ABILITY TO UNDERSTAND MATHEMATIC CONCEPTS: THE EFFECT OF THE HERMENEUTIC MODEL ASSISTED BY GAMIFICATION TEACHING MATERIALS

Juwita Sari [1], Netriwati [2], Rizki Wahyu Yunian Putra[3]

[1, 2, 3] Study Program of Mathematics Education, Universitas Islam Negeri Raden Intan Lampung

Juwitas595@gmail.com

Abstract

The ability to understand mathematical concepts in learning mathematics needs to be mastered by students to support the learning process and solve various mathematical problems. This study aims to determine the effect of the Hermeneutics-Assisted learning model of gamification teaching materials on the ability to understand mathematical concepts of students. This research is a type of Quasy Experimental Design research with a 3×1 factorial research design. The data collection technique in this study was a test of the ability to understand mathematical concepts. The data analysis techniques used are normality test, homogeneity test, and one-way analysis of variance. Based on the results of the study, it was concluded that there was an effect of applying the Hermeneutics learning model assisted by gamification teaching materials on the ability to understand students' mathematical concepts. Hermeneutics learning model assisted by gamification teaching materials has a significant influence on the ability to understand mathematical concepts of students.

Keywords: Hermeneutics Learning Model, Gamification Teaching Materials, Mathematical Concept Understanding Ability

INTRODUCTION

The ability to understand mathematical concepts makes it easier for students to face and solve problems in mathematics (Diana, Marethi and Pamungkas, 2020). Understanding concepts in the mathematics learning process can support students in choosing the right design for solving a concept (Inayatusufi, Hakim and Sari, 2020; Ntjalama, Murdiyanto and Meiliasari, 2020). Mastery of a concept allows students to gain unlimited new knowledge (Winata and Friantini, 2020). The ability to understand concepts is related to systematic and rational thinking patterns when solving a problem (Febriantika, 2019; Selfia, Jazuli and Samparadja, 2020).

The ability to understand good concepts requires the commitment of students in choosing a meaningful way of learning and is more than just memorizing (Sukaesih, Indiati and Purwosetiyono, 2020), but requires students' motivation in finding a conceptual

relationship between the knowledge possessed and the knowledge learned in the classroom. (Sundary, Jatmiko and Widyastuti, 2020). Students with good mathematical concept understanding skills can improve problem solving skills, classify and categorize information, work with abstract concepts and perform systematic and complex mathematical calculations (Habibi, Triyana and Kurniawati, 2020). If students do not have sufficient conceptual understanding skills, students will experience difficulties in the mathematics learning process (Apiati and Hermanto, 2020; Prasadi, Wiyanto and Suharini, 2020).

Based on the results of field studies, it was found that at the time of learning, educators still used conventional learning approaches with the lecture method and were given some questions and then students worked on them. It can be seen that in classroom learning activities, educators are more active while students are more passive. So that students tend to be silent, listen and accept what the teacher says. This causes students to be passive, even tend to be bored in learning in class and there are still many students who lack the motivation to learn. This causes the low ability of students to understand mathematical concepts. Therefore, research will be conducted on the ability to understand mathematical concepts in terms of the ability to understand mathematical concepts of students.

Educators as an important component in the learning process need to improve their quality in classroom learning. Accuracy in the selection of learning models plays an important role in improving the ability to understand mathematical concepts of students. Cooperative learning model that can be used as an alternative to improve students' understanding of mathematical concepts is the Hermeneutics learning model. In this study, the Hermeneutics learning model will be combined with gamification teaching materials to distinguish it from previous studies.

Several studies on the Hermeneutics learning model have been carried out previously by several researchers and the results show that the Hermeneutics model is effective for improving students' creative thinking skills (Putri, Ahied and Rosidi, 2019), emotional intelligence (Syafruddin and Herman, 2020), and can increase motivation and student learning outcomes (Yulianti, Murdani and Kusumawati, 2019). Learning with gamification teaching materials is categorized as very interesting and suitable for use in

learning mathematics (Wirawan and Putra, 2018) and can also improve students' mathematical reasoning abilities (Sari et al., 2020).

