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Academic Achievement, Enthusiasm and Attitude of High School Students Regarding Quizizz as an Educational Gamification Tool for Physics

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ABSTRACT

Educational gamification is one example of game-based learning that has been applied in the teaching and learning process. Students can effectively practice their skills and connect lessons to real-life problems. However, there is still limited usage of gamification in teaching and learning in schools. The study's goals were to determine how well students performed in Physics when learning in traditional classrooms versus gamified classrooms, how excited the students were about learning Physics, how they felt about the experience, and whether they thought it was enjoyable to be in a gamified classroom. A quasi-experimental design was used to collect the data. 54 Form 4 students were in the treatment group, which took a game-based test, and the control group, which took a paper-and-pencil test. Only the experimental group received a set of questionnaires. The data from both results were recorded and analysed using SPSS version 25. The data obtained from the independent sample t-test concludes that students in the gamified classroom have a higher mean score (mean = 5.78) compared to traditional learning (mean = 4.63). A paired sample t-test on students' enthusiasm before and after using Quizizz showed that gamification significantly improved their enthusiasm, with a p-value less than 0.05. Additionally, it can be argued that Quizizz supports students' attitudes towards learning Physics, as 13 out of 15 questions had a p-value less than 0.05. Interestingly, there was no difference in mean attitude in using Quizizz in terms of gender, p-value = 0.196. The descriptive analysis reveals that the students in the treatment group had a positive perception of using Quizizz for Physics questions. Initially, most students selected strongly agree and agree. The findings suggest that the gamified test enhanced their performance, attitude, and enthusiasm and fostered a competitive learning environment.

Keywords: Academic achievement educational gamification Enthusiasm for learning physics Game-based learning Gamified classroom Traditional classroom

INTRODUCTION

Science education is one of the keys that can help our country align with the Industrial Revolution 4.0. Therefore, the Ministry of Education under the Malaysian Education Development Plan 2013 - 2025 aims to reach a 60:40 ratio of students in the pure science stream to those in social science or literature at both the

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secondary and higher education levels. This means that the science stream class will have 60% of students higher than the social science class, which consists of 40% of students in upper secondary and higher education levels (Saleh, 2014). Other than that, the Ministry of Education also takes the proactive step to encourage students' interest in science education by switching from the Kurikulum Bersepadu Sekolah Menengah (KBSM) to the Kurikulum Standard Sekolah Menengah (KSSM). Students are introduced to a variety of technologies through the most recent curriculum to satisfy future wants and demands. The learning process for students will become more engaging and meaningful, which influences the students to think critically and creatively.

However, only 19% of the roughly 44700 candidates who took the Pentaksiran Tingkatan Tiga (PT3) 2021 decided to enrol in the science stream class when entering form four (Salleh, 2022). The packages that are available for the pure science stream classes consist of biology, chemistry, and physics subjects. (Saleh, 2014) discovered that among the three subjects, 75% of Malaysian students think physics is a boring topic. (Alhassan Marifa et al., 2023) found that the teacher's instructional strategy failed to engage the students. In the 21st century, teachers could use technological elements to encourage students to learn pure science subjects, especially physics.

Background of Study

Teachers should implement technology-based learning to increase students' interest in the instruction they deliver. One example of technology-based learning is gamification, and there are a lot of gamification tools that can be used for education. Gamification in the teaching and learning process could promote engagement, encourage motivation to learn, lessen boredom, and get the student to think about the lesson's contents. Gamification in education is a student-centred strategy where the learner will be more independent, and the teacher will just serve as a guide for knowledge rather than a knowledge distributor. Teachers should select learning strategies that can successfully and actively engage students. With this method of instruction, students can make judgments using their imagination and critical thinking skills, and they can also gain new experiences while learning (McKnight et al., 2016).

Recently, the use of technology in teaching and learning has increased among teachers and school students during the pandemic of Covid-19. This is because all methods of learning that required face-to-face lessons have shifted completely, and online schooling was implemented due to the closure of all educational institutions worldwide. To make the online class have an impact on student performance, the teachers are advised to implement the technology as the instructional strategy. One of the educational technology tools used by the teacher is gamification, such as Kahoot, Quizizz, and Gimkit. (Aristana & Ardiana, 2021) found that gamification can boost learning motivation and that students enjoy learning using the gamification method during the outbreak.

Days after Malaysia entered the endemic phase, secondary school students nationwide started attending face-to-face classes without any rotation. There is an increasing number of students losing their willingness and interest in lessons, especially science ones. This is because the school rules do not allow the use of gadgets among the students. However, there are several Sekolah Berasrama Penuh in Malaysia that allow their students to bring tablets and laptops during the teaching and learning process. So, this study will look at how well Form 4 students at Sekolah Berasrama Penuh (SBP), a Fully Residential School in the Selangor area, do in school, how they feel about quizzes as a way to make learning physics more fun, and how they feel about using them in synchronous lessons.

Statement of Problem

Difficulties and students' learning performance in physics among science students in Malaysia have been the issue, and they have been somewhat less than satisfactory over the past years. In 2015, (Veloo et al., 2015) found that students in secondary schools, particularly those in rural regions, disliked physics and considered it a boring subject. (Saleh, 2014) discovered that the majority of students find the physics lessons they are required to take in class to be quite dull. At the same time, the students who were evaluated by the teacher using the gamified classroom had better performance compared to the students who had assessments through the traditional classroom (Legaki et al., 2021). This is due to the features available in the online educational classroom, such as the leaderboard, avatar, points, and badges, which increase the student's motivation to answer questions or complete assessments.

Besides, the performance of students in gamified classrooms is better than in traditional classrooms. Students learn critical thinking and decision-making skills through gamification in education, which they can apply in real-life situations. According to (Furió et al., 2014) the gamification education tool could effectively transmit knowledge among children in the short term. For example, the research result showed that the children who learnt using the game could remember the knowledge that was available in the game compared to the traditional classroom. This type of action recalls some topic contents and shows a positive attitude among the students towards learning physics in the gamified classroom.

Furthermore, students are less motivated to answer traditional assessments from teachers, especially in science subjects. Students in science subjects tend to lack motivation for answering tests in traditional classrooms, which can result in lower academic performance as well as involvement in their subject matter. There are two types of motivations, which are intrinsic and extrinsic. Intrinsically motivated students engage in educational activities driven by their curiosity and enjoyment. Extrinsic motivation, on the other hand, operates independently of the task itself and receives fuel from external pressure or reinforcement, like rewards or recognition. Even though both types of motivations are available in the traditional and gamified classroom, the gamification strategy is adaptable and may be used in a variety of learning materials that can boost students' motivation to learn and improve their class participation (Hong & Masood, 2014).

Objectives of The Study and Research Questions

The objectives of this study are:

1. To compare the students' academic achievement in learning Physics using traditional learning and gamified classrooms.
2. To determine the students' level of enthusiasm in learning physics among the secondary students toward the gamified classrooms.
3. To investigate the students' attitude in learning physics toward the gamified classrooms.
4. To determine students' perception of the gameful experience in the gamified classrooms.

