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Development of Gamification-Based Flipped Learning in Mathematics Learning as an Effort to Overcome Learning Obstacles

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Abstract

The purpose this research was motivated because students experienced obstacles in learning mathematics in the Covid-19 Pandemic Era which affected learning outcomes. In addition, student activities in playing online games cause students to have no motivation to learn. This study aims to produce a digital learning design, namely gamification-based flipped learning and determine its feasibility. The research method was carried out using the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation) in mathematics, especially the Building Space material in Class V. In this study, data were collected through questionnaires, which were then analyzed by using two paired sample t-tests. The results of this study stated that the learning tools developed were appropriate both in terms of the Lesson Plan (RPP), Student Worksheets (LKPD), and learning evaluation instruments as well as comparisons of learning outcomes before using gamification-based flipped learning and learning after using flipped learning-based learning. gamification so that the development of gamification-based flipped learning in mathematics learning is valid, practical, and can be used to overcome learning obstacles experienced by students

***Keywords** : Gamification-based Flipped Learning, Mathematical, Learning Obstacles*

Abstrak

Tujuan Penelitian ini dilatarbelakangi karena siswa mengalami hambatan dalam pembelajaran matematika di Era Pandemic Covid-19 yang mempengaruhi terhadap hasil pembelajaran. Selain itu, aktivitas siswa dalam bermain *game online* menyebabkan siswa tidak memiliki motivasi belajar. Adapun penelitian ini bertujuan untuk menghasilkan desain pembelajaran digital yaitu *flipped learning* berbasis gamifikasi dan mengetahui kelayakannya. Metode penelitian dilakukan dengan menggunakan model pengembangan ADDIE (*Analysis, Design, Development, Implementation, Evaluation*) pada pelajaran matematika khususnya materi Bangun Ruang di Kelas V. Dalam penelitian ini, data dikumpulkan melalui kuesioner, yang selanjutnya dianalisis dengan Uji-t dua sampel berpasangan. Hasil penelitian ini menyatakan bahwa perangkat pembelajaran yang dikembangkan sudah sesuai baik dari segi Rencana Pelaksanaan Pembelajaran (RPP), Lembar Kerja Peserta Didik (LKPD), dan instrumen evaluasi pembelajaran serta perbandingan hasil pembelajaran sebelum menggunakan *flipped learning* berbasis gamifikasi dan pembelajaran sesudah menggunakan *flipped learning* berbasis gamifikasi sehingga pengembangan *flipped learning* berbasis gamifikasi dalam pembelajaran matematika ini valid, praktis, dan dapat digunakan untuk mengatasi *learning obstacles* yang dialami oleh siswa.

Kata Kunci: *Flipped Learning* berbasis gamifikasi, Matematika, Hambatan Belajar

INTRODUCTION

The emergence of *Coronavirus Disease* 19 or what we know as Covid-19 which was declared a WHO pandemic because of its spread to almost all parts of the world including Indonesia. Many victims fell because it spread so easily and quickly. This makes the government must limit the activities that exist in the community. The restrictions on these activities have a fairly large impact on almost all sectors including education. The impact experienced by the education sector is that all students in Indonesia must carry out the online learning process from home. This is an emergency condition that becomes a challenge for students, teachers

and even parents to take on the role of being the teacher of their own children at home. The policies issued by the government in the use of distance learning require teachers and students to be able to use technology. Teaching and learning activities of course cannot be carried out as usual face-to-face, thus learning and teaching activities for students and educators are assisted by using several applications that can support the teaching and learning process, such *as WhatsApp Group, Zoom, Google Meet, google learning* and other applications.

On the other hand, many students who study from home use it to play online games such as *Free Fire, Play Unknown Battleground,* and Mobile Legends.

One of which is *computer game addiction* (playing too many games). Basically playing games too often can make students addicted so they have less concentration, especially in terms of studying. This will be seen when students are faced with new problems, students have difficulty solving them because of the concepts they do not understand thoroughly. Thus the long-term impact of addiction to playing games will make it difficult for students to solve mathematical problems.

Conceptual understanding ability is one of the important mathematical abilities to be mastered by students in learning, giving an understanding of things that need to be seen carefully in learning. As a result, the learning process must pay attention to the situation, especially the ability of students.

