



SiMaYang Type II Learning Model Assisted by Kahoot Application: Its Impact in Improving Student's Concept Understanding Based on Apos Theory

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Abstract

This research aims to determine the effect of the SiMaYang type II learning model assisted by the Kahoot application in increasing students' concept understand based on the APOS theory. This research is quasi-experimental with posttest only control group design. The sample of this research consisted of 67 students who were divided into three classes. The sampling technique used was the class random sampling technique. The research instrument was declared valid with a good difficulty level and reliable. Therefore, it could be used to collect data on students' conceptual understanding. Furthermore, the One-Way ANOVA test was used to test the hypothesis with a significant level of 5%. This research shows that the SiMaYang type II learning model assisted by the Kahoot application positively influenced students' conceptual understanding.

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INTRODUCTION

Mathematical abilities are needed by human beings in mastering and developing science and technology (Kamarullah, 2017). Mathematics is an exact science that contains the basis to construct ideas and reasoning (Purnomo, 2017; Rahmah, 2013). Mathematics is also one of the main subjects learned by students from basic education to secondary education (Kamarullah, 2017). Therefore, mathematical ability is one of the abilities that each student needs to have. One important mathematical ability is mathematical concept understanding (Sudarman & Vahlia, 2016; Suraji et al., 2018).

Mathematical concept understanding is an ability to interpret and explain something, which enables human to provide an overview, formulate settlement strategies, apply simple calculations, use symbols to represent concepts, and change one form to another (Agustina et al., 2018; Mawaddah & Maryanti, 2016; Susanto, 2013). Concepts in mathematics are interrelated, which prove that this ability is essential (Hutagalung, 2017). A student will have difficulty understanding a material if he does not understand the previous related material (D. Novitasari, 2016). Therefore, an educator must always emphasize learning that refers to the concept of understanding theories. In this research, the conceptual understanding uses the APOS theory. This theory emphasizes that in learning mathematics, a mathematical concept can be developed through the action-process-object stage. Therefore, students' conceptual understanding is more measurable. The APOS theory

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can increase students' activity in the learning process through the action, process, and scheme stages (Marsitin, 2017; Ningsih, 2016).

Poor mathematical concept understanding will negatively influence students' learning outcomes and mathematical problem-solving abilities (Hartati et al., 2017; L. Novitasari & Leonard, 2017). Therefore, educators and students need to improve their interaction to trigger the development of this ability. Therefore, the SiMaYang type II learning model is a good learning model for the classroom.

The SiMaYang Type II learning model teaches abstract concepts and related symbols and trains students' imagination (Bait et al., 2018). This learning model has four learning stages: orientation, exploration-imagination, internalization, and evaluation (Iriani, 2016). It is expected that this learning model to help students improve their mental models and conceptual understanding.

Several studies reveal that the SiMaYang type II learning model affects students' learning outcomes (Iriani, 2016) and representation (Bait et al., 2018; Sholihah & Arif, 2020). None of these relevant studies have looked at the impact of the application of the SiMaYang type II learning model on students' mathematical concept understanding based on the APOS theory. Also, to make the implementation of this learning model easier, the researcher added the Kahoot application in the learning process.

Kahoot has several advantages, one of which is that it contains quizzes in game format. The quiz can make students more active, innovative, and productive (Aflisia et al., 2020; Hartanti, 2019; Kurnia, 2018). Kahoot can maintain students' learning motivation in the learning evaluation process, and an enjoyable atmosphere can be created. Kahoot is also appropriate for the COVID-19 pandemic, where the learning process is done online.

The Kahoot application has been used in several previous relevant studies. It positively influences students' learning motivation (Hartanti, 2019), students' Arabic mastery (Aflisia et al., 2020), and students' learning interest (Ningrum, 2018; Wigati, 2019). The difference between this research and several relevant studies that have been mentioned previously lies in the combination of the SiMaYang type II learning model with the Kahoot application on students' mathematical concept understanding. It is hoped that this combination can bring about positive impacts during the learning process.

