

Effectiveness of The Implementation Game-Based-Learning in Increasing Student Learning Outcomes

Nabila Nur Maulida^{1(*)}, Sukadi², Sri Rahayu³
^{1,2,3} Universitas Pendidikan Indonesia, Bandung, Indonesia
nabilanurmaulida1@upi.edu

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Abstract

The government has now started to lower the Implementation of Community Activity Restrictions level during the COVID-19 pandemic, but it cannot be predicted that it will return to normal. This makes the world of education to be able to choose a learning model whose implementation is flexible both offline and online. Learning outcomes are an indication of the success of a learning process. In line with the previous explanation, the purpose of this study is to determine the effectiveness of implementing Game-Based-Learning (GBL) learning-assisted Kahoot! with digital media in improving student learning outcomes in the subject of Construction Cost Estimation. This research is a pre-experimental design in the form of a one-group pretest-posttest research design, with 42 students participating in a vocational high school in West Java. The results of the study show that the application of GBL helps students to gain better learning experiences with an average score that is more effective than before the treatment, where the value obtained has exceeded the category of determining the completeness of learning outcomes for productive subjects that have been determined. To see the picture that GBL can improve student learning outcomes, it can be seen from the results of the N-Gain increase test, the result is an increase with a moderate category. Based on the research findings and discussion in terms of the process and improvement of student learning outcomes, the N-Gain Score of 65.00% is categorized as quite effective, so the application of GBL can be applied according to current conditions and can be more optimal.

Keywords: Construction Cost Estimation, Game-Based-Learning (GBL), Kahoot!, Learning Outcomes

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INTRODUCTION

As stated in the preamble to the 1945 Constitution, "Educating the nation's life", to support national equality, it is necessary to have a key or tool that is believed to support the nation's intelligence. Education is a cultural heritage from generation to generation, which is one of the keys that have been proven to be able to educate humans, change human personality, mature thoughts, thinking skills, feelings, and character, and foster creativity (Rahman et al., 2022). Education has a very important form of activity in it. One of the prerequisites that must be met during the learning process is the ability of the teacher to increase or strengthen the active participation of students. Therefore, the activeness and creativity of teachers motivating students to be directly and actively involved in learning is one aspect that conditions the achievement of learning objectives and the smooth running of teaching and learning activities, which will affect students' mastery of concepts (Dina Hakiky, 2020). As a student who focuses on the realm of vocational education, it is necessary to study further how the challenges will be when entering the vocational education level.

One of the Graduate Competency Standards for Vocational High School level education units (SMK) which is attached to the Attachment to Permendiknas No. 23 Year 2006, is to prove the ability to think logically, critically, creatively, and innovatively in decision making.

This means that SMK graduates must be able to work, be independent/capable of entrepreneurship, and be able to continue their education to the tertiary level (Sudaryat, 2016). Modeling and Building Information Design or abbreviated as DPIB, is one of the skill programs that have a high enough interest at the vocational school level. There are several subjects in the Modeling and Building Information Design expertise package, one of which is Construction Cost Estimation which is studied in class XI and class XII. In line with the Core Competencies and Basic Competencies of Vocational High Schools/Madrasah Aliyah Vocational Schools compiled by the Directorate of Vocational High Schools in 2019, the development of the current curriculum where with Construction Cost Estimation learning, is expected to provide experience for students to be able to understand the main points of initial discussion inclusive construction calculations, so that students are encouraged to think critically in solving problems in the real world (in the field). Vocational education is an exclusive education designed to prepare students to enter the real world (in the field) with the field of expertise they have chosen and can foster a professional attitude in the relevant field (Ramdhani, 2018).

