The Use Of Game-Based Learning Media On The Understanding Of Mathematics Concepts Of Elementary School Students

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Abstract. The problem in this study is the need for more understanding of students' mathematical concepts at SDN Gegerbitung. Their mathematics learning scores still need to be higher than the KKM. This study aims to determine the effect of using Game-Based Learning on Elementary School Students. This research is a type of quantitative research using a quasi-experimental approach, the design in this study uses the Nonequevalent Control Group Design. The population in this research is all class III SDN Gegerbitung, with the first sample class IIIB totaling 20 students as the experimental class whose lessons use game-based learning and the second sample class IIIA totaling 20 students as the control class using conventional learning. Data on the ability to understand mathematical concepts were measured through a test instrument. To analyze the data in this study, a statistical test was used, namely the independent sample t-test. Based on the results of the t-test, the value of Sig = 0.003 <0.05, which means that there is a significant influence between the use of Game-Based Learning and Understanding of Mathematics Concepts for Elementary School Students. In addition, based on the results of the final test (posttest) obtained an average of 82.25 for the experimental class. At the same time, the control class received an average score of 72.50. This indicates that using Game Based Learning can improve students' understanding of mathematical concepts at SDN Gegerbitung for the 2021/2022 academic year.

Keywords: Elementary School Students, Game-Based Learning, Mathematics Concepts,

INTRODUCTION

Mathematics is one of the essential subjects to be taught to students because basic concepts in mathematics are often present in everyday life. According to Suherman (Studi et al., 2019, p. 353), mathematics is the science of logic regarding shapes, arrangements, quantities, and concepts interconnected with large numbers, which are divided into three fields, namely algebra, analysis, and geometry. Although learning mathematics is an essential part of everyday life, this low quality of education may be because the teaching presented is still unattractive, so it seems haunted, complex, and scary, so students often do not master the basic concepts contained in the subject matter. Mathematics resulted in fatal errors in student learning success, so student learning outcomes were low (Astuti & Leonard, 2012, p. 103).

Associated with learning Mathematics, only some things students learn can be understood just like that. So to make it easier for students to learn Mathematics learning, they can use the media. Media is also believed to be able to assist teachers in facilitating and overcoming communication problems experienced by teachers when teaching material. In line with what is described by (Amir, 2014: 73-74), that is one of the factors that determine the success of teaching, namely the use of learning methods that are in the development and abilities of students so that optimal education is achieved.

According to Sudono (Amir, 2014: 74), teachers can use learning media appropriately to achieve learning objectives and create a teaching and learning process that is not boring. Students can understand what the teacher is presenting by using the media in the learning process, namely, to bridge abstract mathematical concepts into concrete s. Therefore, using media in the learning process is necessary for optimal learning objectives.

Mathematics education develops in line with the changes and developments of the times. Humans at an early age are now familiar with and have experience using gadgets, smartphones, and the sophistication of existing technology. As stated by (Amir, 2014: 74), the use of media in learning mathematics in elementary school is essential. It is by the child's thinking stage. Children

can use suitable media to appreciate real mathematics based on clear and visible facts. So that students easily understand the material being taught.

The primary and most crucial element that students must have is mathematical concepts. Mathematical concepts are the basis students must understand because they can form their mindsets mathematically. In line with Suherman et al. (Fitria et al., 2019: 125), mathematical concepts are arranged hierarchically, structured, logically, and system, typically starting from the simplest to the most complex concepts. So, understanding the concept is crucial for students to solve problems from the most specific and complicated things. Concept understanding also underlies students to understand the following concepts.

The era of globalization is an era where humans cannot be separated from digital technology—users of digital technology from an early age to old age. Digital games are one part of digital technology that has various functions and purposes according to the wishes of its users. Starting from the goal of maintaining social contact with others, as a medium of entertainment, to learning media as an educational function (Kustiasih & Haryati, 2018: 52). A phenomenon that is commonly seen in this modern era is early childhood who are already fluent in operating gadgets or digital technology such as personal computers and smartphones. But its use is more in games that aim for entertainment.

