DEVELOPMENT OF GAMIFICATION APPS TO ENHANCE CRITICAL THINKING AND CREATIVE THINKING

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Abstract

It is believed that gamification is one of the solutions to students' lack of critical and creative thinking skills. This study develops gamification applications to enhance their critical and creative thinking skills. The method used is a mixed method research method with an exploratory sequential design. The results showed that the gamification application prototype was successfully developed by first validating the material through experts with an average score of 81.8%, media validation by experts with an average score of 85.3%, responses to the use of teaching materials by students with an average score of 82.9%, and the response to the use of gamification teaching materials by lecturers with an average score of 81.7%. Based on the treatment that has been carried out in the experimental class, there is an effect of using gamification on students' critical and creative thinking skills.

Keywords: Creative thinking, Critical thinking, Gamification, Higher education.

1.Introduction

Every student has the same opportunity to have critical thinking skills. This means that someone who initially does not have critical thinking skills can have these skills with specific treatments. Lai [1] explains that critical thinking skills can be taught. Silva [2] adds that knowledge and thinking must be conducted simultaneously in practice. Meanwhile, Case [3] argues that implementing critical thinking in the classroom is by presenting challenging questions or assignments to reflect critically on curriculum content and skills. Furthermore, Pithers and Soden [4] add that critical thinking is taught in the teaching process by placing more emphasis on certain forms of reasoning according to the field of study and providing examples of how these forms of logic can be applied to both inside and outside the classroom. The same thing is also conveyed by Ennis [5] that critical thinking skills are obtained as a natural consequence of involvement with the subject matter. The field study results show that students of the class of 2019 have problems developing critical and creative thinking skills. Based on the results of interviews with lecturers of the History Education Study Program, it can be seen that most students do not have good critical and creative thinking skills. In addition, lecturers have not been maximal in developing teaching materials, so that innovation and creation are not so visible in learning activities.

One way that can be done to overcome the problem of critical and creative thinking is to use games and their elements in history learning in the classroom. Supriatna and Maulidah [6] explain that the essence of using games in education is a fun atmosphere. All learning methods must be directed at creating a happy atmosphere in learning or joyful learning. It is undeniable that in the 21st century, many students have never or like to play games, whether it's based on Android applications or websites. Conditions like this should be exploited by bringing fun and their elements into history learning, and this activity is called gamification. Gamification uses game elements in non-game activities [7].

Gamification is an attempt to apply game elements into the classroom to engage and motivate students [8]. Another thing explained by Kapp [9] is that gamification uses game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems. Gamification comes in various forms, and the most widely used are points, leaderboards, and medals [10].

Kam and Umar [11] added that Gamification uses game elements like storytelling, avatars, challenges, achievements, progression levels, rewards and leaderboards to enhance user interest and increase user participation in non-game environments. Media that can be used in the implementation of gamification include Kahoot!, Socrative, class dojo, class badges, class craft, ribbon hero, play brighter, goose chase, Minecraft: education edition, and others [12].

The results of the study support that gamification is the right solution to overcome the problems in this study, namely: gamification influences critical thinking [13, 14], gamification influences creative thinking [15, 16] and gamification influences critical and creative thinking [17, 18]. In order to fill in the research gap mentioned earlier, this study aims to develop gamification applications to improve students' critical and creative thinking skills.

2. Methods

The research method used in this study is a combination research method (mixed methods). The design used in this study is an exploratory sequential design [19]. This design was chosen according to the purpose of the research, namely developing teaching materials that can overcome the problems faced by prospective history teacher students in local history lectures. This method combines qualitative (phase 1) and quantitative (phase 2) research procedures. Creswell [20] explains that this design is a design in which the researcher starts by exploring qualitative data and analysis and then uses the findings in the second quantitative phase.

3. Results and Discussion

In this development stage, here are the features that exist in the gamification application (Table 1).

Table 1. Features in the gamification application.

No.	Feature	Description
1		This feature contains material for each level. Each user can study this material to further hone their skills in the material. In this feature, there are three types of material form pdf, video, and audio
2		This feature is a symbol to start the game. In this feature, three levels can be done by each user, but in group work. Beginning in Level 1 first, after completing it, can only work on to Level 2, and so on until Level 3.
3		This feature is developer information of this app.
4		This feature is a leader board or a list of scores that have completed the task for each level. Its presentation is made from the highest to the lowest value. For this list, only the name of the group leader is visible.
5		This feature is a setting to increase or decrease the sound in the application and exit the application.
6		This feature is a badge consisting of 4 descriptions, namely: Description: Badge (badge) is given to each user for each work. The badge as a gold mark means that the user can solve the problem in less than three minutes. The badge in the form of a silver sign indicates that the user can solve the problem in less than five minutes. The badge in the condition of a bronze mark means that the user can solve the problem in more than five minutes. The badge in the form of a dash indicates that the user has been working on the question for more than 6 minutes, and the system will automatically lock the question so that the user cannot do it. The existence of this badge can be used as a reference to be more focused and understand the material better.

The following is the user interface on the gamification menu displayed in the quiz application (Fig. 1).

Fig. 1. **User interface of the quiz application and display task/quiz.**

The use of gamification teaching materials was carried out on 72 students of history education at the Siliwangi University class of 2020 who were divided into experimental and control groups. The implementation of learning activities at this stage uses the zoom meeting media because there are still concerns about the spread of COVID-19. The experimental group consisted of 39 people, and the control group consisted of 33 people. The other sample consisted of 40 students of Galuh University history education class 2021 who were divided into experimental and control groups. The experimental group consisted of 20 people, and the control group consisted of 20 people.

