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Impact on Educational Effectiveness Using Digital Gamification

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ABSTRACT

The use of digital technology in education can help make the learning process more fun, interactive and effective. One form of applying digital technology in education is through gamification. In the era of increasingly advanced digital technology, the use of digital gamification in education is very interesting to note. Gamification is the process of adding game elements to non-gaming activities to increase motivation and interest. The purpose of this research is to evaluate the impact on the effectiveness of education using digital gamification. The methodology used is a case study at a university that uses gamification in learning. The results of the study show that the use of digital gamification in education has a positive impact on students' motivation and interest in learning, as well as increasing learning effectiveness. However, it should be noted that the implementation of gamification must be done properly so that it does not become a distractor and must be adapted to the material to be taught.

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1. INTRODUCTION

The application of game elements in non-play contexts, such as in social life, has become a trend in recent years. This concept is used to increase people's motivation, participation and involvement in various social activities. Gamification can be found in various aspects of social life, such as education, work, health, and the environment. Examples are the use of scores or points to motivate students in learning, the use of game elements to improve employee performance at work, or the use of game applications to help people monitor their health. However, keep in mind that gamification is not always positive. Poor or unethical use of gamification can lead to abuse and manipulation, as well as lead to addiction and unhealthy behavior. Therefore, it is important to consider the long-term effects of the use of gamification in social life and ensure that its use is carried out in a responsible and ethical manner [1]. An earlier study on students aged 7 to 16 in the UK revealed that the

majority of them regularly played home video games, whereas a more recent study that online gaming accounted for a large portion of Greek students' domestic internet use between the ages of 12 and 16 [2]. Gamification games do have a significant impact on life, especially in terms of motivation, engagement and participation in certain activities [3]. Challenge, fantasy, and curiosity are crucial game mechanics that increase player involvement [4]. The nature of gamification games requires changing students' cognitive capacity, especially related to their ability to solve problems and make decisions. In gamification games, students are faced with challenges or problems that they have to solve, and they have to make the right decisions within a limited time. To face these challenges, students need to use their cognitive capacities, such as memory skills, problem solving, and critical thinking skills. Gamification games can also develop students' cognitive capacities by providing structured and systematic exercises to hone these abilities. However, keep in mind that each individual has a different cognitive capacity. Some students may be better able to tackle more complex challenges, while others may need more help or practice. Therefore, it is important to consider the level of difficulty and complexity of gamification games so that they can adapt to students' cognitive capacities. In addition, excessive or inappropriate use of gamification games can negatively affect students' cognitive capacity. Relying too much on gamified play in learning or social activities can take away from deeper learning experiences or more real social interactions. Therefore, there needs to be the right balance between the use of gamification games and other learning methods or social activities to maximize students' potential [5]. However, Prensky (2003) describes "Digital Game-Based Learning" as combining game motivation with academic material (DGBL) [6].

Educational games can increase the effectiveness of learning academic subjects because they can make the learning process more interesting, interactive and fun for students. Educational games can provide a fun and refreshing learning experience, which can help motivate students to learn and develop their interest in the subject. In addition, educational games can help students to understand difficult concepts in a more effective way. In educational games, concepts can be presented in a more real context and can be applied directly to situations faced by students. This can help students understand these concepts better and apply them in everyday life [7].

The game design approach can be an effective way to direct the development of educational software. This is because the game design approach prioritizes a fun, interactive, and engaging user experience. In the context of building educational software, this can help increase student motivation and interest in learning [8]. Game design approaches can also help improve learning effectiveness. In educational software that uses a game design approach, learning materials are presented in a more attractive and easy-to-understand form for students. This can help students to better understand the learning material and make the learning process more effective [9].

In addition, a game design approach can help develop students' skills and abilities. In educational software that uses a game design approach, students can learn while playing and perform challenging tasks. This can help improve students' cognitive, social, and psychomotor skills [11].

However, keep in mind that a game design approach is only one way to guide the development of educational software. Effective educational software must integrate game design approaches with proven effective learning principles and support desired learning goals. In addition, it is also necessary to pay attention to the balance between the use of educational software with social interaction and a more in-depth learning experience [12]. The effectiveness of learning and, in some circumstances, the motivational effects of games designed expressly for educational purposes were the subject of numerous studies and projects. Several studies and projects looked at the learning effectiveness and, in some cases, the motivational impacts of games made specifically for educational purposes [13]. Gaming can increase students' enthusiasm and academic performance in math and science lessons for students in grades 4 through 8, according to the E-GEMS ('Electronic Games for Education in Math and Science').