Therefore, learning using game-based media will likely stimulate students' thinking processes and make learning more fun. As explained by Sanjaya (Wulandari et al., 2017: 166), the era of globalization makes children prefer to learn by using computers, laptops, tablets, or electronic-related items rather than print media such as books. The concept in this study refers to game-based learning techniques that can help increase the potential and quality of students in acquiring knowledge. Dellos (Pranoto, 2020: 27) explains that that-based learning is a tool that can help students solve problems, improve critical thinking and make an assessment in the learning process.

As explained by Squire & Jenkins (Kustiasih & Haryati, 2018: 52), a good game is a game that contains elements of choice and consequence, while an excellent educational game is a game that forces players to form theories and test their thinking on simulation results. Thus digital games are digital devices that allow users to have fun with rules that have been designed in such a way and can be used as learning media for educational functions. According to (Mahar, R, and Radhika, 2015: 2), learning in and ng has a significant effect on the teaching and learning process because it can increase students' motivation and performance by increasing their interest in modeled learning.

Game-based learning in this research uses a web-based game which can be accessed via the following link: Game Addition of Story Problems - Free Addicting Game (construct.net). A web-based application is an application that can be accessed using a web browser or web browser over the internet. The advantages of web-based applications include: first, it requires a license when using web-based applications because the permit is the responsibility of the application service provider. Second, it does not require high specifications to perform and use web applications. Third, it can be run anywhere and anytime without installation. Fourth, it can be used in various types of operating systems. Fifth, it can be accessed through many media, such as computers, laptops, and smartphones (Hatmoko in (Andika, 2020: 5)

Based on the background of the research above, the researcher identified several problems that will be used as research materials, including: in general, the lack of use of media in learning activities in elementary school, learning is boring because learning aids are less attractive, the need for appropriate media to improve understanding of the material in school students base. To facilitate efforts in research, it is necessary to limit the problem. The limitation of the problem to be studied is the use of game-based learning media in the mathematics learning process.

This study aimed to determine the effect of game-based learning on understanding mathematics concepts in third-grade elementary school students.

METHOD

This study uses a type of quantitative research (quantitative research). According to Hermawan (2019:16), quantitative analysis is an inductive, objective, and scientific research

method. The data is in the form of numbers (scores, scores) or statements that are assessed and analyzed by statistical analysis. Quantitative research is usually used to prove and disprove a theory. Because this research usually starts from an idea tideland theatres search, ed; The data is generated, then discussed, and conclusions are drawn.

This research was conducted to determine the effect of using game-based learning media on understanding elementary students' mathematical concepts. The design used is a quasi-experimental (Quasi ExQuasi-Experimentalding to (Nugraha et al., 2020: 272), quasi-experimental is a research method that tests hypotheses in the form of causal relationships through manipulation of independent variables and examines changes caused by these manipulations. Therefore, this study uses a Non-Equivalent Control Group Design. Where there is an experimental group and a control group. The research sample is the third third-grades of SD Negeri Gegerbitung, totaling 40 students.

Research Instruments

The instruments in this study were interviews and tests. This study used structured interviews with target informants, namely class III students. The test instrument in this study was compiling questions in the form of a game to determine students' ability to understand learning material. This test is given at the pretest, the test is carried out in a conventional way or without using digital game-based learning media, and the posttest or test is carried out using the help of digital media.

The games used in this study can be accessed via the web that has been provided. This study's questions used description or descriptions, totaling additional Competency: 3.1 Explain the properties of arithmetic operations on integers. 4.1 Solve problems involving the use of the properties of using operations on integers. In this study, researchers did not carry out validity and reliability. This is due to taking the test instrument from the web-based application used in this study. The questions used are an adaptation of the game-based learning researchers use, where the game can be accessed via the link provided.