However, in reality, students at the SMK still often lose focus in the learning process, especially on math subjects that are not easy to understand instantly. The main factor is the lack of literacy and curiosity in seeking education, as well as the lack of effective learning models used by teachers. This means that Construction Cost Estimation learning tends to be still not optimal in terms of teachers. We need to know that apart from teaching problems, there are also conditions that we need to pay close attention to, namely the COVID-19 pandemic. In several educational institutions, the impact of the coronavirus is quite large, one of which requires teachers to look for alternatives in the learning process (Abidin et al., 2020). The pandemic has resulted in the world of education having to adapt quickly to be able to provide virtual learning sessions, by continuing to involve students while ensuring that the content and learning methods used are relevant to students and the continuity of learning that can support their future profession (Farnell et al., 2021). This is a big challenge because face-to-face situations are still not optimal and the main factor is boredom, then now with the pandemic condition that requires teachers to do face-to-face learning virtually, it can be predicted that the main factor of this boredom will increase.

Based on the statements and problems above, as a teacher, it is necessary to find new alternatives to increase interest, quality, and innovation in learning in the classroom, both offline and online. One effective way is for teachers to apply a Game-Based-Learning model assisted by digital media or known as Digital Game-Based-Learning (DGBL) (All et al., 2021). The purpose of using games from the Game-Based-Learning model is to produce serious learning (ie educational goals), as a device that fundamentally supports the learning process substantially (Winatha & Setiawan, 2020). The game is something that can be said to be liked by all people. Because games can be fun and interesting. Game-Based-Learning has proven to be more effective than traditional learning in increasing knowledge retention, motivation, and meaningful learning, encouraging critical thinking, decision-making skills, and academic performance (Gutiérrez-Puertas et al., 2020). Game-Based-Learning produces students who feel more relaxed, enjoy, happy, spirited, and interested so that boredom will decrease and therefore the absorption of the material conveyed to students will also be better (Cojocariu & Boghian, 2014).

Learning requires the help of supporting media. For that goal to be achieved, the selection of appropriate learning media can certainly provide results in achieving the learning objectives given by a teacher, so that with appropriate and effective learning media students will be more enthusiastic and motivated in participating in learning (Intaha et al., 2020). One of the media that

is in line with Game-Based-Learning based on current conditions is assisted by digital media, one of which is Kahoot! application. Kahoot! is a gamification tool to describe student capabilities through presentations in the form of questions, in the form of an online platform to make multiple-choice tests, Kahoot! can be found and accessed through the website address <https://kahoot.com/> as well as in the mobile application on android or ios (Guardia et al., 2019). One of these online Game-Based-Learning media is Kahoot! which is developed to be able to solve problems individually so that they are challenged in the learning process stimulates students to be more concentrated, collaborative, comfortable in learning, and able to increase learning motivation (Chaiyo & Nokham, 2017). A similar study, namely the use of Kahoot! the application was also conducted examined the effectiveness of using Kahoot! as an evaluation tool for students. The results of his research show that Kahoot! is a very effective evaluation tool (Daryanes & Ririen, 2020).

Game-Based-Learning so far can be used as an alternative to providing student contributions, especially at this time which is done only by online learning, but the effect of this Game-Based-Learning can affect its widespread use (Tavares, 2022). Although this research study appears to have covered previous studies, with the COVID-19 pandemic conditions that require learning to adapt to new habits, namely a combination of offline and online learning, this study is quite different in terms of application. learning and how to respond to the adaptation of this new habit. Therefore, the purpose of this study, researchers have a fairly large level of curiosity to explore further how the effectiveness of implementing Game-Based-Learning assisted by Kahoot! with digital media in improving student learning outcomes, in the subject of Construction Cost Estimation at Vocational High School (SMK). Effectiveness of the implementation game-based-learning in increasing student learning outcomes is researched and restricted to Basic Competencies (KD) 3.11, namely the Material Price Analysis of Building Construction Work Units of students' competence in Building Modeling and Information Design skills, with experimental designs that were not completely serious. Researchers also want to provide education to teachers that the Kahoot! can function as a benchmark for teachers in providing rewards or added value to students who can answer and become winners in quizzes.