The results of a preliminary study through a questionnaire that has been carried out at SD 2 Salakaria, obtained data that of the 24 fifth grade students who play online games as many as 15 people play online games and 9 people do not play online games. It was found that out of 17 fifth grade students, 17 children got a final grade in mathematics below the average (60-69), and 7 children got a final grade in mathematics above the average (≥70). From the results of interviews with the fifth grade math teacher at Elementary School 2 Salakaria, it was stated that almost 80% of the fifth grade students' math scores were still below the KKM (Minimum Completeness Criteria). The students' view of mathematics is that mathematics is useful and useful for calculating numbers. Therefore, this view will cause most students to have limited conceptualization abilities because they learn in a rigid structure and direction. Thus, it can be concluded that students experience learning obstacles or commonly called learning obstacles.

As time goes by, due to the decrease in the number of COVID-19 outbreaks, the government has given permission to carry out face-to-face meetings with certain conditions. With regard to Surat Edaran No. 420/1184-Disdik.1/2021 regarding guidelines for the implementation of face-to-face limited to the Covid-19 pandemic for the 2020/2021 school year, on April 19 the Ciamis District Education Office had carried out face-to-face PBM Trial activities, however, PBM trial activities This is still limited and for the elementary level only grades 5 and 6 can carry out PBM in class. PBM activities in class are activities that students and their parents have been waiting for to study at school with their friends, but in reality students need to adapt again to learning in class. This period is a transition period experienced by students. In line with that at this time teachers do not need to be confused because with the development of information technology is running so fast and penetrated in various aspects of life including aspects of education. Many researchers have developed a game-based learning approach, including the gamification approach. Gamification is seen as the concept of applying game mechanisms to involve and motivate students in learning. In other words, games are now a part of students' daily lives. From here, the researcher wants to change the learning design from the old paradigm to a new paradigm in mathematics. Lack of many mathematics skills caused difficulties in solving problem, Tambychik, T., & Meerah, T. S. M. (2010).

Based on the initial presentation, the researcher felt the need to apply the *flipped learning learning design* using a gamification approach in learning mathematics. Therefore,

the researcher intends to conduct a study entitled "Development of Gamification-Based *Flipped Learning in Mathematics Learning as an Effort to Overcome Learning Obstacles* ". The difficulties felt by students in mathematics subjects online are one of the factors, namely unstable internet access, facilities and infrastructure that support learning are not supportive for the online learning process, especially in mathematics subjects. Not a few students feel that the online learning process is less effective in applied mathematics learning, there is a lack of interaction between teachers and students during the learning process, and there are no new variations in the learning styles applied (Amran et al., 2021).

Learning difficulties are also a condition which causes learners to be unable to learn as they should because certain disorders Fernandes et al., 2019). The fact that so many students do not like mathematics has become an obstacle in itself in understanding mathematics and vice versa, the student who has experienced obstacles in learning mathematics has resulted in him not liking mathematics Fuadiah, N. F. (2016). Based on the explanation above, this study aims to identify and analyze the content of development of gamification-Based Flipped Learning in Mathematics Learning as an effort to overcame learning obstacles.

RESEARCH METHODS

This development research uses the *Research and Development* (RnD) model. So that when the product has been made, it will then be validated by experts to fit the learning criteria. The development model is ADDIE development, ADDIE model. which consists of 5 steps, namely: analysis, design, development, implementation and evaluation. For more details can be described as follows:

a. At the *analysis stage,* things that are carried out include: analysis of relevant journals, analysis of subject matter, analysis of competencies and analysis of student characteristics
b. At the *design stage*, things to do include: determining the Lesson Plan, compiling the stages of the Student Worksheet (LKPD), determining learning steps and making learning evaluation instruments.
c. At the *development stage*, the things that are done include: cultivating / making Lesson Plans (RPP), LKPD, learning evaluation instruments, testing and distribution of RPP content expert evaluations, and improving gamification-based *flipped learning learning designs* based on suggestions from experts, activity trials on individual students and small groups, improvement of activities based on suggestions of individual students and small groups, trial activities on classroom teachers, improvement of gamification approach based on suggestions of classroom teachers.
d. At the *implementation stage,* the thing to do is to conduct a field trial of the gamification-based *flipped learning design* that has been developed
e. At the *evaluation stage,* the thing to do is improve the learning design based on field trials.