Based on the research objective, the research questions are:

1. How is the students' academic achievement in learning physics using traditional learning and gamified classrooms?
2. How is the students' level of enthusiasm in learning physics among the secondary students toward the gamified classrooms?
3. Attitude: a. What are the students' attitudes towards learning physics in gamified classrooms?

b. How do students' attitudes toward gamified classrooms differ in terms of gender?

(iv) What are the students' perceptions of the gameful experience in the gamified classrooms?

LITERATURE REVIEW

Gamification as Attraction in The Learning Process

Various fields such as business, jobs, healthcare, and the environment have applied gamification over the past year (Larson, 2020). In 2013, Nah et al. found that marketers have utilized advergames to blend marketing into games to promote their products and services. For example, some businesses collaborate with third-party providers like Get Heroik to use gamification to motivate their employees to stay active. It was also applied to the education field worldwide (Faiella & Ricciardi, 2015). Gamification in education can be defined as using game design elements in a teaching and learning process.

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Researchers have attempted to explore the attraction of video games used for gamified classrooms. This is due to the game components, such as the points, badges, feedback, levels, rewards, and challenges used in educational games (Saleem et al., 2021). Besides, (Hamari & Koivisto, 2015) discovered that gamification in the context of education enables students to obtain immediate feedback on their classroom progress and acknowledge work completed. Other potential gamification structures also available include content unlocking, combat, boss fights, gifting, social graphs, missions, memes, and certifications (Hamari & Koivisto, 2020).

You can conduct gamification in education face-to-face in a computer lab at school or online at home. Gamification tools come in a variety of forms. Some of them can be accessed anytime, anywhere, and without the need to install any particular software because they are web-based or cloud services (Hamari & Koivisto, 2014). The most popular are Quizizz, Kahoot!, Flip Quiz, Duolingo, Ribbon Hero, ClassDojo, and Goalbook. The features available in the gamification made it more suitable to implement in education. In 2020, Jayalath and Esichaikul discovered that including game elements in an online learning environment makes it easier to accomplish learning objectives, motivates students, and encourages them to learn. It was also thought that gamification would get students more involved in the learning process by making it more fun. This would lead to more constructive, problem-based, and inquiry-based learning (Smiderle et al., 2020).

Quizizz as an Educational Gamification Tool

The features of Quizizz were studied by (Chaiyo & Nokham, 2017) which shows that Kahoot and Quizizz have a lot of advantages over Google Forms when utilized in the classroom. The researcher also indicates that the players can see questions and response alternatives on their displays, thus there is no need for a projector. Each student's question order is random, making it difficult for players to cheat when answering the test.

(Lim & Yunus, 2021) discovered how teachers perceive using Quizizz in the teaching and learning processes. They analysed the perspectives regarding effectiveness, feasibility, difficulty, how Quizizz motivates learners, and willingness to continue using it in the classroom. According to the findings, teachers strongly like Quizizz and how it is used in the classroom because it helps students learn and enhance their language and cognitive skills.

Due to the increasing number of users of gamification education tools, especially Quizizz and Kahoot, (Lestari, 2019) made a comparison between Quizizz and Kahoot based on their features. The researcher indicated and concluded that Quizizz implementation in the teaching and learning process increased student motivation to participate in the test. It is evident by their participation in the Quizizz test, in which they performed better than Kahoot. Some of Quizizz's features weren't in Kahoot, so it made testing more fun for students. Examples of these features include the avatar, power-up, leaderboard, and final answer. The third, Quizizz, allowed students to complete the test without any discussion because each question and each student's response were randomly assigned so students could not cheat on each other. The fourth was that using Quizizz made the classroom more enjoyable and increased student involvement in the topics learnt.

Academic Achievement in Gamified Classroom

Academic achievement is a person's performance and accomplishment in educational settings. Academic achievement can be evaluated at several stages of education, from elementary and secondary schooling to tertiary education and beyond. People frequently use academic success as an indicator to assess a student's skills, potential, and eligibility for jobs, scholarships, or further study. Generally, academic achievement refers to a measure of success or achievement gained by a person in a setting of academics. It includes a wide range of factors, such as grades, test scores, research findings, and overall achievement in the classroom (Drew, 2023).

In the 21st century, the use of technology and online education has all contributed to the continuous development of academic achievement. Technology is now a necessary component of education at every level, from elementary school to university. This integration involves using various resources and technologies, such as computers, tablets, interactive whiteboards, and instructional software. Academic achievement now depends more on digital literacy and the efficient use of technology in the classroom than on the traditional classroom.

All teaching approaches must be mastered by educators to achieve good academic achievement among the students.

(Yokoyama, 2019) research revealed that computer teaching games enhances the academic achievement of elementary school pupils. The findings of this research discovered that playing computer games helps children learn and participate more actively in class by increasing attention and concentration on reading and writing skills. Furthermore, this study's findings demonstrated that students who played computer games throughout the study were more motivated to learn than those who received traditional instruction. This result was in line with the researchers in (Trajkovik et al., 2018), who revealed that computer games can be used together with classroom instruction as a training tool.

Theoretical Framework of Attitude in Gamification

Attitude can be defined as a person's ability to react favorably or unfavorably toward an object, event, idea, or another person that they have learnt to possess (Sarmah & Puri, 2014). It can be either positive or negative, depending on the specific situation over time. For example, with time, attitudes can change and vary (Syyeda, 2016). On the side of education, once developed, a positive attitude can enhance students' learning. On the other side, a negative attitude prevents effective learning and subsequently has an impact on performance (Joseph, 2013).

ABC Theory

The Tripartite Model is one of the theories of attitude, or known as the ABC theory. The ABC theory of attitude consists of three components, which are Affective, Behavioural and Cognitive (ABC). The affective component is described as the feelings or emotions of the individual associated with the attitude object (Mensah et al., 2013). (Guy et al., 2015) found that behavioural related to intrinsic motivation in his study is related to both interest and the desire to learn mathematics. Hence, behavioural can be defined as a willingness to react in a particular way to an attitude object. Besides, the user's knowledge, comprehension, memory, and decision-making regarding the research item are all included in the cognitive component (Zhang & Zhang, 2020). It is what a person thinks or believes about the attitude object.

In this research, the ABC theory of attitude will be used as a theoretical framework to measure secondary school students' attitudes toward physics learning in gamified classrooms. This theory is also suitable to use as it contains three main components: affective, behavioural, and cognitive.

Theory of Plan Behaviour

The next theory related to attitudes is the Theory of Plan Behaviour (Ajzen, 1991). This theory is a helpful framework for exploring the connection between attitude and behaviour. (MacFarlane & Woolfson, 2013) found that attitudes, subjective norms, perceived behavioural control, and behavioural intentions regarding conduct should all be taken into account when attempting to predict certain behaviours. The theory of planned behaviour states that three different processes, which are attitude, subjective norm, and perceived behaviour control, are all necessary for the prediction of intention (Alzahrani et al., 2017)._In general, the Theory of Planned Behaviour explains that when a person perceives an activity as enjoyable and offers positive benefits, he or she receives support and encouragement from others who are already engaging in that behaviour and thus makes assumptions about his or her capacity to complete the task.