RESEARCH METHODS

Methods

The research method used is an experimental method, with a research design of Pre-Experimental-Design (nondesign) in the form of One-Group Pretest-Posttest Research Design. It can be defined as a Pre-Experimental design because this design is not a true experimental form. This is because there are still external variables that also affect the form of the dependent variable. As a result, the experiment which is the dependent variable is not influenced by the independent variable alone. This can happen because there are no control variables, and the sample is not chosen at random (Sugiyono, 2017). In the form of One-Group Pretest-Posttest Research Design, then a group is given a pretest first as an initial measurement before being given a treatment, then treatment is carried out in the form of implementing Game-Based-Learning (GBL), then given a measurement at the end in the form of a posttest. By giving posttest implementation is obtained GBL. The two tests were categorized as complete based on the category of determining mastery learning outcomes for productive subjects, namely category C = 65, which means that students show sufficient understanding of all materials (competent enough).

Data Participation

This research was conducted at a Vocational High School, to be precise in one of the Vocational High Schools (SMK) in West Java. The research sample in this study was class XI students of the Modeling and Building Information Design or abbreviated as DPIB expertise program in the even semester of the 2021/2022 academic year who were studying the subject of Construction Cost Estimation. Sampling in this study uses non-probability sampling, with a saturation sampling technique. So that obtained number of research samples was as many as 42 people.

Data Analysis

This study uses a data collection tool or known as an instrument, in the form of a test instrument. Because this study uses an initial test (pretest) and a final test (posttest), it is enough to use one instrument, namely a test instrument. In this study, the researcher provided a test in the form of multiple choice, a total of 22 questions. The researcher established the research procedure proposed by Arikunto (2019) in this study, there are 3 stages of research procedures, as follows:

1. Planning Stage

At this stage, in short, after compiling the research instrument, the next step is to test the research instrument. The instrument testing was conducted on 30 students of class XI Modeling and Building Information Design. Test the validity of the instrument using the biserial point correlation result is that 2 items are not valid from the total number of questions, namely as many as 22 questions. Furthermore, to test the reliability, researchers used internal consistency, using the Kuder Richardson (KR_{20}), and the results obtained $r_{11} = 0.80$ which belongs to the high-reliability category. Next, namely the difficulty level test with difficulty index, the average results of the questions belonging to the medium category are 50%, while for the easy questions category it is 18%, and for the difficult questions category, it is 32%. Then the last is the discriminatory power test (D), it can be concluded that 77% can be said that the multiple choice questions of this test instrument are more than adequate to distinguish between less competent students and students who are proficient. So that it can be concluded from 22 items of the research instrument, items of instruments that can be used/used as research data collection as many as 20 questions.

2. Research Stage

This research begins with an pretest, then carried out observations of the effects given from the treatment by measuring the dependent variable (increasing learning outcomes in the Estimation of Construction Costs subject) in the form of giving a posttest. At this stage, in short, after the implementation of Game-Based-Learning-based learning is deemed sufficient. So, the researcher continued to analyze the data. Analysis of the data analyzed in this study was conducted to answer the formulation of the research problem, namely to find out how effective the implementation of Game-Based-Learning learning assisted by the Kahoot! with digital media in improving student learning outcomes in the subject of Construction Cost Estimation at Vocational High Schools (SMK) in West Java. In line with the formulation of the problem, the appropriate data analysis is the calculation of the N-Gain Score. In this study, the calculation of the N-Gain Score is divided into 2 (two) calculations as follows:

a. N-Gain

Calculation of N-Gain or gain normality test according to Hake (2002) that N-Gain is a calculation that can describe a general picture of an increase in learning outcomes scores (from an application) between before (pretest) and after (posttest) treatment as well as a comparison, the significant difference between the two learning outcomes.

b. The Effectiveness of the Implementation Game-Based-Learning

As for seeing a picture of the effectiveness of a Game-Based-Learning application assisted by the Kahoot!, according to Hake (2002), the results of obtaining the N-Gain Score can be formulated in the following equation:

$$N\text{-Gain Score (\%)} = N \text{ Gain} \times 100\%$$

3. Report Stage

At this stage, it can be said that the final and fixation stage. Because researchers write reports in written form they need to pay attention to the guidelines for writing scientific papers and be adapted to the data to be processed.

