ICT-Based Gamification Application: Supporting the Implementation of Team Games Tournament Cooperative Learning Model to Improve Students' Learning Outcomes

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ABSTRACT

This research aims to improve students' learning outcomes through the implementation of the Team Games Tournament (TGT) cooperative learning model complemented with ICT-based gamification applications. This research is an experimental research that involved students from class VIII at a junior high school in Ternate city. Students' learning outcome data were collected through multiple-choice test instruments. The results showed that the use of the Wordwall gamification application in the TGT cooperative learning model was significantly more effective to improve students' learning outcomes compared to conventional learning. This research implies that ICT-based gamification applications can be used as a complement to teaching materials. Moreover, the variety of game types utilized contributes to increased student engagement in the learning process.

Keywords: ICT-based gamification applications, Team Games Tournament, Learning outcomes

ABSTRAK

Penelitian ini bertujuan untuk meningkatkan hasil belajar siswa melalui penerapan model pembelajaran kooperatif tipe Team Games Tournament (TGT) berbantuan aplikasi gamifikasi berbasis ICT. Penelitian eksperimen ini melibatkan siswa-siswa kelas VIII pada salah satu Sekolah Menengah Pertama di kota Ternate. Data hasil belajar siswa dikumpulkan melalui instrumen tes berbentuk pilihan ganda. Aplikasi gamifikasi berhasil dirancang dengan menggunakan aplikasi berbasis web yaitu Wordwall dalam bentuk crossword, gameshow quiz, maze chase dan whack-a-mole. Hasil penelitian menunjukkan bahwa penggunaan aplikasi gamifikasi Wordwall pada pembelajaran kooperatif TGT secara signifikan lebih dapat meningkatkan hasil belajar siswa dibandingkan dengan pembelajaran konvensional. Penelitian ini berimplikasi bahwa aplikasi gamifikasi berbasis ICT dapat digunakan sebagai komplemen bahan ajar pada pembelajaran fisika. Selain itu adanya variasi jenis game yang digunakan berimplikasi pada peningkatan keterlibatan siswa dalam pembelajaran yang dilaksanakan.

Kata Kunci: Aplikasi gamifikasi berbasis ICT, Team Games Tournament, Hasil belajar

INTRODUCTION

Games are widely regarded as one of the most engaging and motivating activities, particularly for children and young people (Bang et al., 2023). They offer opportunities for individuals to contemplate and understand complex problems, as well as to develop innovative approaches to explore them (Ilten-Gee & Hilliard, 2021). In this context, games with educational objectives and learning-related content are considered to have significant potential to make the learning process more enjoyable, engaging, and effective (Saprudin et al., 2019; Bang et al., 2023; Tsai et al., 2020; Saprudin et al., 2023). Moreover, games strongly motivate students' engagement in learning and positively influence their emotional, social, and cognitive development. As a result, the increasing popularity and prevalence of games have sparked widespread and growing interest in integrating game elements with curriculum content to enhance contemporary learning for the 21st century (Sun et al., 2023). The incorporation of game design elements into non-game contexts is referred to as gamification (Deterding et al., 2011; Deterding, 2012). Various studies have shown that gamification in education can enhance student motivation, improve learning outcomes, and help develop 21st-century skills (Saprudin et al., 2019; Saprudin et al., 2020).

The advancement of 21st-century education has brought significant changes to the roles of both teachers and students in learning activities. Students are now required to be more active participants in the learning process, while teachers must adapt their teaching methods by implementing learning models aligned with 21st-century educational principles (Hendra & Rahayu, 2020). Additionally, students are expected to develop 4C skills namely critical thinking, problem-solving, communication, collaboration, as well as creativity and innovation—to meet the demands of 21st-century education (Jayadi et al., 2020). One essential component of the 4C skills is collaboration. The collaboration involves joint participation in a coordinated effort to solve problems collectively (Ambara et al., 2019; Mahendra et al., 2018),

