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Mathematical Connection Ability And Students' Independence in Missouri Mathematics Project E-Learning

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Abstract

This study aims to (1) investigate the effectiveness of Missouri Mathematics Project e-learning model, (2) find the pola of mathematical connection ability and students' independence of the eighth grade. This research employed mixed method type referring to the concurrent triangulation design which combined qualitative and quantitative research methods. The subject of this study was the eight-grade students of MTs Taqwal Ilah Semarang academic year 2018/2019. The results show that (1) Missouri Mathematic Project model based e-learning is effective enhancing connection ability (2) Discovered the pola of connection (a) students with high mathematical connection ability can associate the mathematical concept with the previous material, and the other subject or related with real life. (b) students with medium mathematical connection ability can associate mathematical concept with real life, but lack of associate the mathematical concept with the other subject, and some students with medium mathematical connection ability can't associate the mathematical concept with the other subject. (c) students with low mathematical connection ability can't associate mathematical concept with real life.

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INTRODUCTION

Mathematics comprises a variety of topics which relate among others. The correlation is not only between the topics and daily life but also mathematical connection. Mathematical connection is one of mathematical abilities that secondary school students should possess and develop. Sugiman (2008) stated that the important thing is not only mathematical connection but also the awareness of developing mathematical connection. The connection among mathematical topics can be understood by students if they experience learning that can practice their connection ability.

There are three objectives of mathematical connection at schools according to NCTM (2000), including (1) Broadening students' knowledge; (2) considering mathematics as an integrated whole instead of an independent lesson; (3) mentioning the relevance and advantages both at schools and outside the schools. From the objectives, mathematical connection can be categorized into three groups, they are connection among mathematical topic, connection of mathematics and other science, as well as connection of mathematics and real world daily life. Philips (2000) elaborated that mathematical connection can develop students' knowledge including conceptual connection, understanding, and creativity. Mathematical lesson is taught in a sequence, and teaching a new concept should relate to the previous concepts.

During learning process, students are commonly not able to connect the previous lesson with the new lesson. In the study by Azizah (2012), most of the students who are less able to learn mathematics consider mathematics difficult, so they hate the lesson. This triggers students to be lazy and lack of learning activities. The lack of activities will inevitably affect learning outcomes. Mathematics learning process is considered good if the teacher can create a learning atmosphere where students get enthusiastic with the current problems, as a result, students can solve the problems and enhance their mathematical connection ability. Moreover, when selecting learning strategy, approach, method, and technique, teachers should consider students' involvement to be independent and active in the mathematics learning.

According to Purnamasari (2014), learning should condition students to gain new information and knowledge not directly from teachers' explanation, but they should be able to build their concepts and principles. This condition needs learning independence which is created from the learning experience. Furthermore, Sitepu (2012) pointed out that learning independence is students know what they should learn, how to learn, and able to look for relevant learning resources, how to collect, sort out, and process the obtained information.

One of the learning models that involve students to be active and independent is Missouri Mathematics Project. Missouri Mathematics Project model is a program designed to help teachers use effective exercises so that students achieve fantastic improvement (Slavin, 2007). Jannah (2013) added that Missouri Mathematics Project model is designed to combine independence and collaboration among groups. The steps of implementing Missouri Mathematics Project model are (1) introduction, (2) development, (3) controlled practice, (4) independent work, and (5) assignment/homework.

In every learning process, media must be concerned by teachers. According to Faroh (2014), one of the media that can be used in learning is Information and Communication Technology (ICT). Jas (2012) in his study obtained a result that mathematical learning based on the website, in general, can enhance students' conceptual ability. (Rohendi, 2012) in his study of senior high school students elaborated that the learning outcomes of students who follow e-learning are better than those who experience conventional learning. The condition nowadays is there are many students using communication devices connected to the internet, however, the students have not used the devices for optimal learning.

In this study, the writer implements Missouri Mathematics Project e-learning model in Linear System with Two Variables lesson to enhance students' mathematical connection ability and independence. The research questions are (1) how is the effectiveness of Missouri Mathematics Project e-learning model? and (2) how is mathematical connection ability and independence of the eight-

grade students during the implementation of Missouri Mathematics Project e-learning model?

METHODS

This study employed mixed method with concurrent triangulation design by combining qualitative and quantitative research in a balanced way. The quantitative data was obtained using experiment method with quasi-experimental design. The researcher selected nonequivalent control group design. The research subject was the eight-grade students of MTs Taqwal Ilah Semarang.

This study was conducted at MTs Taqwal Ilah Semarang in the eight-grade using Missouri Mathematics Project e-learning model for the Linear System of Two Variables lesson. The research period was the even semester in academic year 2018/2019. In the quantitative research, the sample used was experimental class and control class to investigate the effectiveness of Missouri Mathematics Project e-learning model in enhancing learning independence and students' mathematical connection ability. Meanwhile, in the qualitative research, the sample used was the class with Missouri Mathematics Project e-learning model.