Products that have been successfully developed at the time of design are tested first to ensure that there are no operational errors in the learning design before distributing and field trials. The trial of the development learning design includes: 1) trial design, 2) trial subjects, 3) data collection instruments, 4) types of data, and 5) data analysis. Furthermore, the validity and effectiveness were tested with data analysis based on the results of: a) preliminary trials which included validation of content experts, sources and learning designs. b) Individual trials, small groups, c) Subject teacher trials, and d) Field trials. Individual trials by 3 students, small group trials by 9 students, subject teacher trials by a class teacher, and field trials in one class of 24 people. The results of the reviews from learning approach experts, sources and learning media experts as well as learning designs were then revised based on suggestions and input from experts. The results of the revised learning design that have been improved are then tested on individual students and small groups. During

individual and small group trials, a questionnaire was administered which was used to determine the responses of individual and small group students to *flipped learning.*

RESULTS AND DISCUSSION

A. *Analysis* (Analysis)

Research that is relevant to research conducted by researchers regarding the Development of *Flipped Learning* Based on Gamification Approach in Elementary Schools is previous research, namely research entitled "Efforts to improve the quality of mathematics learning through *flipped learning* and gamification: a literature review" states that the design elements games can be used to complement the *flipped learning approach* so that students have the motivation to learn to participate in learning as a whole. Thus, students will get optimal results from what student-centered learning can offer, namely personalization, higher order thinking, self-direction, and collaboration. In this case the design is considered from various theoretical perspectives, combining *flipped learning* and gamification has the potential to develop students' abilities and skills. Furthermore, the combination of *flipped learning* and gamification can increase the intensity of students to interact with technology.

In addition, a study entitled *"Effects of the Gamification Supported Flipped Learning Model on the Attitudes and Opinions Regarding Game-Coding Education* " written by Özer, et al. (2018) states that teachers who use gamification-supported *flipped learning* turned out to be more enthusiastic about participating in coding training and they showed a positive attitude after implementation. According to these results, the designed environment has a positive effect on students' attitudes towards learning. Meanwhile, according to most teachers, they are satisfied with the activities carried out through gamification supported by *flipped learning* as well as increasing motivation and competition in the classroom. Moreover, in his study Dicheva, et al (2015) show that gamification-supported lessons are more interesting, motivating and successful. students in their lessons improve. In this regard, all future teacher candidates should consider having at least *a smartphone,* tablet or computer and high-quality Internet.

In terms of subject matter, pragmatically mathematics is seen as a science about the real world where many mathematical concepts arise from human efforts to solve real world problems. In this case, the purpose of developing mathematics learning in Indonesia according to the BSNP (National Education Standards Agency) mathematics has a goal to develop thinking skills, contribute to building skills: a) working with concepts, b) working procedurally, c) solving problems, d) reasoning, e) communicating and so that students have a positive attitude towards mathematics.

Thus, the scope of mathematical material is algebra, measurement and geometry, probability and statistics, trigonometry, and calculus. One of the materials used by the researchers is geometry. Geometry and their nets is a mathematical material that is of concern in this study. The reason for choosing the material for building space and its nets is because this mathematical material is easy to make concrete media to help students achieve mathematical understanding.

In addition, there are many forms of building space around students, making it easier for teachers in the learning process. In this case, the shape of the space is also called a three-dimensional shape which has a space that is limited by several sides. The sides can be formed through the arrangement of flat-shaped nets.

Mathematics learning activities do not focus on mastery of mathematical material alone, but mathematics material is positioned as a tool and means for students to achieve competence by Nasaruddin, N. (2013). Also mentions that mathematics is not perfect knowledge because itself, but with mathematics can help humans in understand and master problems in other fields, such as social, economic, and nature Supriyanto in Mizaniya, M. (2020). Good mathematical skills will open up great opportunities in a more productive future. On the contrary,

poor mathematical skills will reduce these opportunities (Wahyuningsih, E. (2019).

In line with that, the basic competencies and indicators contained in the material have the following aspects of knowledge and skills. (See **Table 1**).

Table 1. *Basic Competencies and Indicators*

Basic Competencies	Indicator
3.6 Explaining and finding simple geometrical webs (cube and block)	3.6.1 Analyzing the nets of cubes and blocks
	3.6.2 Identify the shape of the cube and cuboid space nets
4.6 Creating simple geometrical webs (cubes and blocks)	4.6.1 Solve problems related to nets of simple spaces (cubes and blocks)
	4.6.2 Presenting problem solving related to nets of cubes and blocks

On the other hand, through the questionnaires that have been distributed, the learning of SDN 2 Salakaria students is hampered due to the large number of students who use mobile phones to play online games such as *Free Fire, Play Unknown Battleground*, and *Mobile Legends.* In this case, students play online games with a frequency of 4-5 times a day, resulting in a lot of time being spent just playing. This is because students do not carry out activities and other activities and cause children not to gain knowledge. The length of time in playing online games, when children play online games for 3 hours per day makes children think that online games are more important than other things, such as doing learning activities. In line with that, in full attention, children when playing online games make children not want to do other activities such as learning activities. Then emotionally, children who play this online game cause an emotional feeling in the child and cause a feeling of pleasure or sadness when they lose when playing online games. This is what causes children to want to continue playing online games so as to achieve a satisfaction in the child.

