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Optimization of The Digital Game Based Learning Instructional Design (DGBL-ID) Method as Learning Support Media

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ABSTRACT

The development of science and technology has encouraged reforms in the use of technology results in the learning process. As a teacher, you must package learning to be creative, innovative, and fun in order for learning to be successful. One way for learning to package learning to be interesting is to use learning media. One of the learning methods that can be applied to an angragogical approach and is effective in achieving learning objectives is learning using digital game-based learning methods (DGBL). This study aims to develop game-based learning in order to create a learning environment that is motivating, fun, and enhances creativity. Through a game-based learning approach in learning, it is hoped that the DGBL-ID method can stimulate emotional, intellectual, and psychomotor activities through the aspects of interactivity, direct feedback, virtual representations and repetition of settings and events in a lesson.

1. Introduction

The development of technology in the era of the industrial revolution 4.0 has now influenced various fields. This is in line with the development of science which has a major influence on the world of education. In teaching and learning activities, there are currently progress and effective and creative innovations, so these changes are very helpful in achieving an advanced and modern learning process. A learner, in this case a student or student, has a role that is not only used as an object, but also acts as a subject who actively participates in learning. With the development of technology and science, of course, it has had a considerable impact in the process of improvement and the learning process.

As a teacher, of course, you must package learning to be creative, innovative, and fun so that the learning process is achieved properly. One way that the learning process can provide attraction is by applying the concept of games to learning media, or commonly known as gamification. The Digital Game Based Learning (DGBL) method as one of the methods in game-based learning can be applied to achieve learning objectives.

Digital game based learning (DGBL) is a method that can be used in the adult learning process. Games can provide structured conditions as in real life situations. There are elements that are entertaining and fun in the game, so that it can give a different impression and learning experience, and provide a risk of success and failure that can be repeatedly learned [2]. The features offered by the game also have several things that other learning methods do not have, such as virtual representations, feedback and aspects of interactivity, direct feedback and looping settings in a lesson [3].

Game-based learning development can provide an environment that enhances creativity, is motivating and entertaining. So that through learning games it can be an approach that has an impact on psychomotor, intellectual, and emotional stimuli in children [4]. Therefore, the learning process can apply game-based learning concepts as the right solution. Learning applications in a person have been widely applied, but the resulting research only focuses on learning media for formal writing, reading and arithmetic.

How to distinguish games that are suitable to help students learn in class from those used only for entertainment, in Figure 1. Is a game category that has been classified by experts.

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Fig.1 Categories Game

From Figure 1. it can be seen that the game category is divided into two, namely video games and serious games. Video games are games designed for pure entertainment. While the Serious game is a game designed to teach or help students practice certain skills or content. Even though they are intended for entertainment, video games can be geared towards teaching a different skill, that is, taking them into the realm of serious gaming. On the other hand, serious games can incorporate video game elements to make them more interesting. There is a different balance that needs to be struck between these two types of games, to create something that is both educational and fun for students. [5]

2. Literature Review

2.1 Games and Learning

Ifenthaler, Eseryel and Ge emphasized that there are things that make the difference between the concept of game and play. In the sense that the game is focused on educational needs, while play is used as a feature to give the player an entertaining impression [6]. There are 4 main features in a game, namely rules, objectives, voluntary participation and feedback system related to aspects in the world of education. Each game contains these four features. [7]

a. Rules

This feature deals with limitations that show how a player can achieve goals in a game. With the rules, it can motivate players to find various possible ways to achieve their goals. Therefore, the rules in the game in general will trigger strategic thinking and player creativity

b. Purpose

This feature will be obtained by players from every activity in the game, which makes participants have a sense of purpose. Because the goal of the game has become part of the initial design.

c. The voluntary participation

Everyone is involved in a game on the basis of the understanding that they voluntarily accept the goals, rules, and feedback system that has been set. Voluntary participation is the basic foundation of the willingness of a number of people to play together. The freedom to enter and exit a game will ensure that the stressful and challenging activities involved in the game are perceived as safe and enjoyable.

d. Feedback system

This feature shows participants how close they are to the goal they want to achieve in the game. Forms of feedback systems include points, levels, scores, or progress bars. Feedback given in real-time serves as a promise to players that the desired goals can be achieved. Therefore, the feedback system essentially gives participants the motivation to keep playing.

2.2 Digital Game Based Learning

According to Coffey, Digital Game-Based-Learning is a learning method that combines educational content or learning principles with games that aim to attract students to learn. This DGBL media utilizes educational constructivism theory. With this educational theory, DGBL connects educational content with computers or video games so that it can be used for all subjects and levels of education. DGBL provides learning opportunities for students in interactive instruction and helps students to participate in the global technology society [8].