Missouri Mathematics Project e-learning model was effective if (1) students' learning outcomes improve and achieve minimum mastery; (2) the average of learning outcomes in the experimental class was higher than the control class, (3) there was improvement in the students' mathematical connection ability after Missouri Mathematics Project e-learning model. The mathematical connection ability was analyzed based on the test result and the interview with several student representatives. The data validity was tested using source triangulation technique, which was the interview with student representatives. The analysis of qualitative data adapted Miles and Huberman (in Sugiyono, 2013) concept, including reducing data, presenting data, and drawing conclusion.

RESULTS AND DISCUSSION

The result of posttest of mathematical connection ability was tested using Wilcoxon test as the data was not normally distributed. The Wilcoxon test was conducted by comparing the data of mathematical connection ability with μ_0 = 70 (minimum mastery criteria), and the result is summarized in Table 1.

Table 1. Mastery Test of Mathematical Connection Ability using Wilcoxon

Group	Average	μ_0	N	Z_{hitung}	Sign	Criteria
Experiment	80.30	70.00	20[a] 2[b] 0[c] 4[d]	-3.853	0.000	Complete
Control	61.48	70.00	21[e] 0[f]	-3.511	0.000	Incomplete

Note:

a. Posttest > 70 (experiment)
Posttest > 70 (control)
b. Posttest < 70 (experiment)
Posttest < 70 (control)
c. Posttest = 70 (experiment)
Posttest = 70 (control)
d.
e.
f.

Table 1 shows that out of 22 students in the experimental group, 20 students scored above 70, and 2 students scored below 70. The result of mastery test of connection ability obtained Z = -3.853 with the significance level < 0.05, meaning that mathematical connection ability of students following Missouri Mathematics Project e-learning model was significantly more than the minimum mastery criteria (70) or complete.

The result of posttest of mathematical connection ability after learning can be seen in Table 2.

Table 2. Mathematical Connection Ability after Learning

Variation Source	Experiment	Control
Average	80.30	61.48
Variance	73.98	66.10
Maximum	100.00	80.00
Minimum	66.67	53.33

Table 2 presents the average result of students' mathematical connection ability after learning in the experimental group was 80.30, with the highest score 100 and the lowest score 66.67. This condition was relatively different from mathematical connection ability after learning in the control group with the average score 61.48, the highest score 80, and the lowest score 53.33.

Moreover, the analysis result using U Mann Whiteney test showed that the Z was -3.826 with the significance level 0.000< 0.05, meaning that mathematical connection ability after Missouri Mathematics Project e-learning model and the expository model was significantly different. The average score indicated that mathematical connection ability after Missouri Mathematics Project e-learning model was higher than the average score of the expository model.

Gain calculation was used to investigate the improvement in students' mathematical connection ability after Missouri Mathematics Project e-learning model. Based on the Gain calculation, classically, there was an improvement in students' mathematical connection ability. The calculation result was presented in Table 3.

Table 3. Improvement in Mathematical Connection Ability

Gain	Criteria	Experiment		Control	
		F	%	f	%
0.7 < g	High	5	23	0	0
0.3 < g ≤0,7	Fair	15	68	11	41
g ≤ 0.3	Low	2	9	16	59
Total		22	100	27	100
Average		0.58		0.25	

Table 3 presents that Missouri Mathematics Project e-learning model affects mathematical connection ability, indicated from 68% students who experienced fair improvement with gain ranged from 0.3 to 0,7, the other 9% experienced low improvement, and 23% experienced high improvement.

Students' independence after Missouri Mathematics Project e-learning model improved as presented in Table 4.

Table 4. Learning Independence after Missouri Mathematics Project E-Learning and Expository Model

Interval	Criteria	Experiment		Control	
		F	%	f	%
25.00 – 43.75	Very low	0	0	0	0
43.76 – 62.50	Low	5	23	18	67
62.51 – 81.25	High	17	77	9	33
81.26 – 100	Very high	0	0	0	0
Total		22	100	27	100
Average		68.97		61.84	

Table 4 shows that the average score of students' independence after Missouri Mathematics Project e-learning model in the experimental group was 68.97. 77% of the students had high learning independence, while the other 23% was low.

Through Missouri Mathematics Project e-learning model, students are required to accomplish the tasks by themselves at home or at schools, as the tasks were given online. Subject E13 was able to do pretest well. From the observation result during learning as well as from the interview, subject E13 indicated high independence. Subject E01 included in the low independence category still had difficulties in answering questions that required him to connect mathematics with other disciplines. From the interview result, this subject also did not complete the given tasks. Meanwhile. Subject E14 with incomplete pretest score had low learning independence. After Missouri Mathematics Project e-learning model, the independence and the connection ability improved.

CONCLUSION

Based on the analysis and the discussion, it can be concluded that (1) students' mathematical connection ability in Missouri Mathematics Project e-learning model achieves mastery and reaches the minimum limit more than or equal to 70%, (2) students' mathematical connection ability after Missouri Mathematics Project e-learning model is better than students' mathematical ability in the expository learning, (3) there is improvement in the students' mathematical connection ability after

Missouri Mathematics Project e-learning model, and (4) the students' learning independence after Missouri Mathematics Project e-learning model improves.

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