Level of Enthusiasm among High School Students

Enthusiasm also refers to motivation as a process that initiates, guides and maintains goal-orientated behaviours that cause us to act in order to obtain a desired outcome (Cherry, 2023). As a result, a person who is motivated by a powerful desire or passion will try something out and do it in the hopes of succeeding. Researchers have discovered that students with high or strong motivation have a more favourable view towards physics (Eryılmaz et al., 2011).

The findings of research by (Saleh, 2014) indicated that level of the motivation among secondary school students in learning Physics is at a moderately high level. Although it has been discovered that these students have a reasonably high willingness to learn physics, the majority of students thought studying it in class was dull, and they generally agreed that the subject's teaching strategies failed to hold their interest. From the level of motivation, the results of the research revealed that the most important factor that affects student motivation to learn physics is relationship, followed by stress, effort, value, interest, comprehension, and selection. The results indicate that there is no significant difference. Moreover, the findings also indicate that there is no discernible difference in the motivation of male and female pupils to study physics in schools. These results go against what (Murphy & Whitelegg, 2006) said, who said that around the age of 15, female students are less interested in Physics and tend not to take the Physics subject.

Students' Perspective on Gamified Classroom

Previous research has explored various aspects of students' perspectives toward gamification that are inserted in the teaching and learning process, such as enjoyment, motivation, and satisfaction. When learning through traditional approaches, pupils just focus on the exams rather than attempting to figure out the key concepts of the subject. (Jayasinghe & Dharmaratne, 2013) discovered that when learning through traditional approaches, pupils just focus on the exams rather than attempting to figure out the key concepts of the subject. According to the findings, students preferred to use gamified components and found it easier to comprehend the theories that they learnt. This is because the students prefer to learn the theory behind the topic right away using the gamification web learning tool.

Furthermore, researchers found that gamified homework positively impacted students' sense of autonomy and control over their education. (Tondello et al., 2019) found that the students are more eager to complete the given tasks, work at their own pace, and receive immediate feedback through the gamification learning tool. (Cheong et al., 2014) also found that a large number of participants are eager to use video games to learn. Students also prefer elements such as point systems, leaderboards, player profiles, teams, progress bars, and achievement badges to be useful in creating enjoyment for a game. Overall, students seem to favour the following aspects of a gamified learning system: social interaction, engagement, feedback, and increased learning. These seem to suggest that gamification is particularly suited to learning approaches such as social constructivism and that gamified systems or activities should have a strong focus on feedback.

Conceptual Framework

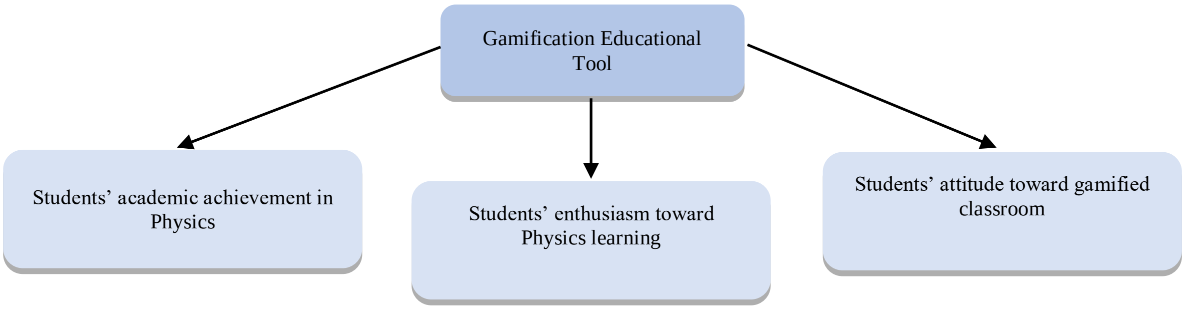

Figure 1 Conceptual Framework

Figure 1 depicts the conceptual framework for implementing gamification as an instructional tool. Quizizz is the treatment variable in this study, while the outcome variables are the students' physics academic achievement, their enthusiasm for learning, and students' attitudes towards the gamified classroom.

METHODOLOGY

Introduction

This research was conducted to know the students' academic achievement, enthusiasm, and attitude of high school students regarding Quizizz as an educational gamification tool for Physics. The research design was the main key to getting suitable data for the problems stated. We employed a quantitative approach and used quasi-experimental research to determine the results of this study. This research design was chosen due to its suitability to compare between two groups of students, the treatment and control groups, in terms of academic achievement, attitude, and enthusiasm. The suitable instruments, which are questionnaires and paper-pencil tests, were also determined by adopting and adapting the previous research that had similarities with this research.

Research Design

Research design is the plan for the gathering and analysis of data. Akhtar (2016) discovered that research design is a plan for the planned research project and may be thought of as the glue that holds all of the components of a research project together. Previous research has established the student's attitudes and motivation toward gamification in the classroom in several ways. We used experimental quantitative research, also known as quasi-experimental research. The quasi-experimental approach was suitable for this research as it allowed us to compare the students' performance, attitude, and level of motivation among the participants. The students from science classes were divided into two groups, which are the control group and the treatment group. The control group will not have access to Quizizz and will conduct their assessments in a traditional classroom setting. However, the students in the treatment group were briefed about Quizizz and needed to complete their assessment on Quizizz. In addition, both groups had the face-to-face teaching and learning session on the topic from Chapter 6 of Form 4, which is Light and Optics, before completing the assessment. After the assessment was completed, a questionnaire on perspective was given only to experimental groups to determine the students' perception of the gaming experience in the gamification assessment using Quizizz.

Population and Sampling

Target population

The target population for this study was boarding secondary schools in the Selangor area. This is because this boarding school allowed their students to bring tablets and laptops during the teaching and learning process. This research was conducted on upper secondary school students who take Physics as an elective subject.

Sample Size

The study's sample consisted of 54 Form 4 students from a public secondary school in Selangor. All Form 4 students enrolling in science stream were involved as participants. This is because Form 5 students prioritised finishing their syllabus and preparing early for Sijil Pelajaran Malaysia (SPM).

Instrument

Test

The test consists of the questions that relate to Chapter 6, Form 4, which is Light and Optics. The nature of the test is available on a paper-and-pencil test for the traditional classroom and online through Quizizz for the gamified classroom. Both the paper-pencil test and Quizizz consist of the same type of questions, which are multiple-choice questions. In total, the students answered 10 questions related to Chapter 6. The "Soalan Percubaan SPM 2022" and "Soalan Percubaan SPM 2021" were the sources of the instruments. This is because the tools help assess student performance in conventional and gamified classes.

Questionnaire

There are three sections in the questionnaire, which are:

(i) Section A: Attitude

(ii) Section B: Enthusiasm

(iii) Section C: Students' perspectives Quizizz as an educational gamification tool for physics

Section A consisted of three sections and had the same question number for each section. This is a result of the research measuring the cognitive, behavioural, and affective components of attitude. Furthermore, the instruments in section C were answered by the treatment group, who were evaluated using Quizizz in order to know their perspectives toward Quizizz as a gamification.

The instrument in section A was adopted and adapted from the research paper University Students' Attitudes Towards the Application of Quizizz in Learning English as a Foreign Language written by (Pham, 2022). The similarities of this research help determine student attitudes towards Quizizz. The questionnaire had 15 items in total, cognitive (5 items), behavioural (5 items), and affective (5 items) with a 5-point Likert scale that was distributed to the students.