Coffey added that DGBL includes activities such as completing simple tasks to develop skills in solving complex problems. Prensky [9] in his book states that DGBL is not only about learning theory but also practicing it. DGBL also connects its players to a learning and training environment. DGBL can make the learning process fun and stimulate learning.

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According to O'Neill [10], the effectiveness of DGBL has several conditions, namely:

a. The intensity and time of involvement in the game
b. Commercial success of the game
c. Acquiring knowledge and skills from the use of games as instructional media

The effectiveness of DGBL as an instructional medium has a direct impact that refers to the cognitive, psychomotor, and affective aspects. This can be assessed by looking at measuring changes between before and after the use of DGBL media in learning. Meanwhile, the effectiveness of DGBL when referring to the application of learning content in real situations can be assessed based on data collection obtained in the field such as main performance indicators or by conducting further tests. This an understanding is obtained that DGBL can be used in learning. The concept is that learning will use digital games as the medium. This digital game contains educational content which contains subject matter according to the existing syllabus. In this digital game used includes active student participation so that students are directly involved in the game both as groups and individually. Meanwhile, the effectiveness of DGBL was measured by looking at the changes between before and after using DGBL media

3. Research Methodology

The method used in this study consisted of the data collection stage and the system development that adopted the DGBL-ID model. This method is a combination of digital game development with an instructional approach at the design stage, so that it can produce games that have educational values. Basically, it defines this by integrating curriculum-related learning into the game [6].

This DGBL-ID consists of analysis, design, development, quality assurance, and implementation and evaluation. The instructional design diagram of the Digital Game Based Learning developed by Zin, N.A.M., Jaafar, A. Yue, W.S can be seen in Figure 2 below [11]:

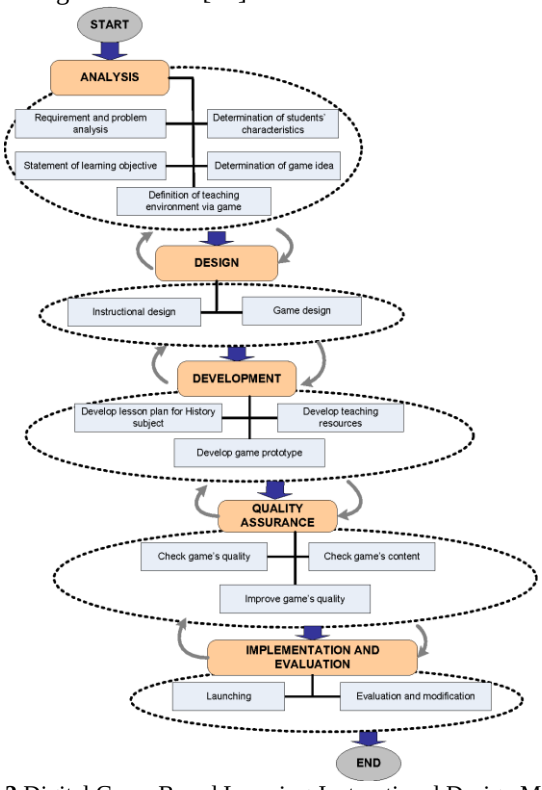

Fig. 2 Digital Game Based Learning-Instructional Design Model

3.1 Games and Learning

The analysis stage includes the process of determining learning objectives, learning analysis as well as problems and needs analysis. Problems faced by students in learning. Characteristics such as learning styles and learners' knowledge were also analyzed. Determination of the knowledge that is entered into the game is also determined at this stage. The type of platform (such as television, computer, or mobile phone) and the features of the game are also analyzed. The strengths and weaknesses of games are also a consideration in

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developing educational games. There are 5 aspects that need to be analyzed in making educational games, namely:

a. Determine needs
b. Problem Analysis
c. Determine the character of students
d. Determine learning objectives
e. Determine the game idea

3.2 Design

Teaching methods and strategies used in educational games are determined at this stage so that the design results can help to achieve learning outcomes. Inquiry, narrative and problem solving are teaching strategies used in the development of educational games. Making story boards and determining multimedia elements in games are also activities that must be done at this design stage

3.3 Development

At this stage of development, a prototype has begun to be made considering the various techniques and types of technology available. This type of technology can be in the form of software that supports game development. Choosing the right game engine can also be an alternative to save time and simplify development during this development stage. There are 3 forms of development in educational games, namely: development of learning plans, development of learning resources and development of game prototypes

3.4 Quality Assurance

In this stage of quality assurance, the results of the developed prototype will be tested in various forms and stages of testing. This test aims to make the game avoid various forms of bugs, and to measure how well the game is to be played. In quality testing, there are 3 stages that must be done, namely: Testing the quality of the game, Testing the content of learning material in the game (material testing) and Improving the quality of the game

3.5 Implementation and Evaluation

At this stage, educational games will be played by students and tested by them in terms of effectiveness and usability. The test results will be evaluated to improve the game. In this phase there are 2 stages that must be done by the developer, namely: Launching or the stage where the game is tested on target users, Evaliation and modification or a stage where users provide feedback on trial results for better game development.