Based on the results of this study, researchers are interested in conducting research with the aim of seeing the effect of the Hermeneutics learning model assisted by gamification teaching materials on the ability to understand mathematical concepts of students. Research in an effort to improve the ability to understand mathematical concepts of students deliberately uses Hermeneutics assisted by gamification teaching materials for the renewal of previous research.

RESEARCH METHODS

The type of research used in this study was a quasi-experimental design with a 3×1 factorial research design, which in this study consisted of three classes, namely two experimental classes and one control class. The research used the Hermeneutics learning model assisted by gamification teaching materials in the first experimental class, the Hermeneutics learning model in the second experimental class, and conventional learning models in the control class. The research design that was used is the Posttest-Only Control Group Design. Here is the research design:
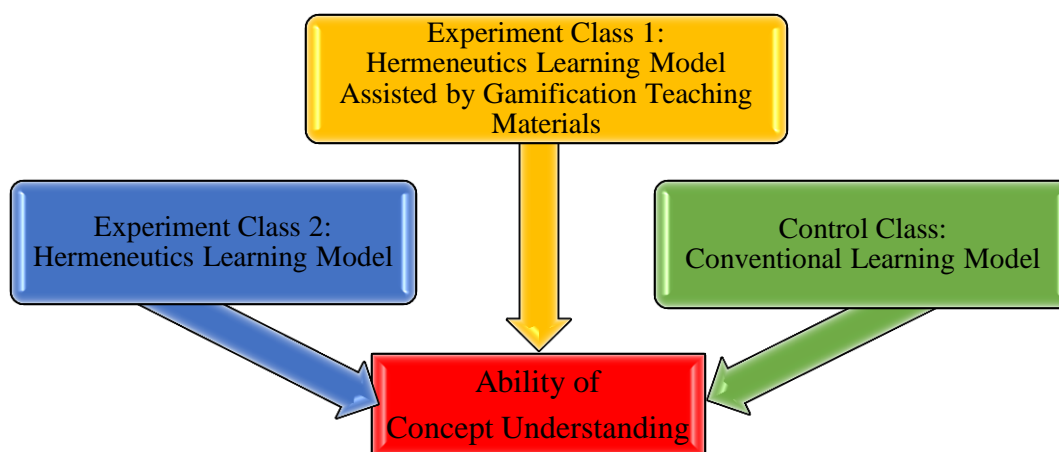

Figure 1.
Experimental Research Design

Based on Figure 1 of the research design, this study aims to see the effect of the Hermeneutics learning model, gamification-assisted learning model, gamification-assisted Hermeneutics learning model, and conventional learning model on students' mathematical concept understanding abilities.

The samples in this study were class VIII A (experimental class 2), VIII B (experimental class 1), and VII C (control class). The number of students in class VIIIA is 23 students, class VIII B is 23 students, and class VII C is 23 students. Class VIII B as the experimental class 1 which applied the Hermeneutics learning model with Gamification teaching materials, class VIII A as the experimental class 2 which applied the Hermeneutics learning model, and class VIII C as the control class that applied the conventional learning model. The material taught in this research is cubes and blocks. Data collection techniques in this study used documentation and test techniques. The research instrument used an instrument to test the ability to understand mathematical concepts. Before testing the hypothesis, a prerequisite test was conducted on the results of the students' mathematical concept understanding ability test in each treatment class. The prerequisite test used is the normality test and the homogeneity test with a significance level of 5%. If the test results are normally distributed and come from the same or homogeneous variance area, it can be continued to test the Statistical Hypothesis using the one-way Analysis of Variance (ANAVA) test.

RESULTS AND DISCUSSION

Results

The results in this study came from the results of the students' ability to understand mathematical concepts which had been tested in three experimental classes and one control class. The following are the results of the research on the ability to understand mathematical concepts that have been obtained:

Table 1
Description of Mathematical Concept Understanding Ability Test Results Data

Group	X_{max}	X_{min}	Centrally Determined Size			Group Variance Size	
			$\bar{x}$	M_o	M_e	R	Sd
Experiment 1	100	68,97	87,48	100	84,48	31,03	9,08
Experiment 1	100	68,97	84,10	75,86	82,76	31,03	9,66
Control	93,10	62,07	76,01	75,86	75,86	31,03	8,28

Based on Table 1, the results of the ability to understand mathematical concepts in the first experimental class obtained maximum and minimum values of 100 and 68.97, respectively, then the second experimental class of 100 and 68.97, while in the control class the maximum and minimum values were obtained respectively 93.10, and 62.07.