Data collection technique

This study will collect through structured interviews with the target resource persons, namely, grade III students, and tests in students of descriptions or essays to determine the ability to understand students' mathematical concepts using game-based learning media. Data related to student's ability to understand mathematical concepts were collected as tests (Pretest and Posttest).

Data analysis

Data analysis is defined as the effort of data that is already available and then processed with statistics and can be used to answer the formulation of the problem in research. Thus, data analysis techniques can be interpreted as a way of carrying out an analysis of the data processing the data to answer the problem formulation. Data analysis in this study aims to determine the extent the school students understand the learning material. The tests carried out in this study were tested using the SPSS 22 program to facilitate the calculation of data from the pretest and posttest results of students post-testing mathematics. Data analysis techniques in this study include the normality and the homogeneity test.

The normality test was processed using the SPSS version 22 application for windows, while the homogeneity test used SPPS (Statistical Package for Social Science). If the data is usually distributed and homogeneous, proceed with the Statistical Analysis Test. To aAInpendent T Test or Independent Sample T Test using SPSS 22 is used to analyze the data.

RESULTS

This research was conducted at SDN Gegerbitung, which is located at Jl. Veteran No. 11 Villages/Kec. Gegerbitung Kab. Sukabumi, West Java Province, 43197. The study was conducted at the beginning of the even semester of the 2022-2023 academic year, to be precise,e in May. In this study, the design used was a quasi-experimental non-equivalent control group using two

classes: y class IIIA as the control class and IIIB as the experimental class. With each class of 20 students.

The data collection technique was carried out by giving a pretest to students before being given treatment or treatment. After the pretest is done, the students are given treatment or treatment by applying GaGame-Based learning media, which then students carry out the posttest. The experimental class was given treatment or treatment by applying GaGame-Basedearning impress, while the control class did not use a learning model.

Based on the research that has been done, the data obtained from the pretest and posttest results in class IIIA and IIIB SDN Gegerbitung. The data was obtained using a test instrument, namely an essay test or a description of 5 questions. The questions were given at the pretest before the students received treatment to determine the student's initial critical thinking skills and at the posttest, after the students were given medicine to assess the effect of the therapy provided, namely Game-Based Learning media in the experimental class. At the same time, the control class did not use a learning model. The research data that have been obtained are as follows:

Table 1. Data of Pretest and Posttest Values for the Control Class and Experiment Class.

Data	Experiment class		Control class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Average	43.75	82.25	46.25	72.50
Minimum Value	30	75	30	70
Maximum Value	60	95	65	85
Std. Devices	8.867	6.172	10.987	5.405
Variance Value	78.618	38.092	120.724	29.211
Sum	20		20	

Based on table 1, it can be described that there are 20 students in the control class at SDN Gegerbitung. Based on the calculation results, the average pretest score for students' understanding ability in the control class is 46.25, with the lowest score being 30, the highest score being 65, a standard deviation of 10,987, and a variance value of 120,724. The posttest results of the student's understanding ability in class III SDN Gegerbitung averaged 72.50 with the lowest score of 70 and the highest score of 85, a standard deviation of 5,405, and a variance value of 29,211. The post On average, the post-test results on the third-gradual third-grade students' understanding ability y 2.25, with the lowest score of 75 and the highest score of 90, a standard deviation of 6.17a,n, and a deviance value of 38,092.

After testing the normality of the data and homogeneity, the results obtained that the data is declared customarily distributed. The variance in the study is homogeneous. Then the next step is to test statistical hypotheses, which are tested, namely the difference in the ability to understand mathematical concepts graduated students with conventional methods and using Game Based media. Learning. The results of statistical analysis using the SPSS program. The following are the results of hypothesis testing data analysis using SPSS.

Table 2. Hypothesis Test Results

t	Sig.	Decision
3.134	0.003	There is a significant effect.

Based on table 2, in carrying out the test, the results obtained t = 3.134 and Significance (Sig.) = 0.003, so 0.03 <0.05, or it can be said that there is a significant effect. Thus it can be concluded that game Based Learningmedia influences the ability to understand mathematical concepts of an experimental class study.