RESULTS & DISCUSSION

Results

Based on the research sample that has been described previously amounting to 42 people, selected samples of class XI Modeling and Building Information Design-1 and XI Modeling and Building Information Design-2 with each class totaling 21 people, where in this study there was no control class so the research sample acted as the experimental class. Researchers carry out learning activities on the subject of Construction Cost Estimation, which is precisely the basic competency of KD. 3.11. The researcher chose the unit price analysis material for building construction work because KD 3.11 is a continuous material with basic competencies before and after which there needs to be a strong understanding of this material. KD. 3.11 This is a basic competency that is used both in the pretest and in the posttest, where this material has an equal weight combination between the calculation material and the theoretical material. Later on, the effectiveness of the results can be found from the results of the pretest and posttest, pretest is obtained before the treatment, while the posttest is obtained from the test results after the treatment, namely Game-Based-Learning-based learning. The steps taken in this study are in line with the research design steps of the One-Group Pretest-Posttest Research Design, which was proposed by Rukminingsih (2020) namely: 1) Determining subject groups to be used as research samples, 2) Pre-test (pretest), 3) Provide treatment, 4) Give final test (posttest), 5) Find the average score and standard deviation, both from pretest and posttest to comparing the two, 6) Testing the difference in a mean or data analysis.

Implementation of game-based-learning syntax

Implementation of Game-Based-Learning is adapted to current conditions, so Game-Based-Learning is more digital. So that it can be handled with individual games. More specifically, according to Dina Hakiky (2020) that Game-Based-Learning, especially with games, is learning that can combine educational content with game-centered forms to attract students to learn (learning objectives) based learning process game utilizes digital games as a medium to deliver learning that can be accessed by each individual independently. In table 1, the implementation of the Game-Based-Learning digitally in class XI Modeling and Building Information Design which is used as an experimental class, according to the syntax of the Game-Based-Learning (GBL) model digitally is divided into five phases as follows.

Table 1. Implementation of game-based-learning syntax

No	Learning Activities	Duration
1	Kegiatan Pembukaan	15 minutes
	Core Activities, divided into:	
	Phase 1: Selecting games according to the topic/material, and explaining concepts	
2	Phase 2: Determining the game system and rules	160 minutes
	Phase 3: The game begins	
	Phase 4: Summarizing knowledge	
	Phase 5: Reflecting	
3	Closing Activities	5 minutes
	Total Duration	180 minutes

Different in student learning outcomes before and after treatment

The learning outcomes before the treatment was given were taken from the results of the pretest. Pretest data is an initial picture to see students' abilities before the treatment of the implementation of Game-Based-Learning. While the learning outcomes after being given treatment were taken from the posttest data as the final picture to see students' abilities during teaching and learning activities with the implementation of Game-Based-Learning (after treatment is given). With the number of questions for each test as many as 20 multiple choice questions. Differences in student learning outcomes can be presented in table 2, as follows.

Table 2. The value of students pretest and posttest learning outcomes

No	Item Assessment	Class XI Modeling and Building Information Design (Experiment)	
		Pretest	Posttest
	Students	42	
	Category Minimum	C = 65	
1	Lowest student score	20,00	55,00
2	Highest student score	85,00	100,00
3	Average learning outcomes	57,02	84,52

Kemendikbud in 2018 issued a Guide to Assessment of Learning Outcomes and Character Development in Vocational High Schools, by setting a minimum standardization or a minimum completeness category for the value of productive subjects in category C with a minimum score of 65. class XI Modeling and Building Information Design students seen from the average pretest are still classified as incomplete under the category of determining mastery learning outcomes for productive subjects, namely in category C = 65, with category D which means not yet competent, while judging from the average the final test (posttest) is classified as complete with category B+ which means competent. To see the effectiveness of the application of learning in improving learning outcomes, it is necessary to calculate the N-Gain Score.