Based on the results of observations conducted at one of the junior high schools in Ternate City, it was found that few teachers applied interactive learning models in the teaching and learning process. This finding is supported by interviews with students, which revealed that teachers predominantly used lecture-based methods. Opportunities for discussion or collaboration among students were also rarely provided. Data from the mid-semester science (physics) test scores of eighth-grade students in the research population showed that 42% of students had not yet met the minimum mastery criteria (KKM). Several students with scores below the KKM stated that they did not enjoy science (physics) lessons because they found them too boring. Under such conditions, learning does not foster the development of 4C skills, which are essential components of 21st-century education. This situation can significantly impact the teaching and learning process and ultimately affect student learning outcomes.

Other studies suggest that conventional learning is no longer considered effective, as it places too much emphasis on the teacher as the primary source of knowledge transfer (Raharjo & Kristin, 2019). If this condition is allowed to persist, it may lead to a decline in student activity and creativity. In fact, science learning should foster students' scientific attitudes toward scientific concepts to support their activities and creativity (Gathong & Chamrat, 2019; Rositayani & Abadi, 2019). Therefore, careful consideration is needed when selecting a learning method or model that aligns with the needs of the times and captures students' interest. Several factors should be taken into account when choosing a teaching method, including its suitability for learning objectives, individual student differences, teacher competencies, the subject matter, classroom conditions, available facilities, and others (Suswanto, 2020). The cooperative learning

model, a form of group-based learning, is one of the modern learning models that can be utilized by teachers. Experts highly recommend the use of cooperative learning models, as they offer several advantages over conventional methods (Lestari & Widayati, 2022). Specifically, cooperative learning can reduce students' dependence on teachers, encourage students to take greater responsibility for their own learning, improve academic achievement, and enhance student learning activities (Wati et al., 2018).

Successful learning can be achieved by selecting and applying appropriate learning models that facilitate knowledge absorption, actively engage students, reduce boredom, stimulate curiosity, and encourage skill development (Dewiyanti, 2018). A learning model refers to the approach used, encompassing learning objectives, stages of learning activities, the learning environment, and classroom management (Gunarta, 2019; Murdika, 2018). Learning models can enhance the quality of classroom instruction by promoting student collaboration with peers. In science education, the "Teams Games Tournament" (TGT) learning model is considered particularly appropriate. Educators are encouraged to implement learning models aligned with this concept to support student engagement and optimize their potential in achieving learning goals. This should be done in ways that maximize the quality of learning during instructional sessions. Through collaboration, students can develop cooperative attitudes, engage in group discussions, and actively participate in the learning process (Masrita, 2017).

Previous research on the TGT learning model has been conducted, showing that the application of TGT cooperative learning significantly affects physics learning outcomes (Wijaya et al., 2023; Turnip et al., 2023; Lestari et al., 2023). It has also been found to increase the significance of student learning (Parhusip et al., 2023), as well as enhance student motivation and generate positive responses toward learning (Abdillah et al., 2022). The TGT cooperative learning model has been proven to improve students' collaboration skills, as evidenced by the percentage of success achieved in cycle 2, which exceeded 60% (Dewi & Juwana, 2023). Additionally, the integration of online educational game media in TGT cooperative learning has been shown to increase interest and improve learning outcomes in history subjects (Sutriati et al., 2023).

Based on the description above, it is evident that the TGT learning model has proven effective in influencing several dependent variables, as measured by previous researchers. However, previous studies have largely overlooked the implementation of the TGT learning model in combination with ICT-based gamification applications, and none have specifically focused on physics subjects. This research aims to investigate the improvement in student learning outcomes when taught using the TGT learning model, assisted by gamification applications. The novelty of this research lies in the integration of various types of gamification applications within the TGT cooperative learning model and the provision of empirical evidence supporting its effectiveness in enhancing student learning outcomes.