METHOD

This research employed the quasi-experimental with posttest only control group design. The population in this research were the seventh-grade students of SMP Negeri 33 Bandar Lampung. The researchers applied the cluster random sampling technique to select three groups as the research samples. Each group was given different treatments. First, experimental group 1 was treated with the siMaYang type II learning model assisted by the Kahoot application. Next, experimental group 2 was treated with the siMaYang type II learning model. Finally, the control class was treated with the conventional learning model. The instrument used in this research was a concept understanding ability test given after the treatment.

The collected data were then tested for their normality and homogeneity. Furthermore, the ANOVA test was performed on the normally distributed and homogeneous data. Figure 1 displays the research procedure.

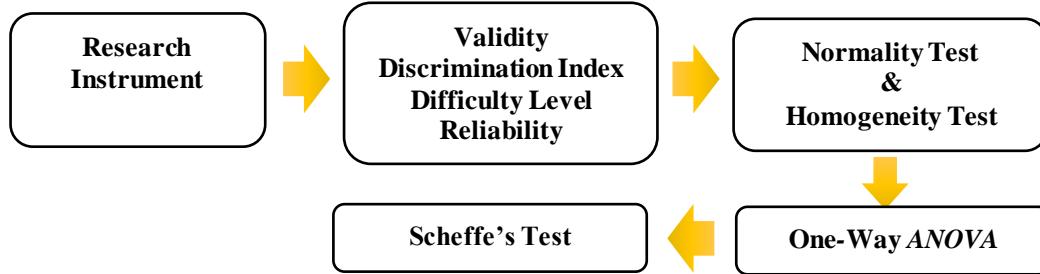


Figure 1. Research Procedure

RESULTS AND DISCUSSION

Students were given different treatments (SiMayang type II learning model assisted by Kahoot, SiMayang type II learning model, and conventional learning model). In addition, the students were given a concept understanding ability test at the end of the meeting. Table 1 displays the test results.

Table 1. The Results of Posttest

Learning Model	X _{min}	X _{max}	Central Tendency			Size of Group Variance	
			\bar{x}	Mo	Me	J	S
SiMaYang Type II Assisted by Kahoot	91	39	66.94	76	64	52	14,224
SiMaYang Type II	85	30	57.35	61	60	55	14.0465
Conventional	76	24	48.22	52	52	52	13,549

Table 1 shows that the highest mean score was obtained by the group that applied the SiMayang type II learning model assisted by the Kahoot application. Therefore, the SiMaYang type II learning model assisted by the Kahoot application provided the best problem-solving ability. Furthermore, the prerequisite tests (normality test and homogeneity test) were performed on students' mathematical concept understanding ability data. The results of the prerequisite tests analysis are presented in Table 2.

Table 2. The Normality Test Results

Characteristics	Significant			Results	Interpretation
	Control	Experimental I	Experimental II		
Significance level (α)	0.05	0.05	0.05	> sig	Normal distribution
Significance value (sig)	0.200	0.200	0.089	> sig	Normal distribution

Based on table 2, it can be concluded that the three groups of research samples came from populations that were normally distributed. Furthermore, a homogeneity test was carried out using the Bartlet test. The following summary is presented in Table 3,

Table 3. Homogeneity Test Results

Characteristics	Significance	Results	Interpretation
Significance level ()	0.05		Homogeneous distribution
Significance value (sig)	0.997	> sig	

Table 3 shows that all research sample groups had the same variance (homogeneous). Therefore, the next step was conducting the one-way ANOVA test of the unequal cell. The test results are presented in Table 4.

Table 4. The Results of One-Way ANOVA Test

Characteristics	Significance	Results	Interpretation
Significance level ()	0.05		
Significance value (sig)	0.000	< sig	H_0 is rejected

Based on table 4, the SiMaYang type II learning model influenced students' concept understanding. Furthermore, the Sceffe test was performed to find out which learning model had better results in increasing students' conceptual understanding. The test results are presented in Table 5.