2. LITERATURE REVIEW

In the study, two training initiatives for computer memory concepts were contrasted. The only distinction between the two programs was that one incorporated learning objectives and learning content through games, while the other did not [15]. Therefore, any variations in learning outcomes and student attractiveness between the two applications could be attributable to the game element [16]. The students who took part in the study were divided into two groups, with Group A using a gaming application and Group B using a non-gaming application (Group B) [17]. In order to investigate the impact of the type of application utilized (gaming, non-gaming), the study used a pretest/posttest experimental design, taking before and after measures of each group[18]. After the interventions were finished, students' opinions on several features of the application they had used were also solicited using a feedback questionnaire, and the impacts of application type on those opinions were investigated [19]. As a moderating factor, the gender of the students was used [20].

The study's hypotheses were developed using an overview of the research literature, and they are as follows:

I. When it comes to computer memory expertise, pupils in Group A would perform noticeably better than those in Group B.
II. When compared to the students in Group B, the students in Group A would have much higher favorable opinions of the application employed.
III. Boys in Group A would do much better than girls in terms of computer memory knowledge, whereas in Group B, the difference would not be statistically significant.
IV. Boys in Group A would have much more favorable opinions of the application than girls, however in Group B, the difference would not be statistically significant.

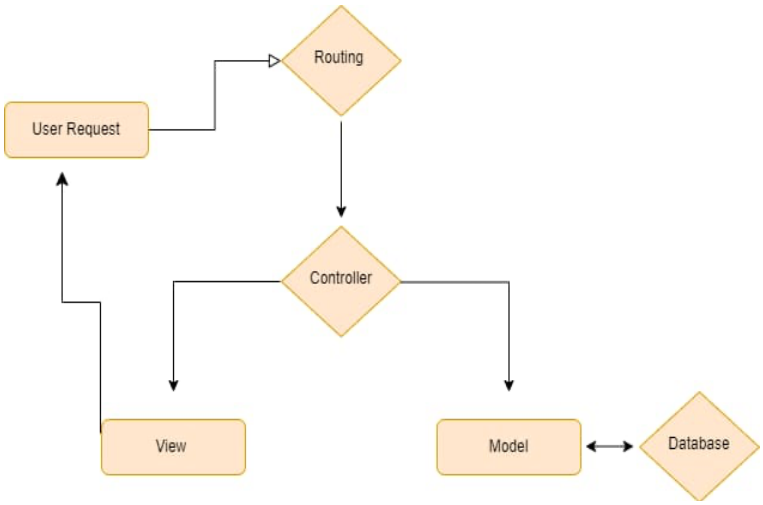

Figure 1. MVC Laravel

3. METHOD

Experimental research with a posttest-only control group design is a type of research that compares two groups, namely the control group and the treatment group. This research was conducted by giving treatment or intervention to the treatment group, while the control group was not given treatment or only given very minimal treatment. The posttest-only control group research design was carried out by collecting data after the intervention was given to the treatment group and the control group, then comparing the results obtained from the two groups. [21]. In this design, participants

are divided into two groups: a control group taught using traditional learning methods and an experimental group taught using digital gamification [22]. After the lesson is finished, the researcher will measure the learning achievement of the two groups with a test or quiz (post-test) [23]. The advantage of this design is that the researcher can evaluate the effectiveness of different learning methods by comparing the learning achievements between the two groups [24]. However, the weakness of this design is that it is difficult to control for other variables that can affect learning achievement, such as motivational factors or student background factors[25]. Therefore, the researcher needs to pay attention to these factors and take action to control them during the research implementation [26].

The questionnaire used is the Guttman scale. The Guttman scale consists of a series of statements or items arranged according to the level of agreement with a particular topic [27]. The statements are scored from 1 to N, where N is the total number of statements on the scale [28]. Each statement is considered stronger than the previous statement and only gets a higher score if the respondent agrees with the previous statement [29]. This Guttman scale can provide accurate and useful information in evaluating the effectiveness of digital gamification in increasing student motivation, understanding, enthusiasm, and self-confidence [30].

Tabel 1. Kriteria Angket Respon

No	Persentase	Kriteria
1	90%-100%	Sangat Baik
2	70%-89%	Baik
3	40%-69%	Cukup
4	20%-39%	Buruk
5	0%-19%	Buruk sekali

4. RESULTS AND DISCUSSION

The study of the student biographical information revealed that there were no statistically significant differences between the two intervention groups after the classes of students were randomly assigned to Group A and Group B. In particular, there was no discernible difference between the two groups in the percentage of boys and girls (v2 = 0.159, df = 1, p = 0.690). Additionally, there were no statistically significant differences between the students in Group A and Group B in the ANOVAs that evaluated the remaining biographical factors. The pertinent descriptive statistics are shown in Table 3.

