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The Effectiveness of Educational Games on Post-Pandemic Learning

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Abstract

Learning through interactive media gives additional value to the educational world because it enables learners to represent themselves. Game-based learning promotes learners' creativity, critical thinking and cognitive skills related to technology use. Previous research discovered that game-based learning has a positive effect on learners. Therefore, in this research, an applied study was conducted on the use of the E-CrowdWar educational game with high school students. The purpose of this study was to determine the effectiveness of using games in learning to improve student learning outcomes. The study was conducted with 100 high school students in Blitar and 100 in Kediri. E-CrowdWar was used during the classroom activities along with in-class learning. An independent sample t-test was used to measure the effectiveness of game-based learning. The integration of games into online learning had a significantly positive effect on student learning outcomes. The pre-test results showed that the average student learning outcome score in both cities was the same, namely 65 points. After implementing game-based learning, student learning outcomes in Kediri increased to 90.74 points and in Blitar to 86.95 points. The study discovered that game-based learning through E-CrowdWar was effective in promoting the students' academic outcomes, although there were differences in the mean score. Based on the results, game-based learning provides tremendous improvements in learning outcomes and so should be applied, especially in the economic field.

Keywords: Gamification, Education, Learning Result

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1. Introduction

During the 21st century, disruptive learning has become a phenomenon in the educational world. Many learning innovations related to technology have emerged and interactive game is one of those. According to research [1], the learning process could happen well when someone is happy and not stressed. Game in learning promotes the learners to take risks and this faculty is acknowledged as a normative value by modern pedagogy [2]. Game-based learning offers positive features and experiences

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and both could go along well if conducted with game simulation beforehand with popular approaches [3], [4].

Interactive media learning gives additional values to the educational world as it enables the learners to represent themselves. Game-based learning promotes the learners' creativity and their critical thinking related to technology use [5]. The utilization of mobile learning covers from the inquiry model to the use of the mobile game in the learning process [6], [7] that could offer learning experiences and develop learners' cognitive skills better compared to the conventional learning [3].

Teacher is the most critical component of learning that holds crucial roles. They are demanded to possess various skills so they could create learning innovations [8], [9]. The teacher has to be prepared to provide feedback to the students regarding the effective ways of learning, one of which is learning through the game [10]. Since 1950, game-based education has been acknowledged as a learning instruction in various scientific fields from international relations to the social work department [11].

From the description above, it could be concluded that game-based learning gives positive effect on both students and teachers. Therefore, the researcher wanted to conduct a study on the effectiveness of E-CrowdWar educational game at the high school level to measure the teachers' level of readiness to face the era of disruptive learning.

2. Literature Review

2.1. Educational Competencies

The 21st century people are demanded to possess better capacities than the previous generation. This century has revolutionized many aspects of life, one of those is education [8]. The competencies of the students and teachers are critically required during this century as stated by the theory that the convergence of individual competencies is shaped from the synthesis of their self-potentials and surroundings [12]. Determining the roles of educational content also need a thorough reflection, from the knowledge of the content itself, the curricular, and pedagogy [13].

Each human of the 21st century is required to be a tech-savvy that could utilize technology to learn. According to a study [8], 21st schools should be based on digital technology and they need to apply it for learning. Next, another study [12] explained that the teachers should own IT competencies and employ those skills in every phase of the teaching and learning process, from planning to the assessment. For instance,

during developing the test, the teachers need to create some innovations involving technology that would assist the assessment process [14].

The 21st century educational mastery is supported by technology in learning and education. Technology as a learning innovation is meant to develop education and to help minimize the skills gap. The applications of technology in education, among others, are:

- To discover creative solutions to overcome basic challenges in education;
- To make education available for the public with lower costs or to provide better education with similar costs;
- To provide a tool for the learners to learn knowledge real-time by utilizing the better variance, volume, and speed of data transfer; and
- To increase the teachers' productivity as it could help the distribution of assignments and examinations with such flexibility that might suit the learners' differences in competencies and characteristics.

Besides, technology in education could assist the development of 21st century skills, such as communication, creativity, persistence, and collaboration.

2.1.1. Game-Based Learning

Learning with technology and the internet covers a broader area than the conventional learning. The integration of technology in learning is deemed critical to achieve the learning objectives [15]. An example of the application of technology in learning is the use of the smartphone as a tool for media of inquiry in higher education. It is currently acknowledged that the use of smartphone creates dynamic learning as the learners could utilize it to interact and collaborate with various sources and partners all around the globe [16], [17], [3]. Smartphone as learning media has various dimensions. To create fun learning, the smartphone could be used to apply game-based learning. In this sense, a study [3] has proven that game-based learning served better learning experience than the conventional ones. Another similar study [7] discovered that the use of game-based learning could provide a better learning experience when collaborated with learning instruction that guided the students. However, the application of game-based learning needs to suit the existing methods so there would be compatibility between the game and the lesson [18].