Then Mean, Median, dan Modus in the first experimental class were 87.48, 100, and 84.48, respectively, then in the second experimental class they were 84.10, 75.86, and 82.76, while in the control class the Mean, Median, dan Modus were 76.01, 75.86, and 75.86, respectively. The conclusion is that the results of the ability to understand mathematical concepts in the experimental class one that applies the Hermeneutics learning model with Gamification teaching materials are higher than the results of the problem-solving ability in the second experimental class that applies the Hermeneutics learning model and the control class that applies the conventional learning model.

After the data obtained from the test scores for the ability to think mathematically critically, then the data obtained will be analyzed. Data analysis is a method used to strengthen the results of hypothesis testing or final conclusions in research. The data on the test scores for mathematical critical thinking skills from the experimental class and the control class will be analyzed using the data normality test, homogeneity test, and hypothesis testing. If the analyzed data is normally distributed, then you can use parametric statistical techniques, whereas if the analyzed data is not normally distributed, then you can use non-parametric statistical techniques (Casella and Berger, 2002).

The first step will be data analysis in the form of a normality test on the results of the students' mathematical critical thinking ability test. The test decision in the normality test is if the p-value> = 0.05, then the data is normally distributed. The following are the results of the calculation of the normality test of mathematical critical thinking skills:

The first step will be data analysis in the form of a normality test on the results of the students' mathematical critical thinking ability test. The test decision in the normality test is if $p - value > \alpha = 0,05$, then the data is normally distributed. The following are the results of the calculation of the normality test of mathematical critical thinking skills:

Table 2
Normality Test Results for Understanding Mathematical Concepts

Group	$p - Value$	Significance	Decision
Experiment 1	0,187	0,05	Normal Distribution
Experiment 2	0,200	0,05	Normal Distribution
Control	0,134	0,05	Normal Distribution

Based on Table 2, the results of the calculation of the normality test on the ability to understand students' concepts at a significance level of = 0.05, a conclusion can be drawn that the data obtained from the experimental class 2 and 1 control class came from a

population that was normally distributed because it was in accordance with the criteria where $p - Value > \alpha$.

The next step will be data analysis in the form of a homogeneity test on the results of the students' mathematical concept understanding ability test. The following are the results of the homogeneity test calculation on the ability to understand mathematical concepts :

Table 3
Homogeneity Test Results of Mathematical Concept Understanding Ability

Statistics	Concept Understanding Ability
$p - Value$	0,358
Homogeneity	$p - Value > 0,05$
Conclusion	Homogen

Based on Table 3, it can be seen that the data on the ability to understand mathematical concepts comes from the same or homogeneous population variance because it is in accordance with the criteria where $p - Value = 0,358 > \alpha = 0,05$.

Hypothesis testing in this study uses a parametric test, namely one-way analysis of variance (ANAVA), because the data is known to come from a normally distributed population and the same population variance. The following is a table of the results of the one-way analysis of variance analysis (ANAVA) hypothesis test for the experimental class:

Tabel 4
Hypothesis Test Results Analysis of Variance (Anava) One Path

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1598,722	2	799,361	9,806	,000
Within Groups	5380,294	66	81,520		
Total	6979,016	68			

Based on Table 4, it can be seen that the results of the One-Way Anova analysis obtained a $p - Value$ of 0.000 with a significance level of 0.05. This shows $p - Value < 0,05$, so H_0 is rejected and H_1 is accepted. The conclusion is that there is an average difference in the ability to understand mathematical concepts from the three treatments. This shows that learning using the Hermeneutics learning model with Gamification teaching materials, Hermeneutics learning models, and conventional learning models have different effects on students' mathematical concept understanding abilities.