METHODOLOGY

The experimental method used in this research involved three groups with different treatments, as shown in Table 1 (Sung & Hwang, 2013). This research involved 69 eighth grade students at a Junior High School in Ternate city. The students were divided into three groups: the experimental group (23 students), control group A (23 students), and control group B (23 students). Data on student learning outcomes were collected using a multiple-choice test instrument. The data were then analyzed using normalized gain (Hake, 1998) and inferential statistics.

Table 1. Experimental design

Group	Pretest	Treatment	Posttest
Experiment	T_1	TGT cooperative learning model assisted by gamification application	T_2
Control A	T_3	TGT cooperative learning model	T_4
Control B	T_5	Conventional learning	T_6

RESULTS AND DISCUSSION

Description of the Gamification Application

The gamification application was designed using the web-based platform Wordwall, which includes various activities such as crosswords, gameshow quizzes, maze chases, and whack-a-mole. Screenshots of the gamification application are shown in Figures 1, 2, 3, and 4. Wordwall is a web-based gamification tool designed with educational game principles. It can be accessed via both PC and mobile devices through the website https://wordwall.net/ without the need to download any additional applications (Dhika & Destiawati, 2022; Hidayah & Prasetyo, 2022; Hasanah et al., 2024).

The crossword is one of the templates provided by Wordwall. It is a game where players fill in empty boxes with letters according to the given clues (Permana & Kasriman, 2022). Typically, crosswords consist of questions with horizontal and vertical answers (Nurkhasanah et al., 2024). Crosswords make learning more effective and enjoyable, while also being easy for teachers to create and for students to use.
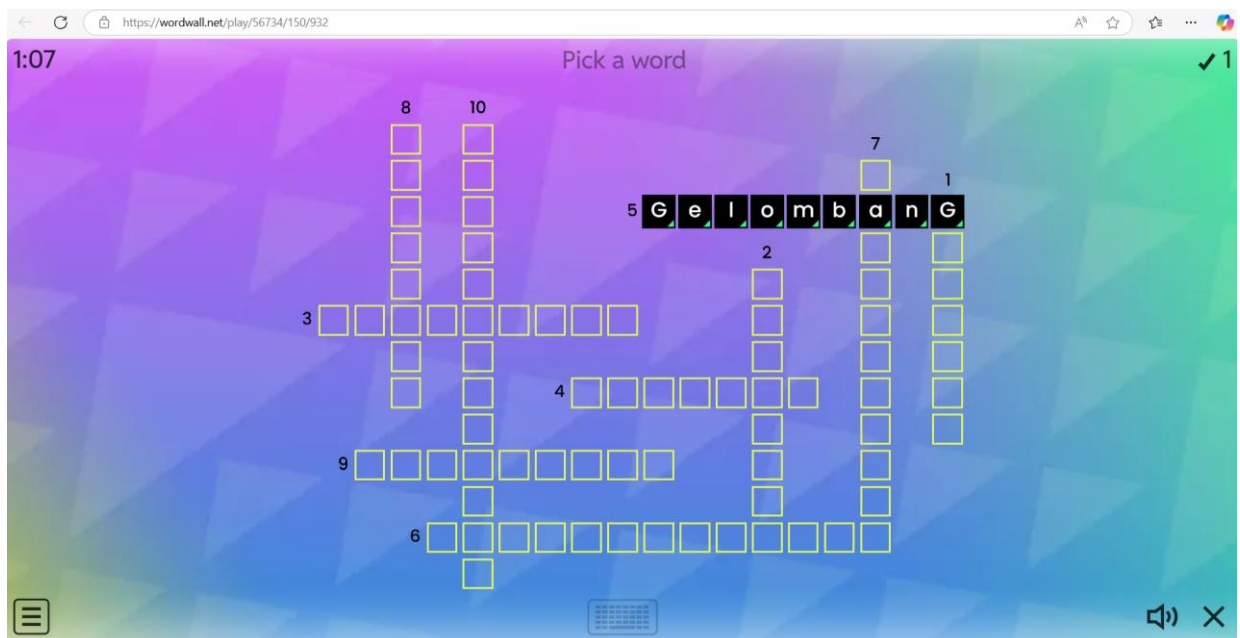