Differences in student learning outcomes before and after treatment

To find out the description of the increase in learning outcomes, it shows that student learning outcomes are included in the category of high, medium, or low improvement obtained from the results of the calculation of the normalized gain or N-Gain. The gain is used as a reference to describe the increase in students' abilities which include understanding, and mastery of students' concepts after the implementation of learning (learning models) is carried out. To see the

categories, we can use the interpretation of the Gain (g) according to Hake (2002) which is presented in table 3, as follows.

Table 3. Category of N-Gain

<i>N-Gain (g)</i>	Category
$g \geq 0,30$	Low
$0,30 \leq g \leq 0,70$	Medium
$g \geq 0,70$	High

So, it can be concluded from the table that has been described above that it can be categorized as an increase in student learning outcomes if a large N-Gain is obtained around 0.50. The results of the N-Gain test calculations in this study are summarized in table 4, as follows.

Table 4. Recapitulation of student learning outcomes

No	Item Assessment	Class XI Modeling and Building Information Design (Experimental)			
		<i>Pretest</i>	<i>Posttest</i>	<i>N-Gain</i>	Category
Students		42			
1	Average learning outcomes	57,02	84,52		
2	Lowest student score	20,00	55,00	0,65	Sedang
3	Highest student score	85,00	100,00		

From the results of the calculation of the N-Gain, to determine the effectiveness of the application of game-based learning in improving learning outcomes, it can be seen by changing the N-Gain to N-Gain Score. By multiplying the N-Gain by 100%.

The following is the calculation:

$$N-Gain\ Score\ (\%) = N\ Gain \times 100\%$$

$$N-Gain\ Score\ (\%) = 0,65 \times 100\%$$

$$N-Gain\ Score\ (\%) = 65,00\ \%$$

To be more accurate in seeing how effective it is, it can be interpreted in the category of effective level, which is presented in table 5.

Table 5. Category of n-gain score index

<i>N-Gain Score (%)</i>	Category
>40	Not Effective
40-55	Less Effective
56-75	Quite Effective
>75	Effective

Based on the calculation of the N-Gain Score test, it can be concluded that the N-Gain Score value of 65.00 is based on the N-Gain Score index category which has been presented in Table 5, including the category of quite effective effectiveness. To answer the formulation of the research problem, how is the effectiveness of implementing Game-Based-Learning in improving student learning outcomes in the subject of Construction Cost Estimation at Vocational High Schools (SMK) in West Java in the experimental class (XI Modeling and Building Information Design) quite effective, this means that the implementation of GBL-based learning with the help of Kahoot! with digital media is said to be effective and able to improve student learning outcomes.

Discussion

From the results of the research that has been described previously that the average value of student learning outcomes seen from the pretest in the absence of treatment is still less than the category of determining the completeness of learning outcomes for productive subjects that have been determined. This is a study that needs to be considered, from the results of the study, one of the contributing factors is the learning conditions before the pretest implementation, students do not regularly schedule between online and offline which is more dominant online, this can be one of the triggers for students to not explore the material delivered. A similar study was also conducted by Ni Made Septiana Dewi & Ni Wayan Mudiasah, in 2021. Ni Made Septiana Dewi & Ni Wayan Mudiasah researched online learning during the COVID-19 period, focusing on the implementation and learning outcomes. The results of his research are that apart from the difficulty of signaling, and other internet-related issues, the thing that is of concern is that the material is difficult to convey (from the teacher's point of view) and difficult to understand and understand (from the student's perspective) (Dewi & Mudiasih, 2021).