After the decision H_0 test is rejected, it can be concluded that there is at least 1 pair of models that provide an average ability to understand different mathematical concepts, then further tests are carried out using the Scheffe method. Scheffe's method is used in this study to determine which learning has a better effect on the ability to understand students' mathematical concepts. Scheffe further test results can be seen in the following table:

Table 5
One-way Analysis of Variance Analysis (Anava)

(I) Learning Model	(J) (I) Learning Model	Mean Difference (I-J)	Std. Error	Sig.
Hermeneutics Model with Gamification teaching materials	*Hermeneutika* Model	3,37348	2,66245	,452
	Conventional Model	11,47087[*]	2,66245	,000
Hermeneutika Model	Hermeneutics Model with Gamification teaching materials	-3,37348	2,66245	,452
	Conventional Model	8,09739[*]	2,66245	,013
Conventional Model	Hermeneutics Model with Gamification teaching materials	-11,47087[*]	2,66245	,000
	Hermeneutika Model	-8,09739[*]	2,66245	,013

*. The mean difference is significant at the 0.05 level.

Based on Table 5, it can be seen that the learning model that has a significant difference is between the Hermeneutics learning model learning model and Gamification teaching materials with conventional learning models. This is because in that class the p-Value value is 0.000 with a significance level of 0.05, then p-Value <0.05. So that the ability to understand mathematical concepts by treating the Hermeneutics learning model with Gamification teaching materials is significantly different from the ability to understand mathematical concepts by treating conventional learning models. Then between the Hermeneutics learning model and the conventional learning model, the p-Value value is 0.013 with a significance level of 0.05, so p-Value <0.05. So that the ability to understand mathematical concepts with the treatment of the Hermeneutics learning model is significantly different from the ability to understand mathematical concepts with the treatment of conventional learning models. Based on the results of the analysis of the further test, it can be concluded that the Hermeneutics learning model with Gamification teaching materials and Hermeneutics learning model gives the best influence on the ability

to understand mathematical concepts of students compared to conventional learning models.

Discussion

The results obtained by the researchers are also in line with previous studies using the Hermeneutics learning model with Gamification teaching materials by Intan Naumi Putri Putri, Mochammad Ahied, Irsad Rosidi, the results obtained that learning with the Hermeneutics model can improve students' creative thinking skills (Putri, Ahied and Rosidi, 2019). Further research by the results obtained that Yulianti, Eka Murdani, Intan Kusumawati, the results obtained that learning with the Hermeneutics model can increase students' motivation and learning outcomes (Yulianti, Murdani and Kusumawati, 2019). Then research by Yosi Marenda Wirawan, Rizki Wahyu Yunian Putra, the results obtained that this gamification teaching material is categorized as very interesting and suitable for use in learning mathematics at school (Wirawan and Putra, 2018).

Based on the research results obtained by the researchers, the application of the Hermeneutics learning model assisted by gamification teaching materials in the first experimental class has a better effect on the ability to understand mathematical concepts of students compared to the second experimental class which applies the Hermeneutics learning model, and the control class which applies the model. conventional learning. This can happen because the Hermeneutics learning model assisted by gamification teaching materials has different characteristics from conventional learning models, one of which is derived from the steps of the learning model. Hermeneutics learning model assisted by gamification teaching materials, Hermeneutics learning model, and conventional learning model have different learning model steps.

The learning process in the Hermeneutics learning model assisted by gamification teaching materials has 4 stages. The first step in the Hermeneutics learning model with Gamification teaching materials is the step to provide a special view. In this step, educators direct students to start learning with an attitude of confidence and readiness so that students will understand the problem with full attention. This step can train the indicators of the ability to understand mathematical concepts, namely the ability to restate a concept.

The second step of the Hermeneutics learning model with Gamification teaching materials is the step to understand the meaning of the problem. Educators in this step explain the learning materials in detail and provide LKPD gamification teaching materials

about cubes and blocks. Students analyze with existing information so that it becomes a set of ideas to solve existing problems. This step can train indicators of the ability to understand mathematical concepts, namely the ability to provide examples and not examples of a concept and classify objects according to certain properties according to the concept.