Table 5. The Results of the Multiple Comparison Test

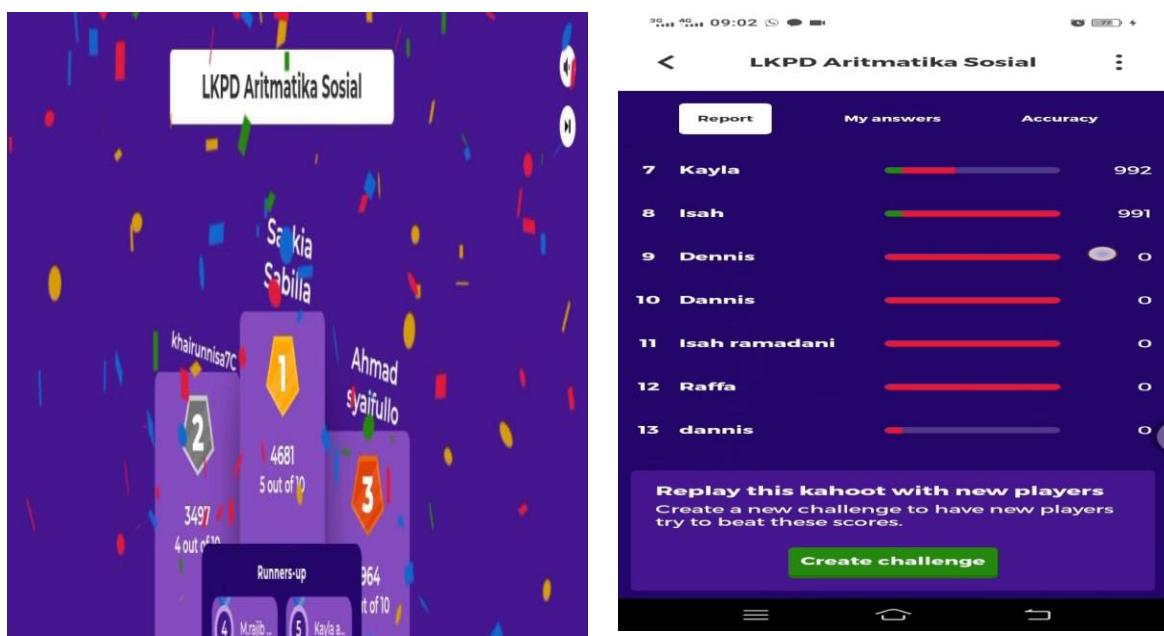
Comparison	Significance	DK	Decision
μ_1 vs μ_2	$P_{1-2} = 0.041$	$P_{1-2} \in \text{DK}$	H_0 is rejected
μ_1 vs μ_3	$P_{1-3} = 0.000$	$P_{1-3} \in \text{DK}$	H_0 is rejected
μ_2 vs μ_3	$P_{2-3} = 0.028$	$P_{2-3} \in \text{DK}$	H_0 is rejected

The first row of Table 5 (μ_1 vs μ_2) shows that H_0 is rejected, meaning there was a significant mean difference between experimental group 1 and experimental group 2. Based on table 1, the average score of the experimental group 1 was 66.94, which was greater than the average score of the experimental group 2 (57.35). Therefore, the SiMaYang type II learning model with Kahoot improved students' concept understanding better than the application of only the SiMaYang learning model type II.

The second row of Table 5 (μ_1 vs μ_3) shows that H_0 is rejected, which means a significant mean difference between experimental group 1 and the control group. Based on table 1, the experimental group 1 (66.94) average score was greater than the average score of the control group (48.22). Therefore, the SiMaYang type II learning model assisted by the Kahoot application improved students' mathematical concepts understanding better than the conventional learning model.

The third row of Table 5 (μ_2 vs μ_3) shows that H_0 is rejected, meaning there was a significant mean difference between the experimental group 2 and the control group. Based on table 1, the experimental group 2 (57.35) average score was greater than the average score of the control group (48.22). Therefore, the SiMaYang type II learning model improved students' mathematical concept understanding better than the conventional learning model.