A. Design

The design stage is the first step in making learning resources or all objects. The first step is to make a Lesson Plan, starting with determining the KI, KD and learning activities that will be carried out. The second step is making Student Worksheets (LKPD), LKPD containing the material discussed and questions regarding the material listed. Then the third step is to determine the learning design, the learning design used in this study is the *flipped learning design. Flipped learning* is learning that combines online learning with classroom meetings. According Ubaidillah, M. (2019) in *flipped learning*, things that are usually done in class such as explaining the material, giving assignments, exercises and homework are transferred to online learning. This means that students carry out learning activities at home then the material learned at home is then discussed during face-to-face learning in class. In *flipped learning design learning*, researchers prepare learning videos. as a learning resource that students must learn at home. The researcher uses a gamification-based *flipped learning design* because the current condition of learning can still be done offline but is limited by time. Then the gamification approach is used as an effort to involve students in learning. In this case, to make a learning evaluation instrument. In making the evaluation instrument, the researcher used a *game based learning approach* where the researcher used Moodle and Quizizz in making the evaluation instrument. This is done because the current character of

students likes something creative, practical and fun in various activities including learning activities. By packing evaluation instruments with games, students will not feel bored when working on them

B. Development

After designing, at the development stage, it is carried out on the Lesson Plan (RPP), LKPD (Student Worksheet), learning evaluation instruments, by conducting validation tests from RPP content experts, learning resources and design experts, improving the gamification approach based on suggestions and comments from experts, from teachers, as well as from the results of testing activities on individual students by 3 students, small group testing by 9 students.

As for some suggestions obtained from RPP experts on numbering such as A, 1, a, etc. The learning objectives should describe the steps so that indicators of learning success can appear, and there is an error in one of the points of the learning objectives that requires minor revisions.

In the design of learning devices, there is an LKPD whose validity is tested by covering 3 aspects, namely content, design, and also language. The score on the content aspect is 75%, the design is 84%, and the language is 88%. Based on the criteria table, it shows that the design and language are valid/good and for the content the category is quite good/fairly valid. In the LKPD validation there are several suggestions obtained from learning design experts, namely the inclusion of the formulation of learning objectives in the LKPD, the suitability of indicators with the objectives in the lesson plan, writing explicit and implicit instructions for students to be able to communicate or present the results, and there are suggestions on several writings such as " class" and "absence number" so that it can be concluded that this LKPD is suitable for use in the field with minor revisions. For learning evaluation instruments, obtaining a very good percentage with a score of 100% so that it shows a good/valid category and does not need revision.

The results of the test on mathematics teachers on the developed learning tools showed a percentage validity level of 90% with a good/valid category. According to him, learning with the gamification approach is very helpful in learning and is also educative, creative so that it makes students more enthusiastic in the learning process. However, there is a small revision in the RPP, there is a writing error that should be a grid of blocks or cubes to become a food web.

The results of individual and small group tests were carried out by giving questionnaires to students. The results of individual and small group tests show the level of validity of learning with the gamification approach based on the average results of student responses of 96.67% and 94.17% with very good categories so there is no need for revision.

C. *Implementation*

In the implementation phase, a field trial was conducted at SDN 2 Salakaria with a total of 24 students. In the learning process applying the gamification approach, student enthusiasm was very high and students liked the learning approach used. Learning is carried out systematically in accordance with the lesson plans that have been made. In the learning process with the gamification approach using a cooperative model (group) and using the media star as a *reward* for students who successfully answer or students who ask questions during the learning process. With this approach, students are motivated to be more focused, more active in learning. And at the final stage of learning the group that managed to collect the most stars, and for the most active students get certificates and prizes as *rewards.* So it can be concluded that at the implementation stage, student responses in learning are very good, and the gamification approach makes students more enthusiastic in learning so that it can have a positive impact on the assessment of learning outcomes.

D. *Evaluation* (evaluation)

At the evaluation stage, obtained from the results of field trials on 24 students with the

results of the posttest and pretest assessments given. Testing the results of the posttest and pretest given was tested with the results of the t-test which showed an increase in student learning outcomes. This is indicated by the results before learning using gamification-based *flipped learning learning designs* and learning after using gamification-based *flipped learning learning designs.* To find out whether there is a difference in the average student learning outcomes before using the gamification-based *flipped learning learning design* and learning after using the gamification-based *flipped learning learning design,* it is necessary to formulate the research hypothesis as follows: Ho = there is no difference in the average student learning outcomes between before using *flipped learning learning design* with gamification approach and learning after using *flipped learning learning design* with gamification approach. Ha = there is a difference in the average student learning outcomes between before using the gamification-based *flipped learning learning design* and learning after using the gamification-based *flipped learning learning design.* (See **Table 3**).