Next, Glynn et al. (2008) designed the Science Motivation Questionnaire, from which we adopted and adapted the instrument in section B. The word science in the title of the questionnaire was changed to physics, and the scale was adapted and given the new name, Physics Motivation Questionnaire (PMQ), to use in this research. The PMQ contained 15 items with a 5-point Likert scale. Meanwhile, the instrument in Section C—students' perspective towards gamified classrooms—was adopted and adapted from the students' perceptions of Quizizz in their daily online quizzes by (Basuki & Hidayati, 2019).

Reliability and Validity

Questionnaire

To determine the suitability and validity of the questionnaire items, a pilot test was conducted among 14 secondary school students in Batu Pahat, Johor. The questionnaire also had very clear instructions to make sure the respondents answered accurately.

Table 1 Reliability Level of Cronbach's Alpha Coefficient

Coefficient of Cronbach's Alpha	**Reliability level**
More then 0.90	Excellent
0.80-0.89	Good
0.70-0.79	Acceptable
0.60-0.69	Questionable
0.50-0.59	Poor
Less than 0.59	Unacceptable

Table 1 shows the level of reliability of Cronbach's Alpha. If the Cronbach's Alpha coefficient is less than 0.59, we consider the instruments to be unacceptable. Furthermore, we classify the reliability of instruments as acceptable if the Cronbach's Alpha coefficient falls between 0.70 and 0.79.

Table 2 Reliability of Instruments

Section	**Cronbach's Alpha**	**N of items**
Attitude	0.898	15
Enthusiasm	0.852	15
Perspective	0.746	15

Table 2 shows the reliability of the research instruments. Section attitude with a Cronbach's Alpha score of 0.898 measures how students feel about the gamified classroom and how they think, act, and feel about learning physics. This is a positive result. Next, the questionnaire for the students' level of enthusiasm for learning physics is 0.852, and the Cronbach's alpha for their perspective after using Quizizz is 0.746, which is acceptable according to the reliability level of the Cronbach's alpha coefficient.

Test

In order to test the validity of the instrument, the test was checked by the expert physics teacher to approve whether it was suitable to evaluate the student's knowledge in the physics subject using both the paper-pencil test and Quizizz.

Research Process (Flowchart)

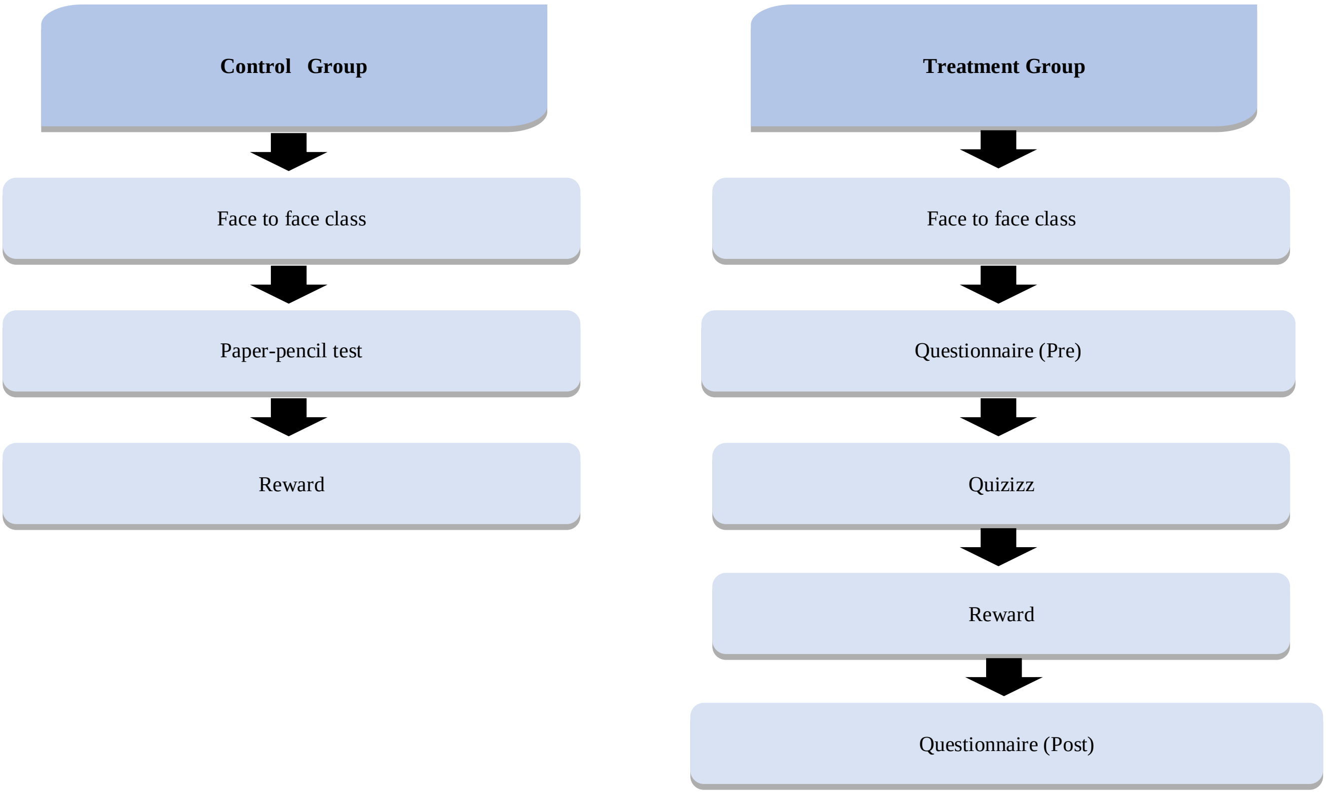

Figure 2 Flowchart of research processes

Figure 2 shows the research process. The first step was getting permission from the headteacher of Physics at Kolej Islam Sultan Alam Shah to collect data from two Form 4 science classes. After getting approval, the students will be divided into two groups, where one classroom acts as a control group and the other one acts as a treatment group.

On the next page, a lesson plan for each class was made for Topic 6: Light and Optics. The subtopics were 6.1 Light Refraction, 6.2 Total Internal Reflection, 6.3 Image Formation by Lenses, 6.4 Thin Lens Formula, 6.5 Optical Instruments, and 6.6 Image Formation by Spherical Mirror. The teaching and learning process in both groups was conducted in the same duration as the timetable, and both the treatment and control groups will learn the same topic and contents. After that, in the next class, the control groups need to answer 10 questions on the paper pencil test that relate to the subtopic and submit them before the class ends.

Conversely, the treatment group received a briefing on the Quizizz platform. The students were required to answer the questions about the subtopics 6.1 Refraction of Light, 6.2 Total Internal Reflection, 6.3 Image Formation by Lenses, 6.4 Thin Lens Formula, 6.5 Optical Instruments, and 6.6 Image Formation by Spherical Mirror through the link invitation or code number that was shared during the class. The Quizizz was conducted in classic mode, where the students answered the questions at their own pace, and the live results were popped on a leaderboard, which was shown on a smart TV in front of the classroom.