Figure 1. Wordwall crossword
https://wordwall.net/play/56734/150/932

Other game templates selected for this research and available on the Wordwall application include the gameshow quiz, maze chase, and whack-a-mole templates. Figure 2 displays the gameshow quiz, Figure 3 shows the maze chase template, and Figure 4 presents the whack-a-mole template.
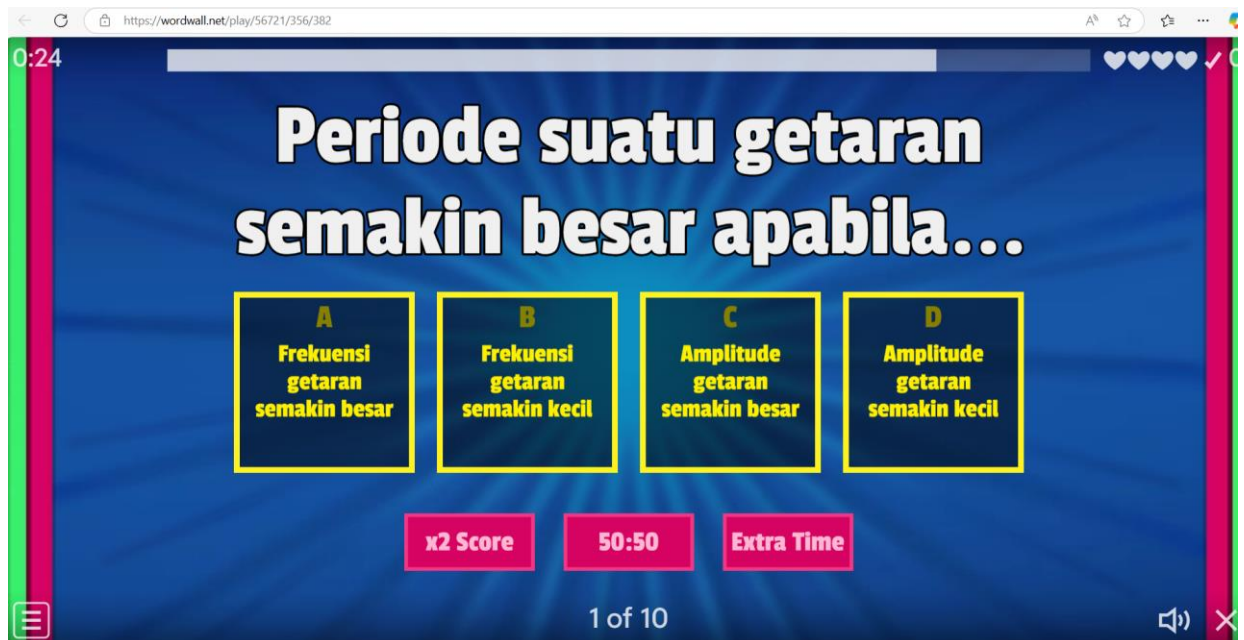