Table 3. T-Test Test Output analysis T-test with SPSS

T-Test

[DataSet0]

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest	65.8333	24	8.62084	1.75972
	posttest	77.1667	24	6.67680	1.36290

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	pretest & posttest	24	.792	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	pretest - posttest	-1.133E1	5.26404	1.07452	-13.55614	-9.11052	-10.547	23	.000

Based on the *output table* of the t-test analysis using SPSS, it is known that the number of data is 24 which shows 24 students who took the *posttest* and *pretest.* The average score for the *pretest was 65.8333 which was rounded up to 66. Meanwhile, the posttest* average was 77.1667 rounded up to 78. Thus, it can be concluded that there is a difference in the average student learning outcomes in the *pretest* and *posttest.* Based on the *paired samples test output table,* there is a sig (2-tailed) value of 0.000 <0.05, so as the basis for decision making according to Field, (2009) it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be concluded that there is a significant (significant) difference between the average student learning outcomes before using the *flipped learning learning design* with the gamification approach and learning after using the *flipped learning learning design* with the gamification approach.

CONCLUSION

Based on the results of data analysis and discussion in this development research, the process of designing the development of gamification-based *flipped learning* adapted to the development stages using the ADDIE model which consists of five stages, namely: (1) *analysis,* (2) *design, (3) development,* (4) *implementation,* and (5) *evaluation.* The results of the study obtained the following data:

1. The results of the validation of the Lesson Plan (RPP) show that each aspect that is tested for feasibility in the RPP format and language is categorized as valid with some suggestions obtained from RPP experts so that it requires minor revisions.
2. The LKPD that was tested for validity was in the valid/good category and there were several suggestions obtained from design experts so that this LKPD was suitable for use in the field with minor revisions. While the learning evaluation instrument, obtained a very good percentage so that it showed a good/valid category and did not need revision.
3. The results of trials on mathematics teachers on learning tools developed show that learning with a gamification approach is very helpful in learning and is also educative, creative so as to make students more enthusiastic in the learning process,
4. The results of individual and small group tests were carried out by giving questionnaires to students. The results of individual and small group tests

show the level of validity of learning with the gamification approach based on the average results of student responses getting a very good response so there is no need for revision.

5. The results of the field trial showed that there was an increase in student learning outcomes so that the gamification-based *flipped learning design was feasible to be used in learning design.*

REFERENCES

Amran, A., Suhendra, S., Wulandari, R., & Farrahatni, F. (2021). Hambatan siswa dalam pembelajaran daring pada mata pelajaran matematika pada masa pandemik covid-19 di sekolah dasar. *Jurnal Basicedu*, *5*(6), 5179-5187.

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: a systematic mapping study. *Journal of Educational Technology & Society*, *18*(3), 75-88.

Fernandes, L., Winardi, Y., & Appulembang, O. D. (2019). Hambatan belajar matematika: Studi kasus di kelas VIII suatu sekolah di Semarang [Barriers to learning mathematics: A case study of grade 8 students at a school in Semarang]. *JOHME: Journal of Holistic Mathematics Education*, *3*(1), 16-31.

Fuadiah, N. F. (2016). Miskonsepsi sebagai hambatan belajar siswa dalam memahami matematika. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara*, *7*(2), 87-92.

Mizaniya, M. (2020). Analisis materi pokok matematika MI/SD. *Auladuna: Jurnal Pendidikan Dasar Islam*, *7*(1), 98-110.

Nasaruddin, N. (2013). Karakterisik dan ruang lingkup pembelajaran matematika di sekolah. *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam*, *1*(2), 63-76.

Özer, et all (2018). Effects of the gamification supported flipped classroom model on the attitudes and opinions regarding game-coding education. *International Journal of Emerging Technologies in Learning (iJET)*, *13*(1), 109-123.

Tambychik, T., & Meerah, T. S. M. (2010). Students' difficulties in mathematics problem-solving: What do they say?. *Procedia-Social and Behavioral Sciences*, *8*, 142-151.

Ubaidillah, M. (2019). Penerapan Flipped Classroom Berbasis Teknologi Informasi pada Mata Pelajaran Fiqih di MTs Al-Chusnaniyah Surabaya. *Islamika: Jurnal Ilmu-Ilmu Keislaman*, *19*(01), 34-45.

Wahyuningsih, E. (2019). Pembelajaran Matematika dengan Pendekatan Problem Based Learning dalam Implementasi Kurikulum 2013. *Jurnal Pengembangan Pembelajaran Matematika*, *1*(2), 69-87.