DISCUSSION

The discussion of the results of this study aims to determine the effect of using Game Based Learning media on the understanding of mathematical concepts for elementary school students in the experimental class, namely class IIIB SDN Gegerbitung, on the additional material. This research is a quasi-experimental research with a quantitative approach; the design used in this study is the Nonequivalent Control Group Design. The method of this study used two classes, namely the control and experimental classes—the experiment class types IIIB with a total,l of 20 students. At the same time, the control class is class IIIA, with 20 students.

This research begins with conducting a pretest first of the control class and experimental class at SDN Gegerbitung before the implementation of the treatment. The goal is to determine the extent to which students' initial mathematical concepts are capable. After the pretest is done and the results are known, the student's score data has been obtobtainedreatment is applied using Game Based Learning media in the experimental class and conventional learning models in the control class.

At the first pretest meeting, it was seen that most students still needed clarification about what they would do with the given. Students need help in workinrking on the questions given because some students still have the lowest problem, the highest of 60, and the average value obtained was 43.75 and still below the KKM. At the same time, the KKM still applies in the experimental class. Likewise, in the control class, the results of the pretest students understood, and posttest results scored 35, the highest of 65, and an average value of 46.25, while the KKM applied as 75 in the control class.

At the next meeting, namely the second and third meetings, students were given treatment or treatment by applying game-based learning media when learning took place in the experimental class of Gegerbitung State Elementary School and conventional models in the control class. With game-based learning media, students seem to increase in understanding abilities. Here students are given a stimulus by applying game-based learning media, and the response that students give is a behavior change and can prove students' ability to understand mathematical concepts.

Furthermore, at the fourth or last meeting, students were given a posttest, the purpose of doing a posttest using game-based learning media on the ability to understand mathematical concepts of experimental class students at SD Negeri Gegerbitung. The value obtained from the post-test is a value of 75. The highest value is 9,5, and the average value is 82.25. These results indicate an increase after students are given treatment or treatment. In this way, the existing KKM 75 can be completed by students very well. Likewise, in the control class, the posttest results for this understanding ability have the lowest score of 70, the highest of 85, and the ave e value obtained is still below the KKM, which is 72.,50.

At the same time, the KKM applied I,s 75 in the icon clasThereforere for the ability to understand mathematical concepts of the control class,s students of SD Negeri Gegerbitung get ga good category.After the pretest, posttest, and treatment were given by applying game-based learning media during learning, the next step was to test this data requirement. The data tested were pretest and posttest, with the normality and then homogeneity tests. This normality test is to find o determine if the data we have obtained usually is dust distributed aft. Theta in control and experimental classes show that if the significance value (Sig.) is more than 0.050, then the data is usually f it is less. If0.050 t, then the information is no,t normally distributed. After being tested, the significance (Sig.) was 0.155 for the control class, and 0.196 and 0.196 for the experimental class data in the control class, and the practical course is practical ripe because 0.155 is more excellent than tthan0.050 (0.099 > 0more significant 0.051 is more remarkable than 0.050 (0.128 > 0.050).

Next, the homogeneity test was carried out on the pretest and posttest data. This homogeneity test was conducted to determine the nature of the data, homogeneous or not homogeneous. If later the pretest and posttest data show that the significance value (Sig.) is more than 0.050, then the data is homogeneous, and if it is less than 0.050, then the information is not homogeneous. From the results of testing the data that has been carried out, the significance value appears to be 0.4then the data is homogeneous because the significance value is more than 0.050 (0.495 >

0.050). After knowing that the data is regular and homogeneous, the next step is to test the hypothesis.

Because the information is usually distributed and homogeneous, the practical hypothesis test is the Indeteststtestttt or Independent Sample T, where only two paired data are tested, namely pretest and post-test test data. IndT-Testnt T Test or Independent Sample T Test aims to determine whether or not hypotheses weave made are accepted not. The idea that has been made and proposed is the effect of game-based learning media on understanding elementary school student's mathematical concepts.