In the subsequent class, the students from both groups received different rewards. The name and mark of the student who gets the high score on the test for the control group will be announced in front of the class. The other students also were praised as they could answer the question. The treatment group has a leaderboard that shows the ranks of students after answering Quizizz, which is displayed in front of the classroom through the smart TV.

After that, the questionnaires consisted of 3 sections for the treatment group, which are Student's Attitude, Motivation, and Perspective, distributed to the students on the next class hour, which is the third face-to-face class. The students were briefed on how to answer the questionnaire, and after completing it, the questionnaires were collected from them.

Data Analysis

Five types of data analysis were used to answer the research question. These are test score analysis, enthusiasm analysis, attitude analysis, motivation analysis, and perception towards gamified classroom analysis (Table 3). Inferential analysis, which is an independent sample t-test was used to analyse the test score between the groups and students' attitude toward gamified classrooms that differ in terms of gender, while a paired sample t-test was used to compare the mean of the pre-test and post-test of the treatment group for students' enthusiasm and attitude toward using Quizizz. Lastly, descriptive analysis was used to define the frequency and mean in determining the student's perception of the gameful experience in the gamified classroom.

Table 3 Data Analysis

Research objective	Research question	Instrument	Analysis
1. To compare the student's academic achievement in learning Physics using the traditional learning and gamified classroom	How is the student's academic achievement in learning Physics using the traditional learning and gamified classroom?	Test	Independent sample t- test
2. To determine the student's level of enthusiasm in learning physics among the secondary students toward the gamified classroom	How the student's level of enthusiasm in learning physics among the secondary students toward the gamified classroom?	Questionnaire	Paired sample t-test
3. To investigate the student's attitude in learning Physics toward the gamified classroom.	What is the student's attitude in learning Physics toward gamified classroom?	Questionnaire	Paired sample t-test
	How do student's attitude toward gamified classroom differ in term of gender?	Questionnaire	Independent sample t- test
4. To determine students' perception of the gameful experience in the gamified	What student's perception of the gameful experience in the gamified classroom?	Questionnaire	Descriptive analysis

FINDINGS

Findings for Demographic Data

Both traditional and gamified classroom questionnaires included two demographic data-related questions in their first section. This data is essential for studying the backgrounds of responders. All respondents were 16 years old. The details gender ratio for both classroom are as follows:

Table 4 Gender in Gamified Classroom

	Frequency	**Percent**
Male	12	44.4
Female	15	55.6
Total	27	100

Table 4 shows the distribution of gender among respondents in gamified classrooms. Based on the data collected, the number of female students is larger than the number of male students. There were 12 (44.4%) respondents from the gamified classroom that were categorised as male, while there were 15 (55.6%) respondents that were categorised as female.

Table 5 Gender in Traditional Classroom

	Frequency	**Percent**
Male	12	44.4
Female	15	55.6
Total	27	100

Table 5 shows the gender distribution among respondents in traditional classrooms. 12 (44.4%) of the respondents who completed the paper-pencil test were classified as male, while 15 (55.6%) of them were classified as female.

Findings for Research Questions

How is the students' academic achievement in learning Physics using traditional learning and gamified classroom?

We administered a Quizizz test to students in the gamified classroom and a paper-pencil test to students in the traditional classroom. Table 6 displays the comparison between the two classes. The difference in scores between the gamified classroom (mean = 5.78, SD = 1.826) and the traditional classroom (mean = 4.63, SD = 1.6440) was found to be statistically significant (p = 0.019). By comparing their mean scores, it is concluded that students in gamified classrooms have a higher mean score for physics tests compared to traditional classrooms.

Table 6 Comparison Mean of Student's Academic Achievement

Class	N	Mean	Std. Deviation	Sig. (2-tailed)
Gamified	27	5.78	1.826	0.019
Traditional	27	4.63	1.644	

How is the students' level of enthusiasm in learning Physics among secondary school students toward gamified classrooms?

Table 7 Paired-Sample T-Test of Student's Enthusiasm in Learning Physics using Quizizz

			Mean	Std. Deviation	t	Sig. (2-tailed)
1	Pre	The Physics I learn is relevant to my life	4.00	0.784	-3.049	0.005
	Post		4.59	0.501		

2	Pre	Learning Physics is interesting	4.15	0.949	-2.28	0.031
	Post		4.59	0.501		
3	Pre	Learning Physics makes my life more meaningful	3.81	0.921	-3.721	0.001
	Post		4.59	0.501		
4	Pre	I am curious about discoveries in Physics	4.22	0.698	-2.508	0.019
	Post		4.63	0.565		
5	Pre	I enjoy learning Physics	4.07	0.829	-3.017	0.006
	Post		4.59	0.501		
6	Pre	I put enough effort into learning Physics	4.04	0.98	-2.105	0.045
	Post		4.52	0.643		
7	Pre	I use strategies to learn Physics well	3.67	1.074	-2.962	0.006
	Post		4.37	0.629		
8	Pre	I prepare well for Physics test and lab	3.44	1.188	-3.747	0.001
	Post		4.44	0.698		
9	Pre	I am confident I will do well on the Physics test	3.48	0.975	-3.595	0.001
	Post		4.33	0.555		
10	Pre	I am confident I will do well in Physics labs and project	3.56	0.974	-4.347	0.000
	Post		4.48	0.580		
11	Pre	I believe I can earn a grade of “A” in Physics	3.63	0.742	-4.533	0.000
	Post		4.41	0.694		
12	Pre	I am sure that I can understand Physics	3.81	0.622	-3.171	0.004
	Post		4.41	0.747		
13	Pre	I like to do better than other students on Physics tests	3.81	0.681	-4.009	0.000
	Post		4.52	0.643		
14	Pre	Getting a good Physics grade is important to me	4.15	0.718	-1.783	0.086
	Post		4.52	0.580		
15	Pre	Scoring high on Physics test matters to me	4.15	0.662	-1.883	0.071
	Post		4.48	0.580		

We conducted a paired sample t-test to compare students' enthusiasm before and after the implementation of Quizizz in a gamified classroom. Table 7 shows the paired sample statistics for the pre- and post-Likert scale of students’ enthusiasm for gamification when learning physics subjects.

Table 7 also shows that Pair 1, which is the item “The Physics I learn is relevant to my life,” is in pre (mean = 4.00, SD = 0.784) and post (mean = 4.59, SD = 0.501). The difference between the before and after answers to the physics test using Quizizz is statistically significant: t = -3.049, p-value = 0.005.

Then, Pair 2 item “Learning Physics is interesting” in pre (mean = 4.15, SD = 0.949) and in post (mean = 4.59, SD = 0.501); t = -2.280, p-value = 0.031. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in students’ enthusiasm; they agree that learning through Quizizz makes physics more interesting compared to traditional.

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Next, Pair 3 item "Learning Physics makes my life more meaningful" in pre (mean = 3.81, SD = 0.921) and in post (mean = 4.59, SD = 0.501); t = -3.721, p-value = 0.001. For this analysis, the p-value is smaller than 0.05, hence, there was a significant difference in students' enthusiasm, which they approved of, that their life becomes more meaningful when they study physics in a gamified classroom.