The third step of the Hermeneutics learning model with Gamification teaching materials is the step of presenting and solving problems. Educators in this step provide opportunities for students to work on the LKPD that has been given and present results in the form of problem solutions to hone students' abilities. This step can train indicators of the ability to understand mathematical concepts, namely the ability to present concepts in various forms of mathematical representation and develop the necessary/sufficient requirements of a concept.

The fourth step of the Hermeneutics learning model with Gamification teaching materials is the step of presenting and solving problems. Educators at this stage provide opportunities for students to ask, respond, and work on questions about the learning material being studied. Educators provide feedback that can lead to student self-confidence and a sense of satisfaction in students. Then the teacher concludes that the material has been studied clearly and in detail. This step can train indicators of the ability to understand mathematical concepts, namely the ability to use, utilize and choose certain procedures or operations and apply concepts or algorithms in problem solving.

Based on the description that has been explained, it can be seen that there are differences in the treatment of the Hermeneutics learning model with Gamification teaching materials with conventional learning models. This causes the results of the ability to understand mathematical concepts to be better if taught using the Hermeneutics learning model with Gamification teaching materials compared to using conventional learning models. This is because the Hermeneutics learning model with Gamification teaching materials is better than conventional learning models. The Hermeneutics learning model with Gamification teaching materials makes students more active in the learning process, students are trained to be able to solve problems well, the knowledge gained by students will take longer to remember, and this learning model is very effective because it is a more advanced learning center. prioritize the role of students and are student centered. This causes the factors that influence the Hermeneutics learning model with Gamification

teaching materials to help in working on problems related to understanding mathematical concepts.

The interest of students in the Hermeneutics learning model with Gamification teaching materials can be seen from the atmosphere during the teaching and learning process (KBM), where students feel comfortable, motivated, enthusiastic and look active in learning in class and are able to communicate well in receiving the material that has been delivered by the teacher. researcher. However, there are still students who are passive when the Hermeneutics learning model is applied with Gamification teaching materials, namely when students present the results of group discussions, where there are some students who are less confident in conveying the results of the discussion. Overall, students can respond and understand the material well in the Hermeneutics learning model with Gamification teaching materials.

Students who have received the treatment of the Hermeneutics learning model with Gamification teaching materials produce better understanding of mathematical concepts and can optimize the potential that exists in each student compared to learning using conventional learning models. The results of the study showed that students who obtained the Hermeneutics learning model with Gamification teaching materials had better ability to understand mathematical concepts than learning using conventional learning models.

SUMMARY

Based on the results of the analysis and discussion in this study, it can be concluded that there is an effect of the Hermeneutics learning model assisted by gamification teaching materials on the ability to understand mathematical concepts of students. The ability to understand mathematical concepts of students got the best results in the class that applied the Hermeneutics learning model assisted by gamification teaching materials compared to the other two lessons. There is a significant average difference between the Hermeneutics learning model assisted by gamification teaching materials and conventional learning models on the ability to understand students' mathematical concepts.

The researcher hopes that further researchers who want to measure the ability to understand students' mathematical concepts should choose other learning models that are more effective than the learning models that have been studied by researchers. It aims to

see the level of effectiveness of other learning models to increase the ability to understand mathematical concepts of students.

REFERENCES

Apiati, V. dan Hermanto, R. (2020) "Kemampuan Berpikir Kritis Peserta Didik Dalam Memecahkan Masalah Matematik Berdasarkan Gaya Belajar," *Mosharafa: Jurnal Pendidikan Matematika*, 9(1), hal. 167–178.

Casella, G. dan Berger, R. L. (2002) *Statistical Inference*. 2 ed. Pacific Grove CA: Duxbury.

Diana, P., Marethi, I. dan Pamungkas, A. S. (2020) "Kemampuan Pemahaman Konsep Matematis Siswa: Ditinjau Dari Kategori Kecemasan Matematik," *SJME (Supremum Journal of Mathematics Education)*, 4(1), hal. 24–32.

Febriantika, A. A. (2019) "Kemampuan Pemahaman Konsep Matematis Ditinjau dari Kompetensi Keahlian," *AlphaMath*, 5(2), hal. 1–8.