Berbegal et al. (2017) argue that innovation in the realm of education, namely learning practitioners is a very important thing, it can increase student understanding, activity, student motivation, and game-based learning is seen as a learning model that has the most potential to achieve all goals. that is expected. Thus, the selection of the Game-Based-Learning learning model is believed to be able to provide a good influence on the learning process. Reinforced by research that reveals that Game-Based-Learning-based learning with the help of Kahoot! as a digital medium, can improve student learning outcomes. Significant differences in the effect of learning felt by students with quizzes in the form of the Kahoot! with a Google Form quiz with a difference of 14%, we highly recommend using Kahoot! also Quiziz in the classroom as a tool to enhance an interesting learning experience (Chaiyo & Nokham, 2017).

Overview of treatment and learning

After doing a pretest on the AHS (Work Unit Price Analysis) or KD material. 3.11 which then the results are analyzed to see the initial picture of student learning outcomes. So then, before holding a treatment starting teaching and learning activities (KBM), researchers who act as teachers provide information to students that the next KBM is on KD. 3.11 (Building Construction Work Unit Price Analysis) will apply game-based learning (GBL) or learning with a game in it. Where after the researcher (teacher) provides learning, individual students will immediately measure their abilities by playing while learning through a platform form of Kahoot! with digital media. At the end of the lesson, each individual who has won or won the game by being proven to achieve the highest top 3 (three) scores will receive an award or prize from the teacher. Supported by research Prasetya et al. (2013) that Game-Based-Learning can make individuals accustomed to being able to solve their problems in a fun way, which is a form of a game, ending with competing to be a winner or winning conditions.

This treatment is carried out by current conditions, which must be carried out alternately between being carried out offline and online. Learning challenges during the pandemic or post-pandemic period must be designed carefully and prepared with a combination of learning management between online and offline learning (Koeswanti, 2021). In the social interaction of education, face-to-face (offline learning) a teacher has a very significant position in the classroom, namely the position of maximizing learning activities (Iswardhany & Rahayu, 2020).

This becomes a challenge to be able to carry out a treatment that must be carried out flexibly both offline and online learning. Because this research was conducted during class hours, the students were divided into 2 (two) groups, namely students who studied directly and students who studied online. This group has been determined by the school syntax GBL, at the beginning of learning the teacher explains in advance about the application of GBL which is more towards playing. By the indicators in Basic Competence 3.11, students learn about the meaning of AHS, the rules used to calculate AHS, basic formulas in calculating AHS, looking for coefficients, total prices, overhead costs, and profits, rounding prices, and calculating AHS. After being given sufficient material, the researcher who acts as a teacher at the end of the lesson will always be given an evaluation in the form of games or playing while learning. This learning requires students to learn (focus), but with a fun approach, namely games (Cinta et al., 2021).

In the offline treatment, in this evaluation, new students are allowed to take out gadgets, then access kahoot.it, the teacher gives a game pin and the students play individually. After the game ends, it will be immediately visible on the projector screen the order of the winners of the top 3 (three) highest scores, where they will be rewarded by the teacher in the form of additional points. It can be concluded that the process of teaching and learning activities (KBM) from beginning to end went smoothly, learning model GBL well and enthusiastically when the game is held. Meanwhile, in the implementation of the treatment carried out by online learning, there were few obstacles. That is, there are still some students who do not participate in working on game evaluation this is 50% due to unstable network constraints, and the number of students who find it difficult to independently access Kahoot! In line with the opinion of Prawanti & Sumarni (2020) besides the problem of the need for internet access, the lack of student knowledge about platforms that support learning will certainly have an impact on the learning process. Researchers get around for students who can't log the play games help of the Kahoot!, it is assigned by assignment. On the Kahoot! This, in addition to the live games (directly), can also be made by assignment. Kahoot! application or platform a game-based response.