Afterwards, in Pair 4 item "I am curious about discoveries in Physics" in pre (mean = 4.22, SD = 0.698) and post (mean = 4.63, SD = 0.565); t = -2.508, p-value = 0.019. There was a significant difference in students' enthusiasm for learning physics among the secondary students toward the gamified classroom because the students were more concerned about discoveries in physics.

As for Pair 5, the item "I enjoy learning Physics" in pre (mean = 4.07, SD = 0.829) and post (mean = 4.59, SD = 0.501); t = -3.017, p-value = 0.006. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in learning Physics before and after the implementation of Quizizz.

Table 7 also shows Pair 6 item, "I put enough effort into learning Physics" in pre (mean = 4.04, SD = 0.980) and post (mean = 4.52, SD = 0.643). The p-value of the paired sample t-test is less than 0.05, so there is a statistically significant t = -2.105, p-value = 0.045.

A paired sample t-test was conducted to compare the Pair 7 item, which is the usage of strategies to learn Physics after and before the utilisation of Quizizz. There was a significant difference in score for the strategies in a traditional way (mean = 3.67, SD = 1.074) and Quizizz (mean = 4.37, SD = 0.629); t = -2.962, p-value = 0.006. These results suggest that students were eager to use effective strategies during the gamified classroom.

Next, Pair 8 item "I prepare well for Physics test and lab" in pre (mean = 3.44, SD = 1.188) and post (mean = 4.44, SD = 0.698). The difference between the before and after answers to the physics test using Quizizz is statistically significant: t = -3.747, p-value = 0.001.

Then, Pair 9 item, "I am confident I will do well on the Physics test" in pre (mean = 3.48, SD = 0.975) and post (mean = 4.33, SD = 0.555); t = -3.595, p-value = 0.001. Due to the p-value being less than 0.05, students' enthusiasm for Quizizz learning improves test performance.

As for Pair 10, the item "I am confident I will do well in Physics labs and project" in pre (mean = 3.56, SD = 0.974) and post (mean = 4.48, SD = 0.580); t = -4.347, p-value = 0.000. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in learning physics before and after the implementation of Quizizz.

Pair 11 item, "I believe I can earn a grade of "A" in Physics" in pre (mean = 3.63, SD = 0.742) and in post (mean = 4.41, SD = 0.694). The difference between the before and after answers on the Physics test using Quizizz is statistically significant t = -4.533, p-value = 0.000.

The continuous item from Table 7 was Pair 12. "I am sure that I can understand Physics". There was a significant difference in score for the understanding of Physics using Quizizz (mean = 3.81, SD = 0.622) and the traditional way (mean = 4.41, SD = 0.747); t = -3.171, p-value = 0.004.

Moreover, Pair 13 item, "I like to do better than other students on Physics tests" in pre (mean = 3.81, SD = 0.681) and post (mean = 4.52, SD = 0.643); t = -4.009, p-value = 0.000. There was a significant difference in students' enthusiasm in learning physics among the secondary students toward the gamified classroom because the students desired to perform better on physics tests after the implementation of Quizizz.

Pair 14 item, "Getting a good Physics grade is important to me" in pre (mean = 4.15, SD = 0.718) and in post (mean = 4.52, SD = 0.580); t = -1.783 and p-value = 0.086. A significant difference is not observed as the p-value is greater than 0.05.

Besides, a significant difference is not observed in Pair 15 item scoring high on the Physics test matters to me between pre (mean = 4.15, SD = 0.662) and post (mean = 4.48, SD = 0.580); t = -1.883, p-value = 0.071.

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In short, items Pair 1 until Pair 13 show that the p-value is smaller than 0.05, except for Pair 14 and Pair 15. Based on this, it can be argued that compared to the paper-pencil test, the Physics test supported by gamification significantly improves the student's enthusiasm toward Quizizz as gamification in learning Physics.

Students' Attitude toward the Gamified Classroom

What is the students' attitude in learning Physics toward gamified classroom

A paired sample t-test was performed to compute students' attitudes toward Quizizz and the paper-pencil test. Table 8 displays the paired sample statistics for the Likert scale, indicating the cognitive attitudes of the students.

Table 8 Paired-Sample T-Test of Students' Attitude in Learning Physics Using Quizizz in Cognitive Aspect

			Mean	Std. Deviation	t	Sig. (2-tailed)
1	Pre	Paper pencil test helps me remember more details in my lessons	4.26	0.602	0.681	0.502
	Post	Quizizz helps me remember more details in my lessons	4.15	0.465		
2	Pre	Paper pencil test helps me understand my lessons better	3.59	0.662	-2.431	0.022
	Post	Quizizz helps me understand my lessons better	4.15	0.465		
3	Pre	Paper pencil test helps me solve problems in my lessons faster	3.48	0.759	-2.675	0.013
	Post	Quizizz helps me solve problems in my lessons faster	3.96	0.465		
4	Pre	Paper pencil test helps me compare and contrast different kinds of terms in my lessons	3.67	0.542	-2.849	0.008
	Post	Quizizz helps me compare and contrast different kinds of terms in my lessons	4.30	0.501		
5	Pre	Paper pencil test helps gain more knowledge and develop more skills	3.63	0.736	-2.308	0.029
	Post	Quizizz helps gain more knowledge and develop more skills	4.19	0.501		

Pair 1 item "Paper pencil test helps me remember more details in my lessons" (mean = 4.26, SD = 0.602) and "Quizizz helps me remember more information in my lessons" (mean = 4.15, SD = 0.465); t = 0.681 and p-value = 0.502. A significant difference is not observed as the p-value is greater than 0.05.

As for Pair 2, the item "Paper pencil test helps me understand my lessons better" (mean = 3.59, SD = 0.662) and "Quizizz helps me understand my lessons better" (mean = 4.15, SD = 0.465); t = -2.431, p-value = 0.022. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in understanding Physics before and after the implementation of Quizizz.

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Next, the Pair 3 item "Paper pencil test helps me solve problems in my lessons faster" (mean = 3.48, SD = 0.759) and "Quizizz helps me solve problems in my lessons faster" (mean = 3.96, SD = 0.465). The difference between before and after answers in the Physics test using Quizizz is statistically significant (t = -2.675, p-value = 0.013).

Then, the Pair 4 item "Paper pencil test helps me compare and contrast different kinds of terms in my lessons" (mean = 3.67, SD = 0.542) and "Quizizz helps me compare and contrast different kinds of terms in my lessons" (mean = 4.30, SD = 0.501). The difference between the before and after answers to the physics test using Quizizz is statistically significant: t = -2.849, p-value = 0.008.

There was a significant difference in items "Paper pencil tests help gain more knowledge and develop more skills" (mean = 3.63, SD = 0.736) and "Quizizz helps gain more knowledge and develop more skills" (mean = 4.19, SD = 0.501); t = -2.308, p-value = 0.029.

In summary, Quizizz made a major impact on cognitive development, as 4 out of 5 items show a significant difference between the pre- and post. This is because Quizizz consists of the elements that can help the student learn their lesson better, solve problems faster, compare and contrast important terms, gain more knowledge and develop more skills compared to the paper-pencil test. For example, Quizizz provides immediate feedback that makes it easier for students to review whether their responses are correct or incorrect. Moreover, the visible countdown time element helps the students solve problems faster. Although engaging, the gamified components can often be distracting. The thrill of accruing points, competing with friends, and using an interface that feels like a game could draw students' focus away from the actual information. Post item 1 demonstrates this, as the p-value exceeds 0.005.