The first stage begins by carrying out a pretest in the experimental class and control class which aims to determine the initial conditions of critical and creative thinking skills of students of history education before carrying out learning activities using the gamification. The pretest was conducted using a test instrument which consisted of 30 questions. The experimental class carried out learning activities using gamification teaching materials. At the same time, the control class uses PowerPoint teaching materials. After the learning activities were completed using the teaching materials, a posttest was carried out for each type with a test instrument. The results of students' critical and creative thinking in the form of pretest and posttest results in the experimental class and control class will be analysed using data analysis techniques assisted by the use of SPSS software.

The following is data on the critical thinking skills of historical education students at Siliwangi University, as many as 72 people and Galuh University, as many as 40 people. To test the average difference between two groups of data, it is

necessary to test the assumptions first, namely the Normality Test and Homogeneity Test, with the help of SPSS software, so that the selection of the type of test will be more precise. The statistical analysis below will be presented in the Independent Sample T-Test and N-gain Test.

The use of gamification teaching materials is carried out through a zoom meeting for fear of causing the spread of COVID-19. When carrying out learning activities, lecturers use game-based learning models. Tan et al. [21] explain that Game-Based Learning is a paradigm that utilizes games as a medium to convey learning content. GBL is all about harnessing the power of computer games to captivate and engage them in learning activities. Mz and Sy [22] add that Game-Based Learning is an application that uses the characteristics of video and computer games to create interesting and immersive learning experiences to deliver specific learning outcomes and experiences. Another thing explained by Pivec and Kearney [23] is that Game-Based Learning aims to address new ways of Information and Communication Technology-based instructional design while simultaneously providing learners with the possibility to acquire skills and competencies.

There are two main components in the Game-Based Learning model, namely 1) Pedagogical (psychological needs, critical thinking, exploration, challenge, involvement, competition, practice, goal setting, interaction, construction, motor skills, and motivation) and (2) Game Design (interface, simulation, feedback, literacy, communication, memory and outcome evaluation) [21]. Meanwhile, the main elements in Game-Based Learning consist of Design Specification (Story, Consequence, Rules and Interactivity) and Engagement (Emotional, Psychomotor and Intellectual) [24].

The challenge factor must be considered first in the game system component because it is usually related to teaching objectives. Certain game challenges result from teaching purposes, learning content, and testing players' knowledge and skills [25]. In this study, researchers used Game-Based Learning, which was used in this study based on Input Process Outcome from Garris et al. [26]. The input in the model is to design an instructional program that combines the game's characteristics. Instructional content here means the material prepared by the teacher in the game. This study's instructional content is the material for the local history. Game characteristics include quizzes, badges, levels, points, and leaderboards. Then in the process part, the game cycle works in three parts, namely 1) User assessment; when users start the game, they make subjective judgments about whether the game is fun, interesting, and involves students in its use. These judgments are usually represented by self-reports of interest and involvement, enjoyment, and feelings of mastery. The form of actualization is that students play games on the gamification application that has been provided. 2) User behaviour, formed from the initial and continuous game, determines subsequent behaviour's direction, intensity, and quality. Motivated learners will more easily choose to engage in target activities, pursue these activities more vigorously, and stay longer in these activities than less motivated learners, 3) System feedback. Provides an assessment of progress towards the desired goal. Encourage students to be motivated to focus on the given task.

The next debriefing stage is a review and analysis of events occurring in the game itself. Debriefing can include descriptions of events in the game, analysis of why they happened, and discussion of past experiences. This is the fundamental relationship

between the game experience and learning. For Learning Outcomes, it consists of three: 1) Psychomotor, discussing technical or motor skills, 2) Cognitive, covering critical and creative thinking skills 3). Affective refers to attitude.

The implementation that has been done states that the use of gamification can improve history education students' critical and creative thinking skills. This indicates that the learning process carried out by students is running effectively, meaning that the elements in gamification can construct their knowledge so that their critical and creative thinking skills increase. The theory that can be used in this regard is Kolb's Experiential Learning Theory that learning is a cognitive process that involves constant adaptation to and engagement with one's environment. Individuals create knowledge from experience, not just from instructions received. Conflicts, disagreements and differences drive the learning process as the learner moves between modes of action, reflection, feeling and thinking. Different learning styles reflect learning preferences that can change with the situation [27]. This theory has a fundamentally different view of the learning process than behavioral learning theory. This places life experience as a central and important part of the learning process, and knowledge is created through the transformation of experience [28].

Kolb, in his theory, integrates experience, perception, cognition, and behavior. Each learner must participate in these four modes to complete the learning cycle. The cycle is a continuous process that uses time from the past and builds knowledge for future experiences. Students usually start by participating in an understanding and then observe and reflect on the background. After reflection, learners should analyse their ideas and plans for the final mode, which requires testing their ideas. Each learner will differ in their ability to perform in each way, but adequate performance in each area is needed to complete the learning cycle.

4. Conclusion

The development of gamification teaching materials is carried out through several stages. The first stage is developing materials. The second stage is validating the material with a score of 81.8% and a very strong interpretation. The third stage is to realize the initial gamification design that has been made. The fourth step is validating gamification teaching materials to media experts with a score of 85.3% and a very strong interpretation. The fifth step conducted trials with students through zoom meetings and lecturers who teach local history courses at Siliwangi University and Galuh University three times. In the first experiment conducted on students via zoom, the average value of using gamification was 79.7%, experiment 2 was 83.3%, and experiment 3 was 85.7%. Based on these results, it can be concluded that the interpretation is strong in the first experiment, very strong interpretation in the second experiment and very strong interpretation in the third experiment. Furthermore, trials were conducted on local history lecturers for two tests, with the first experiment having an average value of using gamification of 78.8% and the second experiment 84.6%. Based on these results, it can be concluded that the interpretation is strong in the first experiment and very strong in the second experiment.

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