Figure 2. Wordwall gameshow-quiz
https:///wordwall.net/play/56721/356/382

Figure 3. Wordwall maze-chase
https://wordwall.net/play/56793/942/717

Figure 4. Wordwall whack-a-mole
https://wordwall.net/play/56792/490/713

Improving Students' Learning Outcomes

Improvement of students' learning outcomes in the experiment, control A, and control B groups was traced by calculating the average normalized gain, as shown in Figure 5. The improvement in students' learning outcomes in the experiment group was greater than in the control A and control B groups. The magnitude of the increase in students' learning outcomes in the experiment group was categorized as high, while in the control A and control B groups, it was categorized as medium.
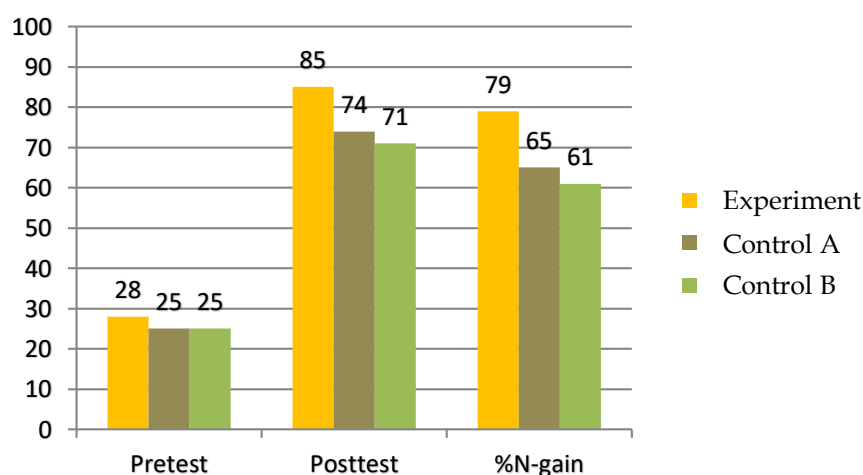

Figure 5. Students' learning outcome

Table 2 shows the results of the normality test, homogeneity test, and One-way ANOVA test. The data distribution in the three groups was normal and homogeneous. The results of the One-

way ANOVA test showed that there was a significant difference in the improvement of student learning outcomes among the three treatment groups. These results indicate that the application of the TGT cooperative learning model can improve students' learning outcomes. The improvement in students' learning outcomes increases with the use of ICT-based gamification applications in the implementation of the TGT cooperative learning model.

Table 2. Statistical analysis result of student learning outcomes

Description		Group		
		Experiment	Control A	Control B
Average $\langle g \rangle$		0.791	0.654	0.619
Standard deviation		0.091	0.159	0.124
One-Sample Kolmogorov-Smirnov test (*Sig.*)		0.886	0.921	0.435
Test of homogeneity of variances (*Sig.*)		0.080		
One-Way ANOVA (*Sig.*)		0.000		
Post-Hoc test (*Sig.*) (Scheffe)	• Exp. – Control A	0.002		
	• Exp. – Control B	0.000		
	• Control A – Control B	0.663		

The attractive and interactive features of the Wordwall application can stimulate students' enthusiasm and motivation in learning (Jannah & Syafryadin, 2022; Hidayaty et al., 2022). The use of this application not only provides a fun learning experience, but also allows students to complete teaching materials and learning assessments at school (Savira & Gunawan, 2022). The Wordwall gameshow-quiz application offers engaging and competitive challenges that can motivate students and positively impact their learning completion (Dewi et al., 2024). The Wordwall maze-chase application, integrated with digital textbooks, can enhance science literacy and improve student learning outcomes (Windari et al., 2023). This maze-chase application can also be designed as STEM-based learning media that aims to develop students' creative thinking skills (Fauziyati, 2023). The attractive and interactive design of the Wordwall maze-chase application can increase students' interest in learning (Nisa & Rohman, 2024). Similarly, the Wordwall whack-a-mole application can improve student learning outcomes when used in the classroom (Nailiyah & Istianah, 2023).

The use of appropriate and engaging media and models greatly influences the student learning process. Learning through the TGT cooperative learning model, assisted with ICT-based gamification application, does not solely focus on the material delivered by the teacher. Instead, students are actively engaged in the teaching and learning process alongside their group members. With the TGT cooperative learning model supported with ICT-based gamification application, learning becomes more enjoyable for students, as they are actively involved in the learning process.

CONCLUSION

The use of ICT-based gamification applications in the implementation of the TGT cooperative learning model can improve student learning outcomes. Student learning outcomes in groups that follow TGT cooperative learning assisted by gamification applications significantly increase compared to groups using cooperative learning without gamification applications or conventional learning methods. The results of this research highlight the importance of using ICT-based gamification applications to enhance learning effectiveness. Additionally, the variety of application types used can serve as a stimulus for student motivation and engagement in learning.

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