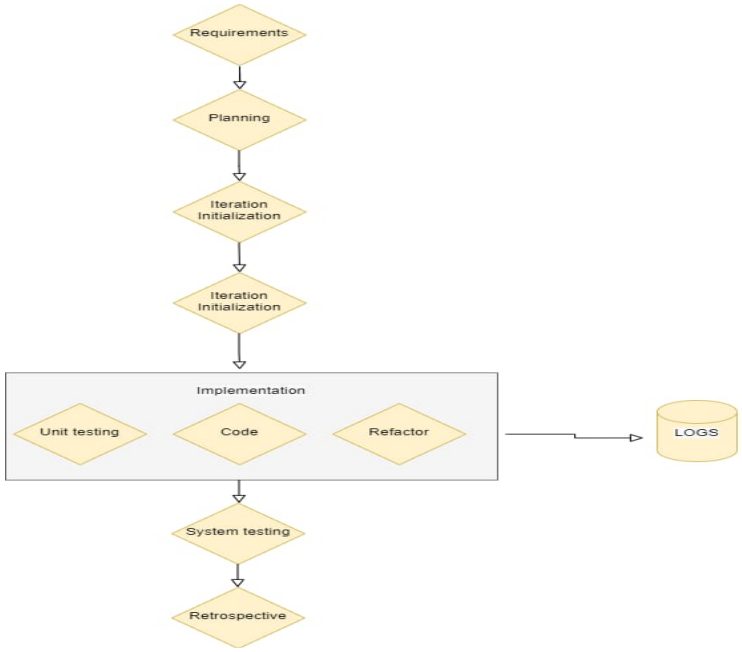

Figure 2. Personal Extreme Programming Stages

The kids in Group A appeared excited when they were told they would utilize a game for instruction, according to the unofficial data acquired from the researcher's observations. They displayed high levels of involvement in their attempt to maintain their number of lives, reach the termination flags, and obtain a high score during their interaction with the game. They appeared to be quite engrossed and interested in the activity. During the intervention, there was a fair amount of silence, but it was occasionally broken by students shouting their joy or disappointment when they encountered barriers or exclaiming their satisfaction or disappointment when they managed to collect a flag.

Only the dimension "accessibility of learning material and questions" showed a gender-significant main effect. In general, girls found it harder to deal with the topics and questions asked in the applications than did boys. This might be explained by the fact that girls initially know less about computer memory. However, no interaction effects that were statistically significant were discovered. Thus, the increased difficulty for the aforementioned girls was unrelated to the kind of application. Additionally, no discernible gender disparities were seen among the students in Groups A or B when it came to their opinions of the application's general appeal, usability, and educational usefulness. Therefore, hypothesis IV was not supported. The analysis of the second section of the feedback questionnaire showed that both groups of students were in favor of adopting the learning styles they had previously encountered, with Group A students finding their particular learning style to be more engaging, effective, active, and "relaxed" than those in Group B. As a girl in Group A put it, "It's more fun and energetic." Because you are focused on a particular objective, you never grow bored like in traditional instruction. To advance in the game, this makes it easier for you to remember information and comprehend concepts that are challenging.

Regarding the recommendations made by students for enhancing the programs they had used, the students in Group A were more critical of the applications they had used and also more demanding than the students in Group B. The former's suggestions focused mostly on the enhancement of the game's aesthetics (such as the use of 3D graphics), as well as the addition of sounds and music, a wider range of activities, and a more daring storyline (e.g. more objects to collect, more rooms, more rivals and competition). The students in Group A were undoubtedly more excited than those in Group B about their participation in the experiment, which was innovative within the context of the classroom

and was regarded as intriguing and educationally valuable for both groups. A boy from Group A described the event as "original and remarkable." I learnt a lot about computer memory and was thoroughly entertained. I wish I could play the game on my home computer as well.

5. CONCLUSION

This study compared a similar non-gaming application in the form of a website to a computer game geared at teaching computer memory topics taught within the Greek high school CS curriculum to determine which was more effective at motivating students to learn. The study also looked into any gender disparities in the game's ability to motivate players and aid in learning. The main conclusions and their ramifications are explained in the sentences that follow. The study showed that, in comparison to the non-gaming strategy, the DGBL technique was both more successful in enhancing students' knowledge of computer memory principles and more motivating for students. Thus, given that, as inferred from this study, educational computer games can significantly increase both knowledge of the embedded subject matter and student enjoyment, engagement, and interest in the learning process, it can be concluded that they can be utilized as learning environments within high school CS courses. These results appear to corroborate the findings of some earlier research as well as a more recent study on schoolchildren, which found that instructional computer games enhanced students' academic achievement and motivation in comparison to traditional instruction in subjects like math and science. However, given that in this study: (a) DGBL was not compared to traditional teaching, which students find boring (Prensky, 2003), but to another engaging form of ICT-based learning; and (b) the participants were not children, but rather adolescents, who are more difficult to engage in school learning and harder to motivate than children, the findings of the present study may be a stronger indicator in favor of DGBL (e.g. Eccles & Midgley, 1989). Additionally, they propose that DGBL can be useful in a range of subjects that are covered in scholastic CS curricula and that demand factual knowledge and conceptual understanding, such as the subject of computer memory. These subjects include computer programming, where games have previously been exploited in scholastic CS education.

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