This t-test or Independent sample t-test used-statistics Program for Social and Science (SPSS) 22 for Windows. The results of this test can be seen that if the significance value (Sig.) is more than 0.050 (> 0.050), then the hypothesis can be accepted, while if the significance value (Sig.) is less than 0.050 (< 0.050), then the ideas are rejected. From the data that has been tested, it is found that the value of T = 3.134 and Sig = 0.0,0, which means 0.003 <0.05, then the HO is rejected or can be stated to have influenced the understanding of elementary school students' mathematical concepts.

Therefore, game-based learning media is proven to affect the knowledge of mathematics concepts for third-grade and third-grade students—this with what was expressed by (Mahardhika, 2015: 2. Game-based learning has a. Gameficeffectsint in-game-based learning the training process and increases students' motivation and performance by increasing their interest in modeled lea education, also supportHidayatsearch Hidayat, 2) that game-based learning game-game earns game-game-baI's how inadequate lead equates.

CONCLUSION

Based on the discussion that has been presented in the previous chapter regarding the data from the use of game-based learning on the understanding of mathematical concepts for the third-grade elementary school students at SDN Gegerbitung, the following conclusions can be drawn: The application of game-based learning media affects the understanding of mathematics concepts for the graduated element of third-grade students at SDN Gegerbitung. This can be shown based on the significance value obtained after conducting the Independent Sample TT-, Test namely SiT-TestTailed) = 0.003, which means that there is an influence between the use of game-based learning on the understanding of elementary school students' mathematical concepts.

SUGGESTION

Suggestions that the author can give are, with the existence of learning media that has been proven effective, it can be an input for schools in organizing the learning process and minimizing the factors that cause students' lack of ability in understanding mathematical concepts by using game-based learning media. A step to be taken into consideration for teachers to increase the factors driving the lack of students' ability to understand thematical concepts by using game-based learning media. With the learning media applied in teaching and learning activities, students are expected to actively learn to improve their storytelling skills and communicate with teachers and classmates. This research is hoped to add insight or provide information for further researchers about the influence of game-based learning media on the understanding of elementary school students' mathematical concept.

REFERENCES
Aldy, P. R. (2017). Analisis Statistik Ekonomi dan Bisnis dengan SPSS (A. P. Cahya (ed.); 3rd ed.).

Amir, A., & Si, M. (n.d.). *PEMBELAJARAN MATEMATIKA SD DENGAN MENGGUNAKAN MEDIA MANIPULATIF Oleh: Almira Amir, M.Si 1*. 72–89.

Andika, ovan & S. (2020). *CAMI: Aplikasi Uji Validitas dan Realibilitas Instumen Penelitian Berbasis Web* (A. A. Saleh (ed.); 1st ed.).

Astuti, A. (n.d.). *PERAN KEMAMPUAN KOMUNIKASI MATEMATIKA. 2*(2), 102–110.

Christiana Sri Wahyuni Kustiasih, S., & Haryati, S. (2018). Jurnal Penelitian Teknologi Pendidikan http://jurnal.fkip.uns.ac.id/teknodika. *Teknodika, Jurnal Penelitian Teknologi Pendidikan*, *16*(01), 1–9.

Dewi, N. P., & Listiowarni, I. (2019). Implementasi Game Based Learning pada Pembelajaran Bahasa Inggris. *Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi)*, *3*(2), 124–130. https://doi.org/10.29207/resti.v3i2.885

Fitria, M., Kartasasmita, B., & Supianti, I. I. (2019). Analisis Kemampuan Pemahaman Konsep Matematis Siswa yang Menggunakan Model Pembelajaran Reciprolcal Teaching. *Jurnal Prisma*, *8*(2), 124–134.