4. Result and Discussion

4.1 Analysis

a. Requirment And Problem Analysis

This game was created as a creative, innovative and educational learning medium aimed at learning adults, especially students, to be more interested and motivated. As well as making learning media that can be accessed or used outside the learning process.

b. Determination Of Stude Characteristic

In this study, the authors emphasized learning for students. By applying concepts and effective learning approaches to adult learning subjects

c. Statement Of Learning Objective

This game will be applied to the game & animation concentration course, so that it has relevance to the existing material. Thus through this gamifkasi the goals achieved can be referred to from the learning achievements of graduates in the subjects in that concentration.

d. Determination of Game Idea

This game is centered on the accuracy and decision making of players against the obstacles that exist in the game. The player must travel and pass obstacles and answer the questions that appear correctly until the end before the predetermined time and life are up. At the end of the game, players will get rewards and scores, and can continue to the next level.

e. Defenition Of Teaching environment via game

This game adapts to technological developments in the era of the industrial revolution 4.0, where Android smartphones are the game platforms that will be used to run this game. This is in addition to technological development factors as well as factors that are more efficient than hardware devices PC platform (personal computer) or laptop and Windows operating system and other operating systems.

4.2 Design

The design stage is carried out to determine what design is needed for make games based on the DGBL-ID method

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a. Instructional Design

General instructional objectives, after playing this game, it is hoped that the user will be able to understand the materials applied in the game. While specific instructional objectives, learning plans for the Game Production and Prototyping courses in Table 1 are as follows:

Table 1
Instructional design objectives

Competency standards
Understand and implement pipelane game production Basic competencies 1. Knowing game production and prototyping 2. Knowing the stages of having idea and shaping the idea 3. Understand the structure of the Asset and level design Indicator 1. Can design pre-production, production and post-production of a game 2. Can Arrange Style, Plot, Settings, Character and Theme in the game 3. Can arrange the environment in the game

b. Game Design

In this game, system design is done by describing a process flow or navigation structure in order to see how the workflow of the system starts when the system is run until the system stops running. Here is the navigation structure in this game:

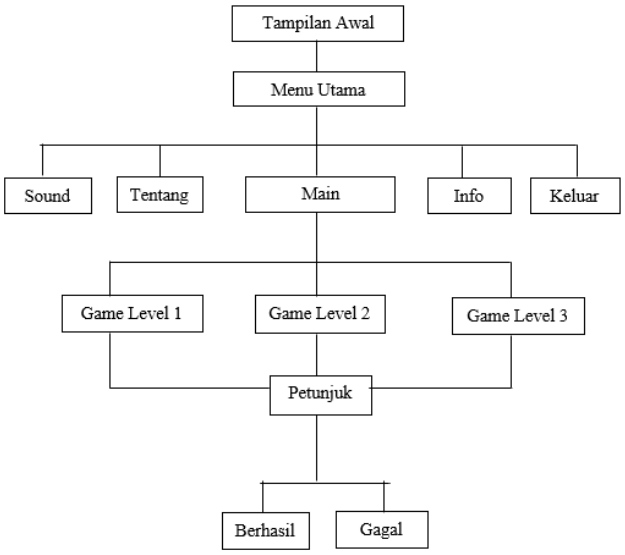

Fig. 3 Navigation Structure

4.3 Development

a. Develop lesson plan for History subject

Users in this game can move from the left side to the right side of the screen and from the bottom side to the top to reach a predetermined target or location. In this game, the user must walk through the existing challenge, so that the user can continue to the next level

b. Develop teaching resources

Making resources using graphics and animation processing software. The software used for game design is Adobe Animate, Adobe Audition, Adobe Illustrator and the ActionScript 3.0 programming language.

c. Develop the game prototype

In this game has 3 game levels, and each level has a different difficulty level, from easy to very difficult levels. Each level has a different challenge and material. Each challenge completed by the player, in order to continue to the next level. In this game the player must complete the game up to 3 levels, where the player must start from level 1 to level 3. Level 2 and later will be locked, and can only be played

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after the player completes level 1. The following shows the game design in Figure 4, Figure 5 and Figure 6

Fig 4. Game menu

Fig 5 Game level

Fig 6. Gameplay

4.3 Quality Assurance

a. Check game quality

To check the quality of a game, it is necessary to test the content and quality of the game. In this research, testing will be carried out using the blackbox method, blackbox testing focuses on the functional requirements of the software. This test is carried out by a third party with the following tests and results in Table 1.