Based on the observations at SMP Negeri 33 Bandar Lampung, the students of the experimental class I were very enthusiastic during the orientation stage by paying attention when the teacher greeted and asked them to be prepared. Then in the exploration-imagination stage, the students were very active when the researchers asked questions or described everyday life phenomena related to the material. Finally, the researcher invited the students to freely imagine then explore their knowledge (Anwar et al., 2015). Students' imagination in the SiMaYang type II learning model was used in the exploration-imagination stage, and the results were shown through the internalization phase. Eliani (Eliani et al., 2018) states that the SiMaYang learning model supports the maximum learning process. During the internalization stage, a student worksheet was given using the Kahoot application. Figure 2 contains the display of the Kahoot application.

**Figure 2.** The Display of the Kahoot Application

At this stage, the students were asked to participate in a game to decide three winners. It made the Kahoot application able to increase students' motivation, learning independence, and learning outcomes (Ilmiyah & Sumbawati, 2019; Izzati & Kuswanto, 2019; Setiawati et al., 2019). The last stage was evaluation. This stage was conducted by distributing the student worksheet. The researchers provided feedback to students in the form of responses or correction to incorrect answers. The researchers also reviewed by concluding each meeting. Some of these findings made students had a better mathematical concept understanding than the other two classes.

In the orientation stage in experimental class II, the students only paid attention when the researchers greeted them and conveyed learning motivations before teaching the learning material. Then in the exploration-imagination stage, the students became very active in the learning process when they asked them questions or described everyday life phenomena related to the material. The researchers invited the students to freely imagine and then explore their knowledge. At this stage, the students were active in the learning process. However, their activeness did not exceed the experimental group 1 students. The researchers distributed an interesting and colourful student worksheet in the internalisation stage that made the students active in working on questions. In the evaluation stage, the researchers gave feedback to students in the form of responses or correction to students' answers. Finally, the researchers reviewed by drawing conclusions at each meeting. However, the students' concept understanding was lower than the experimental class I.

The learning process was carried out in the control class without applying the SiMaYang Type II learning model. The teacher explained and demonstrated the material and then opened a question and answer session. It hindered the students from being active in learning. Only a few questions emerged in this learning process. Consequently, the students had the lowest concept understanding.

Based on the posttest answers and the APOS theory, the experimental group students were dominant in the Action, Process, Object, and Schematic stages. However, the experimental class II students were dominant in the Action, Process, Object stage but failed at the schema stage. Finally, the control class students were dominant in the Action and Object stages but failed at the process and schema stage.

The results of this research complement the previous relevant research. Alvianto and Hartini (Alvianto, 2020) (Hartanti, 2019) state that the Kahoot application eases the teachers in creating interactive questions and games to attract students' learning interest and motivation. Khomsah and Imron also (Khomsah & Imron, 2020) argue that the Kahoot application can improve the quality of learning. Other research also reveals that the SiMaYang type II learning model can improve students' mathematical representation abilities (Bait et al., 2018; Sholihah & Arif, 2020) and students' concept understanding (Suraji et al., 2018). Combining the SiMaYang type II learning model and the Kahoot application encourages students to play an active role in the learning process, develops and explores their potential, and provides meaningful experiences in learning to achieve optimum results. The SiMaYang type II learning model assisted by the Kahoot application is effective because the students are given a role to be more active in learning. Besides, the students are given the freedom to find learning resources, both from the internet and books.

CONCLUSION

Based on the analysis, the SiMaYang type II learning model assisted by the Kahoot application increased students' concept understanding based on the APOS theory. The SiMaYang type II learning model assisted by the Kahoot application improved students' mathematical concepts understanding based on the APOS theory better than applying the SiMaYang type II learning model and the conventional learning model.

The researchers expect further researchers to use the SiMaYang Type II learning model assisted by the Kahoot application in the learning process. The combination of learning models and learning media is a good solution in improving students' mathematical concept understanding. The SiMaYang Type II learning model can also be combined with several other theories. Likewise, the Kahoot application is beneficial in the learning process.

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