Habibi, Triyana, I. W. dan Kurniawati, Y. (2020) "Analisis Berpikir Kritis Matematis Siswa SMP Ditinjau dari Gaya Kognitif Visualizer dan Verbalizer," *Indonesian Journal of Mathematics and Natural Science Education*, 1(2), hal. 99–110.

Inayatusufi, C., Hakim, L. El dan Sari, P. (2020) "Peningkatan Kemampuan Pemahaman Konsep Matematis melalui Model Kooperatif Tipe Scramble dengan Pendekatan Kontekstual Pada Materi Segiempat dan Segitiga di Kelas VII," *Jurnal Riset Pendidikan Matematika Jakarta*, 2(2), hal. 28–37.

Ntjalama, K. M., Murdiyanto, T. dan Meiliasari (2020) "Pengaruh Model Pembelajaran Kooperatif Tipe STAD Berbantuan Media Kahoot! Terhadap Kemampuan Pemahaman Konsep Matematis Siswa," *Jurnal Riset Pendidikan Matematika Jakarta*, 2(2), hal. 13–20.

Prasadi, A. H., Wiyanto, W. dan Suharini, E. (2020) "The Implementation of Student Worksheet Based on STEM (Science, Technology, Engineering, Mathematics) and Local Wisdom to Improve of Critical Thinking Ability of Fourth Grade Students," *Journal of Primary Education*, 9(3), hal. 227–237. doi: 10.15294/jpe.v9i3.37712.

Putri, I. N., Ahied, M. dan Rosidi, I. (2019) "Pengaruh Model Pembelajaran *Hermeneutika* Terhadap Kemampuan Berpikir Kreatif Siswa," *Natural Science Education Reseach*, 2(1), hal. 1–7.

Sari, Y. A. *et al.* (2020) "Penerapan Cooperative Learning Tipe Tapps Menggunakan Bahan Ajar Gamifikasi Terhadap Penalaran Matematis Ditinjau Dari Kepercayaan Diri Peserta Didik Kelas Viii Smp," *Journal of Mathematics Education and Science*, 3(2), hal. 61–67. doi: 10.32665/james.v3i2.140.

Selfia, R., Jazuli, L. O. A. dan Samparadja, H. (2020) "Pengaruh Model Pembelajaran Generatif Terhadap Kemampuan Pemahaman Konsep Matematis Siswa Kelas VII SMP Negeri 34 Konawe Selatan," *Jurnal Penelitian Pendidikan Matematika*, 8(1), hal. 135–148.

Sukaesih, E. S., Indiati, I. dan Purwosetiyono, F. X. D. (2020) "Kemampuan Pemahaman Konsep Matematis Siswa dalam Memecahkan Masalah Kontekstual Ditinjau dari Komunikasi Matematis Siswa," *Imajiner: Jurnal Matematika dan Pendidikan Matematika*, 2(4), hal. 310–320.

Sundary, P., Jatmiko, A. dan Widyastuti, R. (2020) "Metaphorical Thinking Approach With Google Classroom: Its Effect Towards Students' Understanding Of Mathematical Concept Skills," *Indonesian Journal of Science and Mathematics Education*, 3(1), hal. 37–47.

Syafruddin, M. A. dan Herman, H. (2020) "Pengaruh Model Pembelajaran Kooperatif Tipe TGT (Team Group Tournament) Terhadap Kecerdasan Emosi Siswa MAN 2 Makassar," *Jendela Olahraga*, 5(1), hal. 52–58. doi: 10.26877/jo.v5i1.4267.

Winata, R. dan Friantini, R. N. (2020) "Kemampuan Pemahaman Konsep Matematika Siswa Ditinjau Dari Minat Belajar Dan Gender," *AlphaMath*, 6(1), hal. 1–13.

Wirawan, Y. M. dan Putra, R. W. Y. (2018) "Pengembangan Bahan Ajar Gamifikasi pada Materi Himpunan," *Desimal: Jurnal Matematika*, 1(3), hal. 329–335.

Yulianti, Murdani, E. dan Kusumawati, I. (2019) "Pengaruh Penerapan Model Pembelajaran *Hermeneutika* terhadap Motivasi Belajar dan Hasil Belajar Siswa pada Materi Kalor di Kelas X," *Variabel*, 2(1), hal. 24–30.