Table 9 Paired-Sample T-Test of Students' Attitude in Learning Physics Using Quizizz in Behavioural Aspect

			Mean	Std. Deviation	t	Sig. (2-tailed)
6	Pre	I look forward to answer paper pencil test	2.89	0.602	-6.596	0
	Post	I look forward to answer Quizizz	4.26	0.465		
7	Pre	I focus on the questions in paper pencil test	3.70	0.662	-2.760	0.010
	Post	I focus on the questions in Quizizz	4.41	0.465		
8	Pre	I focus on the answer in paper pencil test	3.67	0.759	-3.889	0.001
	Post	I focus on the answer in Quizizz	4.56	0.465		
9	Pre	I respond quickly as possible to each question	3.07	0.542	-4.478	0.000
	Post	I respond quickly as possible to each question	3.93	0.501		
10	Pre	I study harder to answer paper pencil test	3.67	0.736	-2.530	0.018
	Post	I study harder to win Quizizz	4.26	0.501		

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We conducted a paired sample t-test to compare students' attitudes before and after the implementation of Quizizz in a gamified classroom. Table 9 shows the paired sample statistics of the pre- and post likert-scale of students' attitudes toward gamification in learning Physics subjects in the behavioural aspect.

Table 9 also shows Pair 6 which is the item "I look forward to answer paper pencil test (mean = 2.89, SD = 0.602) and "I look forward to answer Quizizz" (mean = 4.26, SD = 0.465). The difference between before and after answers in the Physics test using Quizizz is statistically significant t = -6.596, p-value = 0.000.

Then, in Pair 7 item "I focus on the questions in the paper pencil test" (mean = 3.70, SD = 0.662) and "I focus on the questions in Quizizz" (mean = 4.41, SD = 0.465); t = -2.760, p-value = 0.010. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in students' attitudes in which they agree that they will be more focused on answering questions through Quizizz.

Next, in Pair 8 item "I focus on the answer in the paper pencil test (mean = 3.67, SD = 0.759) and I focus on the answer in Quizizz" (mean = 4.56, SD = 0.465); t = -3.889, p-value = 0.001. For this analysis, the p-value is smaller than 0.05. Hence, there was a significant difference in students' attitudes, and they approved that Quizizz made them focus on the answer.

Afterwards, in Pair 9 item "I respond as quickly as possible to each question in the pre (mean = 3.07, SD = 0.542) and post (mean = 3.93, SD = 0.501); t = -4.478, p-value = 0.000. There was a significant difference in students' attitudes toward learning physics among the secondary students in the gamified classroom because they attempted to reply to every item as immediately as possible.

As for Pair 10, the item "I study harder to answer paper test pencil" (mean = 3.67, SD = 0.736) and post (mean = 4.26, SD = 0.501); t = -2.530, p-value = 0.018. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in learning physics before and after the implementation of Quizizz.

Table 10 Paired-Sample T-Test of Students' Attitude in Learning Physics Using Quizizz in Affective Aspect

			Mean	Std. Deviation	t	Sig. (2-tailed)
11	Pre	I am eager to learn via paper pencil test	3.41	0.602	-3.309	0.003
	Post	I am eager to learn via Quizizz	4.30	0.465		
12	Pre	I find paper pencil test competitive	3.74	0.662	-3.215	0.003
	Post	I find Quizizz competitive	4.44	0.465		
13	Pre	I feel happy about my results in paper pencil test	3.30	0.759	-4.561	0.000
	Post	I feel happy about my results in Quizizz	4.19	0.465		
14	Pre	I feel energetic when I answer paper pencil test	3.26	0.542	-6.928	0.000
	Post	I feel energetic when I answer Quizizz	4.59	0.501		
15	Pre	I feel more confident choosing the correct answers	3.63	0.736	-3.174	0.004
	Post	I feel more confident choosing the correct answers	4.15	0.501		

Table 10 shows the paired sample statistics of the pre- and post-questionnaire of students' attitudes toward Quizizz in answering the Physics test.

Pair 11 items "I am eager to learn via paper pencil test" (mean = 3.41, SD = 0.602) and "I am eager to learn via Quizizz" (mean = 4.30, SD = 0.465). The p-value of the paired sample t-test is less than 0.05, so there is a statistically significant t = -3.309, p-value = 0.003.

We conducted a paired sample t-test to compare the Pair 12 item and the competitiveness between the paper-pencil test and Quizizz. There was a significant difference in score for the strategies in pre (mean = 3.74, SD = 0.662) and post (mean = 4.44, SD = 0.465); t = -3.215, p-value = 0.003. These results suggest that students are more competitive in the gamified classroom.

Next, in Pair 13, the item "I feel happy about my results in the paper pencil test" (mean = 3.30, SD = 0.759) and "I feel happy about my results in Quizizz" (mean = 4.19, SD = 0.465). The difference between the before and after answers to the physics test using Quizizz is statistically significant: t = -4.561, p-value = 0.000.

As for Pair 14, the item "I feel energetic when I answer paper pencil test" (mean = 3.26, SD = 0.542) and I feel energetic when I answer Quizizz (mean = 4.59, SD = 0.501); t = -6.928, p-value = 0.000. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in learning physics before and after the implementation of Quizizz.

Then, Pair 15 items "I feel more confident choosing the correct answers" in the pre (mean = 3.63, SD = 0.736) and post (mean = 4.15, SD = 0.501); t = -3.174, p-value = 0.004. Since the p-value is smaller than 0.05, it can be concluded that there is a significant difference in students' attitudes in which they agree that "I'm more confident selecting the correct answers".

In short, the items Pair 1 until Pair 13 show that the p-value is smaller than 0.05, except for Pair 14 and Pair 15. Based on this, it can be argued that compared to the paper-pencil test, the Physics test supported by gamification significantly improves the student's enthusiasm toward Quizizz as a gamification in learning Physics.

Overall, the averages demonstrate that the experimental group has improved in terms of the cognitive, behavioural, and affective domains. Based on this, it can be claimed that Quizizz-supported Physics courses greatly increase students' attitudes towards learning Physics as opposed to paper-pencil tests.

How do students' attitude toward gamified classroom differ in terms of gender

Table 11 shows the findings of the mean value and standard deviation between male and female students on the attitudes toward the usage of Quizizz in answering the Physics Test. It indicates a small difference between male students (mean = 4.38, SD = 0.422) and female students (mean = 4.15, SD = 0.474).

Table 11 Independent Sample T-Test of Student's Attitudes Toward Gamified Classroom Differ in Term of Gender

	Gender	N	Mean	Std. Deviation
Attitude	Male	12	4.38	0.422
	Female	15	4.15	0.474

What students' perception of gameful experience in gamified classroom?