Gumantan,Aditya,et.al.(2020). Pengembangan Aplikasi Pengukuran Tes Kebugaran Jasmani Berbasis Android. *Jurnal Ilmu Keolahragaan* , *19*(2), 196–205.

Hasratuddin.(2013). Membangun Karakter Melalui Pembelajaran Matematika. *Jurnal Pendidikan Matematika PARADIKMA*, *6*(2), 130–141. http://digilib.unimed.ac.id/id/eprint/960

Hidayat, R. (2018). Game-Based Learning: Academic Games sebagai Metode Penunjang Pembelajaran Kewirausahaan. *Buletin Psikologi*, *26*(2), 71. https://doi.org/10.22146/buletinpsikologi.30988

Irawati, H.,et.al (2018). Pengembangan Instrumen Tes Dan Non Tes Dalam Rangka Menyiapkan Penilaian Autentik Pada Kurikulum 2013 Di Smp/Mts Muhammadiyah Se-Kabupaten Bantul. *Jurnal Pemberdayaan: Publikasi Hasil Pengabdian Kepada Masyarakat*, *1*(2), 503. https://doi.org/10.12928/jp.v1i2.362

Mahardhika, G. P. (2015). Digital game based learning dengan model ADDIE untuk pembelajaran doa sehari-hari. *Teknoin*, *21*(2), 115–122. http://journal.uii.ac.id/index.php/jurnal-teknoin/article/view/3700

Nugraha, S. A.,et.al (2020). Studi Pengaruh Daring Learning Terhadap Hasil Belajar Matematika Kelas Iv. *Jurnal Inovasi Penelitian*, *1*(3), 265–276. https://doi.org/10.47492/jip.v1i3.74

Pranoto, S. E. (2020). Penggunaan Game Based Learning Quizizz Untuk Meningkatkan Keaktifan Belajar Siswa Pada Mata Pelajaran Sosiologi Materi Globalisasi Kelas Xii Ips Sma Darul Hikmah Kutoarjo. *Habitus: Jurnal Pendidikan, Sosiologi, & Antropologi*, *4*(1), 25. https://doi.org/10.20961/habitus.v4i1.45758

Rahmah, N. (2018). Hakikat Pendidikan Matematika. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *1*(2), 1–10. https://doi.org/10.24256/jpmipa.v1i2.88

Rahmaniar, et.al. (2015). Kemampuan Merumuskan Hipotesis Fisika Pada Peserta Didik Kelas XMIA SMA Barrang Lompo. *Jurnal Pendidikan Fisik.*

Siagian, M. D. (2016). Kemampuan koneksi matematik dalam pembelajaran matematika. *MES: Journal of Matematics Education and Science2*, *2*(1), 58–67.

Studi,P., Matematika, P., & Bengkulu, F. U. (2019). *Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS), Vol. 3, No. 3, Desember 2019 eISSN 2581-253X.* *3*(3), 353–361.

Winarno, M. (2013). *Metodologi Penelitian Dalam Pendidikan Jasmani* (2nd ed.). Penerbit Universitas Negeri Malang (UM Press).

Winatha, K. R., & Setiawan, I. M. D. (2020). Pengaruh Game-Based Learning Terhadap Motivasi dan Prestasi Belajar. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *10*(3), 198–206. https://doi.org/10.24246/j.js.2020.v10.i3.p198-206

Wulandari, S., Ainy, C., & Suprapti, E. (2017). Pengembangan Media Pembelajaran Matematika Berbasis Game Interaktif Menggunakan Aplikasi Adobe Flash CS3 pada Materi Pokok Trigonometri Kelas X SMKN 10 Surabaya. *MUST: Journal of Mathematics Education*, *2*(2), 165–177.

Yuhana, A. N., & Aminy, F. A. (2019). Optimalisasi Peran Guru Pendidikan Agama Islam Sebagai Konselor dalam Mengatasi Masalah Belajar Siswa. *Jurnal Penelitian Pendidikan Islam*, *7*(1), 79. https://doi.org/10.36667/jppi.v7i1.357