By giving treatment with game-based learning, assisted by Kahoot! With digital media, it will be easier for teachers to be able to measure student learning outcomes. In addition, after the game as an evaluation tool is finished, the teacher will share a report on the results of the game which contains questions and answers related to the material described. Presenting the results of the implementation (review) of the game Kahoot! format report from different perspectives is one of the features that make this tool popular in the world of education (Rajabpur, 2021). As a result, students are expected to be able to read and study at home. So it can be said that with the help of Kahoot! Apart from being a measuring tool, this is also a tool for storing archives of material that has been submitted. After being given adequate treatment, then to see the final picture of the success of a treatment that has been given, a final test (posttest) is held. The posttest uses multiple choice questions with a total of 20 questions, 4 (four) choices, with the Kahoot! form / feature assignment (assignment). Implementation posttest for 35 minutes. All students of class XI Modeling and Building Information Design participated in the research sample. With the Kahoot! This in addition to easily determining the acquisition of student learning outcomes, can also be observant to see the dexterity of students in answering questions by being proven that there is a deadline for each question and being able to minimize cooperation between friends.

Game-based-learning model

The selection of the Game-Based-Learning, in addition to being flexible in use today, which can be applied online or offline, is also expected to stimulate student interest and develop students'

critical thinking so that they can produce good learning outcomes. This is supported by the opinion of Wibawa et al. (2021) that Game-Based-Learning (GBL), has a high understanding value to improve skills such as critical thinking, communication between people, and making the right decisions. From the results of the research that has been described, it can be concluded that in general in terms of activities, and steps (syntax), the learning applied by teachers for the implementation of GBL can be categorized as running well overall. By utilizing online as a learning innovation (learning model), helping students undergo online learning during the COVID-19 pandemic (Mustakim, 2020). However, the use of digital media also has its drawbacks. One of the main ones is network availability which is sometimes inadequate (Ritiau et al., 2022).

The use of Kahoot! as a game-based-learning media

Kahoot! as a learning media supports this research because, in the implementation of GBL, the evaluation tool will be made into multiple choice questions according to the pretest. During the treatment, Kahoot! dominantly used with live games, according to Samudera (2020) the live games app, functions as a direct game service provider application, namely a game that can be played simultaneously through certain media. This means that with the live games learning can be done online and offline, as long as it is important that both the organizers and participants still have an internet network. As for the implementation of the posttest, it is used with the assignment/homework app or in Indonesian terms is an assignment. In addition to the Kahoot! used as a place to measure students' abilities. With this feature, it can help teachers to assign and give homework or tests to students and teachers in assessing and seeing student progress.

As explained by Arifin (2021) even though on the screen of the Kahoot! only the top five podiums were presented, but the overall score was obtained by Kahoot! found in the report on the Kahoot! The organizers are also able to record (report) all the results of their use, in this study students will be given a report on the results of each game, which can be trusted to help students read and re-learn the questions during the game. In line with previous research, according to the research of Kudri & Maisharoh (2021) that higher learning outcomes were obtained with the application of Kahoot! based learning compared learning outcomes with the implementation of direct learning models.

Learning outcomes

Learning outcomes are possible to become a tool to ensure the quality of education, while still being paired with real actions, one of which is the awareness and needs of students (Erikson & Erikson 2019). With no social interaction between teachers and students, students will feel a lack of attention from the teacher and a lack of learning motivation given by teachers to their students (Iswardhany & Rahayu, 2020). So, in the learning process to improve learning outcomes, there is an important competence, namely social interaction to obtain good learning motivation. The results of the posttest showed a higher average value than the pretest which was used as the final description test with an average learning outcome of 84.52, which means this value belongs to the B+ category with a description of competency mastery, namely competent. So it can be concluded that student learning outcomes in the subject of Construction Cost Estimation with the implementation of GBL produce significant learning outcomes. When viewed from the difference in value, the gain is 27.50. From the increased test carried out by calculating the N-Gain, as a result, it increased with a value of 0.65. After being interpreted with the N-Gain according to Hake (2002), it is included in the medium category. It can be concluded that the implementation of

learning (learning model) based on GBL in Construction Cost Estimation subjects can improve students' abilities well. This is following the opinion of Winatha & Setiawan (2020) concluding that there is a significant difference between classes that apply the Game-Based-Learning seen in learning outcomes, learning achievement, and learning motivation, which overall increased significantly.