The descriptive analysis in Table 12 shows the perception of students in the treatment group during the usage of Quizizz in answering Physics questions. Initially, most of the students preferred to answer strongly agree and agree. There are 4 out of 15 questions that students answered disagreed, which were question 2, question 7, question 8 and question 14. The highest mean score of 4.59 indicates that Quizizz fosters an energetic

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classroom atmosphere. Next, the students found out that they were eager to learn via Quizizz (mean = 4.52). However, only 15 out of 27 students (mean = 3.59) chose to agree and strongly agree that Quizizz is better than a paper pencil test. On average, most students agree that Quizizz doesn't give any chance to cheat (mean = 3.58). Meanwhile, Quizizz is quiet in terms of concentration and focus from any disturbance, showing the lowest rating among the students (mean = 3.56).

Table 12 Descriptive Statistic of Students' perception toward Quizizz

			Frequency				Mean
		SD	D	N	A	SA	
Q1	I find Quizizz exciting, interesting, motivating and fun	0	0	2	10	15	4.48
Q2	I look forward to playing Quizizz	0	1	5	11	10	4.11
Q3	I feel positive when playing Quizizz	0	0	4	13	10	4.22
Q4	I like the collaboration and competitiveness in Quizizz sessions	0	0	1	15	11	4.37
Q5	Quizizz create an energetic classroom atmosphere	0	0	0	11	16	4.59
Q6	Quizizz tends to be under students' control (Students directed/paced)	0	0	5	12	10	4.19
Q7	Quizizz is quite (concentration/focus/disturbance)	0	4	10	7	6	3.56
Q8	Quizizz doesn't give any chance to cheat	0	3	5	12	7	3.85
Q9	Quizizz final leader board satisfies you	0	0	8	10	9	4.04
Q10	Quizizz has some special challenging features	0	0	0	15	12	4.44
Q11	I find Quizizz reveal the real students' competence	0	0	2	15	10	4.30
Q12	I feel Quizizz familiar and simple to do	0	0	5	14	8	4.11
Q13	Quizizz feedback for questions is engaging	0	0	3	13	10	4.26
Q14	Quizizz is better than paper pencil test	0	5	7	9	6	3.59
Q15	I am eager to learn via Quizizz	0	0	1	11	15	4.52

CONCLUSIONS

Summary of Findings and Discussion

The research aims to compare how well students learn physics in terms of their achievement using traditional methods versus a gamified classroom, see how excited or enthusiastic secondary students are about learning physics in a gamified setting, explore their attitudes towards learning physics in that environment, and understand how their perception about the gaming experience in the gamified classroom.

Table 6 shows the mean test mark for the gamified classroom, 5.78, which was higher than for traditional learning which was 4.63. It shows that Quizizz, as a gamification educational tool for answering tests, positively impacts academic achievement, especially in physics subjects. There is a significant difference in students' academic achievement in physics between traditional and gamified classrooms.

Quizizz had a beneficial effect on students' learning in the form of enthusiasm. Quizizz's assessment of the topic motivated students to study it more. Table 7 demonstrates the results of students' enthusiasm for learning physics using Quizizz, with the majority of the items showing a p-value less than 0.05. This data suggests a significant difference in enthusiasm between the pre- and post-tests. Besides contributing to students' enthusiasm for learning, Quizizz also influenced the students to be more competitive, where students like to do better than other students on physics tests.

The study also found that gamification in the classroom with mean scores for all sections positively impacts students' attitudes in terms of cognitive, behavioural and affective aspects, as shown in Table 8, Table 9 and Table 10 respectively. When students exhibit positive affective engagement, they are more likely to feel motivated, engaged, and enthusiastic about the material they are studying. Such an attitude can improve their entire learning process and results.

Based on Table 12, the highest rating strongly agrees with the item regarding the environment that was created during the implementation of Quizizz. One of the main reasons is students quickly identify and improve from their mistakes as they receive immediate feedback on their quiz answers. Throughout the lesson, rapid feedback encourages active learning and keeps students energised and focused. Students typically perform better because Quizizz allows them to rank against their peers. A positive learning atmosphere and healthy competition are also promoted, where students may support one another and exchange strategies such as using power-ups wisely and earning bonus points to push the rank. From the results acquired, students were satisfied with the Quizizz component, namely the leaderboard. It is intended to provide students with precise data about their position after answering each question and total test scores or points at the end of the session. Hence, it indicates that receiving online formative feedback increases students' sense of taking responsibility for their learning experience.

Pedagogical Implications and Suggestions for Future Research

The study's conclusions allow for the determination of many ramifications for both teachers and students. The first implication is that the students engage more in the lesson to rank well by answering the questions correctly. As a result, the academic achievement among the students increases. Multiple-choice, true-or-false, and open-ended questions are among the question types that Quizizz offers. This diversity accommodates varying learning styles and keeps the learning process active, keeping students interested. Secondly, students will also be more eager to learn. This is because Quizizz's competitive aspect, which allows students to view their rankings instantly, could encourage them to higher performance. Furthermore, cooperative elements like team-based games promote a feeling of cooperation and mutual success, which raises enthusiasm. Additionally, Quizizz's instant feedback feature gives students immediate feedback on every question, allowing them to analyze the right responses quickly and learn from their mistakes. Thirdly, teachers can use Quizizz for review sessions in order to help students improve their knowledge before the examination. This review session can be done by using the flashcard elements in Quizizz, where flashcards are available on the reports page following the completion of a homework or live quiz. Effective review sessions can boost students' confidence and create a positive attitude toward their ability to succeed. Finally, teachers can modify feedback preferences according to gender, as guys may be more accepting of competitive feedback approaches, while ladies may want more in-depth and customized input. Modifying feedback on gamified platforms such as Quizizz can assist in meeting these needs.

Future researchers who are willing to investigate more gamification, especially in STEM subjects, are recommended to use different types of educational web tools that promote elements of gamification such as

Kahoot, Quizlet Live, Socrative and Minecraft. This is because it promotes different specific needs and preferences that depend on the learning objectives of the lessons. Next, future researchers can integrate gamification elements in conducting experiments. For example, researchers can make applications based on gamification concepts such as progress bars, time, bar charts and pie charts, leaderboards, self-competition, and rules. By incorporating this element of gamification, the researcher can also investigate its effect on competition and collaboration among the students. Moreover, the future researcher can explore the barriers and challenges among teachers to implement gamification during the teaching and learning process, as the gamification tools were rarely used by the teacher. This is due to different teachers utilising gamification in different ways, and the acceptance of gamification in the classroom is influenced by a number of variables, including the subject matter, the age range of the pupils, and the teacher's own teaching style. Lastly, there was a program and seminars that offered simple guides for the teacher to use educational web tools and technology in the teaching and learning process. Therefore, the future researcher was recommended to investigate the effects of offering gamification training and professional development to educators. The study can evaluate the efficacy of particular training courses intended to give educators the necessary skills and knowledge to incorporate gamification into the classroom. This includes determining if teachers who participate in such training programs feel more competent, confident, and willing to use gamified components.

CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

NN and AWAL carried out the abstract, objectives, conceptual framework, methodology, discussion, conclusions and implications. KSSKMN and HMM did the introduction while NFAK and NK did the literature review sections. NN, KSSKMN and SAZ collected and refined the data and performed the data analysis using IBM Statistics (Statistical Package for the Social Sciences) Version 28 for analysis. All authors read and approved the final manuscript.

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