Table 2.
Blackbox Testing

Pengujian	Detail Pengujian	Hasil yang diharapkan	Hasil Pengujian
Menu Utama	Memilih tombol *sound*	Mengaktifkan/Menonaktifkan *sound*	Berhasil
	Memilih tombol tentang	Menampilkan halaman tentang	Berhasil
	Memilih tombol info	Menampilkan halaman info	Berhasil
	Memilih tombol keluar	Keluar dari *Game*	Berhasil
	Memilih tombol *play*	Menampilkan halaman menu memilih *level*	Berhasil

Pengujian	Detail Pengujian	Hasil yang diharapkan	Hasil Pengujian
Menu Tentang	Memilih tombol *back*	Menampilkan halaman menu tentang	Berhasil
Menu Info	Memilih tombol *back*	Menampilkan halaman menu info	Berhasil
Menu *Level*	Memilih tombol main	Menampilkan halaman menu memilih *level game*	Berhasil
Menu Intro	Memilih tombol *level* 1 / *level* 2 / *level* 3	Menampilkan halaman intro petunjuk *game*	Berhasil

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Menu	Memilih tombol *left*	Karakter berjalan ke kiri	Berhasil
Level 1	Memilih tombol *right*	Karakter berjalan ke kanan	Berhasil
Level 2	Memilih tombol *jump*	Karakter melompat ke atas	Berhasil
Level 3	Memilih tombol shoot	Karakter menembak	Berhasil

b. Check Game's Content

Done to find out the educational content in the game whether it has an impact on the user, if the game is expected to lead the user to learn to eat this game must be able to show this and also this educational game is able to attract the user's attention. This test will be done by testing betha. Beta testing is a test that is carried out objectively, where direct testing involves game application users directly using a questionnaire to the users of the game application being built. Tests were carried out on 20 student respondents and each respondent was given 5 questions to then make an assessment by selecting the 5 options that had been provided for each statement. The following is a list of questionnaire questions given to respondents:

Table 3.
aspects of the statement

No.	Aspek-aspek	Penilaian			
		SS	S	TS	STS
1.	Tampilan *Game* menarik				
2.	*Game* ini mudah dioperasikan				
3.	Materi yang ditampilkan *game* sudah sesuai				
4.	Senang dalam bermain *game* ini				
5.	*Game* sudah layak digunakan				

After calculating the Index formula, a score interpretation criteria based on the interval (distance) is needed. The formula for the interval in percentage form is as follows:

I = 100 / Total Score (Likert)

Then I = 100/4 = 25

So that the resulting interval of 25 (This is the interval (distance) from the lowest 0% to the highest 100%)

The following is the interpretation of the score based on the interval (distance):

1) 0% - 24.99% = Strongly Disagree
2) 25% - 49.99% = Disagree
3) 50% - 74.99% = Agree
4) 75% - 100% = Strongly Agree

Table 4.
Final Test Results

Aspects	Index	Category
1	85.93 %	Strongly Agree
2	87.5 %	Strongly Agree
3	93.75 %	Strongly Agree
4	87.5 %	Strongly Agree
5	85.93%	Strongly Agree

Table 4 shows the final results of Game testing, the average Index formula can be taken as follows:

(85.93% + 87.5% + 93.75% + 87.5% + 85.93%) / 5 = 88.12%

So the average index formula of the respondents is 88.12%, so it is categorized as strongly agree.

c. Import Game's Quality

In this GDBL-ID method, the game must be tested before the game is published. After that, the game will be evaluated both for its usability and effectiveness.

d. Implementation and Evaluation

Basically, there are two stages of Implementation and Evaluation that need to be carried out, based on Figure 1, namely there is a launching and evaluation stage, but the researchers did not discuss launching because they only packed the application in .exe and .apk

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5. Conclusion

Based on the results of the research and discussion that has been compiled, the following conclusions can be drawn:

a. Game Based Learning Instructional Design (Dgbl-Id) has been made as a learning support medium
b. After going through the testing phase using the alpha test, this game shows the results according to the design. In the beta test, the average index formula is 88.12% with the category strongly agree, which means this game has the performance according to expectations and is suitable for use as a learning support medium.

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