A study [2] noted that the concepts and designs of the game could promote the learners' critical thinking since in a game, they are allowed to fail, could have instant

feedback, could see their development, and also could enjoy the story. Research [4] explained that learning through the game would benefit the learners as they could have instructional and metacognitive supports that would not burden their cognitive capacity. It is explained further [19] that virtual learning could also promote the students' learning capacity and the competitive atmosphere among them since they would spend their time more on studying. Based on a study [3], game-based learning could evaluate and train the learners' skills and competencies. Therefore, this study would examine the relationship between educational competencies and technological knowledge.

3. Methods

E-CrowdWar was applied in the classrooms at two schools in Kediri and Blitar. SMAN 3 Blitar and SMAN 1 Kediri were the samples of the research. Those two cities were chosen with consideration of cellular signal coverage. The topography of Kediri is quite flat, therefore it has good signal coverage. On the other hand, Blitar has various ground level that makes its signal coverage worse than Kediri's. To measure the effectiveness of game-based learning, the researcher would apply a quasi-experimental design and employ independent sample t-test to compare the learning outcomes of the students as described by the graphic below.

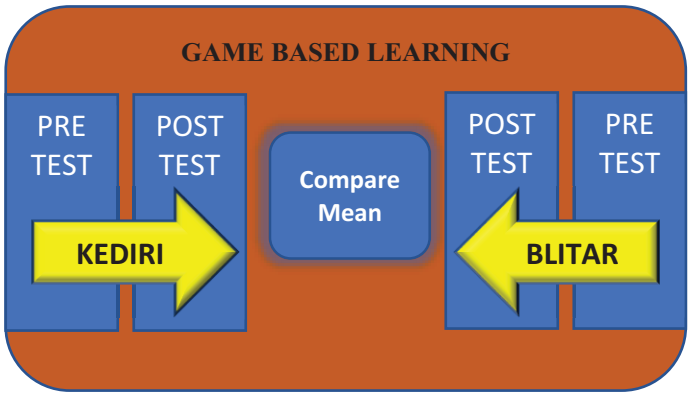

Figure 1: The Research Conceptual Framework

To analyze the differences between the mean scores of the economics subject between the students in Blitar and Kediri after being treated with game-based learning, the researcher applied independent sample t-test with a hypothesis as follows:

1. H_0 = There is no difference in the mean scores between Group A and B.
2. H_1 = There is a difference in the mean scores between Group A and B.

4. Result and Discussion

Based on the data analysis, it could be described that the mean score of the Kediri students before the application of game-based learning was 65.67, the highest score was 91 and the lowest was 20 with a standard deviation of 17.64. After the treatment, the mean score was raised to 90.74 with a minimum score of 70 and a maximum score of 100. The standard deviation was decreased to 7.06.

Table 1: The description of learning results the students in Kediri

Group	*Mean*	*N*	*Mode*	*Min*	*Max*	*Std. Deviation*
Pre Test	65.67	100	80	20	91	17.64
Post Test	90.74	100	100	70	100	7.06

On the second phase observation, the researcher found some findings as shown in table 2. Before the treatment, the mean score of the students in Blitar was 65.97, the lowest score was 3 and the highest one was 87 with a standard deviation of 17.11. This condition was very similar to that of the students in Kediri.

Table 2: The description of learning results the students in Blitar

Group	*Mean*	*N*	*Mode*	*Min*	*Max*	*Std. Deviation*
Pre Test	65.97	100	75	3	87	17.11
Post Test	86.95	100	90	35	100	9.25

After the implementation of game-based learning, the mean score was raised significantly to 86.95 with a minimum score of 35 and a maximum score of 100 while the standard deviation was 9.25.

Based on the data gained from Kediri and Blitar that showed a significant raise, it could be concluded that game-based had positive effect on the learning process during the pandemic. This finding is quite interesting for further discussion, especially in the matter of the effectiveness of game-based learning.

Table 3: Independent sample t-test

Variable	*Equal variances assumed*	*Levene's Test*	
Post-test		F	86.95
		Sig.	0.627
		t	-3.256
		Sig. (2-tailed)	0.001
		Mean Difference	-3.79

From the analysis, it was found that the significant value of Levene's test for equality of variance was 0.627 > 0.05, therefore the data variance in Kediri and Blitar was homogeneous or similar. The result of equal variances assumed showed that the value of sig. (2-tailed) was 0.001 <0/05. From that data, it could be concluded that the hypothesis (Ha) that there is a significant difference in the mean score between the students of Kediri and Blitar was accepted. Meanwhile, the difference in the mean score between the students of two cities was -3.79. The students in Kediri scored higher.

5. Conclusion

In this post-pandemic era, any learning method that adapts the online learning system is the key point that would be very helpful for the students to master the lesson. Game-based learning is a learning method that is adopted based on the interests of today's students. They concentrate more on online games because they are considered more fun than classical learning. We cannot deny that our learning in this post-pandemic era is very monotonous. We need to remember that learning outcomes do not necessarily indicate students 'cognitive abilities but also show students' interest in the learning we provide. No matter how difficult the learning material is, if the students' interest and motivation have been formed, the cognitive outcomes will increase. Based on the data gained from two cities, it could be concluded that game-based learning that integrates games into online learning gave significant positive effects on the students learning outcomes, the limitations of this study tend to observe student learning outcomes, not yet specifically measuring the interest and motivation students towards game-based learning. with these limitations, hopefully it can provide opportunities for further research.

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