The effectiveness of the implementation of game-based-learning based assisted by the Kahoot! in improving learning outcomes

To support the success of learning, namely with appropriate learning models and media in productive subjects, which include 3 (three) aspects, namely cognitive, affective, and psychomotor, one of which is Construction Cost Estimation is based on learning by taking into account the elements of the material that must be mastered by students to meet the goals of vocational education and prepare students who are skilled and competent in their fields (Rofiah & HS, 2021). Game-Based-Learning is designed to match the subject matter with the game and the player's capabilities to maintain and apply the subject matter in the real world Game-Based-Learning is designed to match the subject matter with the game and the player's capabilities to maintain and apply the subject matter in the real world (Cojocariu & Boghian, 2014). This is in line with learning Construction Cost Estimation, which is expected to equip students with experience in understanding the overall basic construction calculations in the current curriculum development so that students can face real-world problems and can also encourage them to be involved in providing solutions and think critically about the field world. So that the capabilities possessed by students are better and even increased because students inevitably are given individual challenges to be able to solve problems in the form of material in the form of games. Learning within the scope of a digital game-focused game allows students to try different behaviors, face various obstacles individually, and take risks directly from every action and initiative they take (Hidayat, 2018).

Based on the results of the N-Gain Score there is an increase in student learning outcomes in the subject of Construction Cost Estimation in terms of the results of the pretest with prior treatment and posttest, namely after the treatment by applying Game-Based-Learning. The N-Gain Score test was conducted to determine the effectiveness of the implementation of learning in improving learning outcomes. From the test, there was an increase in the moderate category, and to be processed into the N-Gain Score according to the formula proposed by Hake (2002), it was enough to just multiply by 100%. After being interpreted with the effectiveness category table, it is categorized as quite effective. So it can be concluded that the description of the effectiveness of implementing Game-Based-Learning in improving student learning outcomes is quite effective, especially in KD. 3.11, namely the combination of calculation and theory in the subject of Construction Cost Estimation. Supported by previous research, based on Sanga et al. (2019) on chemistry subjects that focused on the combination of math and theory, the use of the online game Kahoot! produces a gain with a high category which means it is included in the category of effective learning.

CONCLUSION

Based on the results of research and discussion that have been conveyed, it can be concluded that the implementation of Game-Based-Learning at one of the Vocational High Schools,

especially in the subject of Construction Cost Estimation for class XI Modeling and Building Information Design expertise program, illustrates that in terms of the effectiveness of implementing Game-Based-Learning assisted by Kahoot! with digital media in improving student learning outcomes is categorized quite effectively applied. That is, the implementation of Game-Based-Learning seen from the process and improvement of student learning outcomes is stated to be a new alternative to be used as an application of learning (learning model) which also remains combined with a learning media that supports one of the applications Kahoot! to be used in learning during the COVID-19 pandemic, this is supported by research data that the implementation of Game-Based-Learning is assisted by the Kahoot! can be used flexibly in both offline and online learning.

With this exclusive application, students will also put an understanding of learning during the pandemic for both theoretical material and calculation material. Through this model, it can also be a choice for teachers/educators (teachers) to manifest a fun learning process and attract students' attention. For further researchers, it is hoped that they can add to the study not only to see the effectiveness of an application of learning in terms of observing the value of learning outcomes but also to further deepen the study from observations of the application process to respondents with the help of observation instruments.

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