding also shows an improvement compared to the use of the traditional teaching or direct instruction method (Ayu et al, 2017). Taştan et al (2018) reported significant impact of motivation on academic achievement in science education. The application of e-scaffolding could help students understand the learning conditions, understand the concept of mathematical physics and provide opportunities for students cultivating their achievement and motivation. In comparison with competitive learning or individual learning, it could better promote students' motivation, student's achievement, and teaching quality and was a teaching strategy worth of application to scaffolding. Azevedo and Hadwin (2005) prove that when students learn about complex topics with computer-based learning environments with of scaffolding they show good ability to regulate their learning, and failure to gain a conceptual understanding, this can influence their achievement. based on the first hypotheses, e-Scaffolding can improve student's motivation. Demircioglu and Ucar (2015) proposed that learning motivation was the psychological factor in encouraging students' learning activity. It was an internal drive directly promoting students' learning as well as the initiation and awakening of learning behaviour. Motivation is the essential condition for meaningful learning and individuals proceeding long-term effective (Lin et al., 2017). Learning motivation is a mediator between responses and stimuli. That is, learning motivation is a learner's personal opinions, and learners would appear distinct knowledge needs because of different opinions (Qiang, 2018). The motivation contributes a direct impact on the learning result (Sumual and Ombuh, 2018).

5 CONCLUSIONS

Based on the results of this study, the following conclusions is application of e-scaffolding showed an effect on achievement and motivation of students. This method can help them to learn Mathematical physics at their own place and flexible with their

times. Moreover, it improves the interaction between students and teachers. fast response, online feedback, online note and facilitates group discussion.

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