Citra Journal of Innovative Education Practices

Journal homepage:
https://citralestari.my/index.php/cjiep/index
ISSN: 3093-6942

Use of Kahoot! as an Active Learning Strategy for Year 4 Students in Science Subject at a Primary School in Sarawak

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ARTICLE INFO

Article history:
Received 7 October 2025
Received in revised form 30 October 2025
Accepted 1 November 2025
Available online 2 November 2025

Keywords:
Kahoot!; active learning; gamification

ABSTRACT

The Implementation of the Digital Education Policy reflects the commitment of the Ministry of Education of Malaysia in strengthening the integration of technology in teaching and learning. In line with this initiative, this action research was conducted to evaluate the effectiveness of using the Kahoot! application as an interactive gamification-based learning tool to improve the focus, engagement and achievement of Year 4 students in science subjects in a rural primary school in Sarawak. Guided by the Kemmis and McTaggart Model, this study used a mixed methods design involving 25 students and two teachers through two cycles of action research. Quantitative data was collected through student engagement questionnaires, while qualitative data was obtained through observations, interviews and teacher reflection journals. The findings showed a significant increase in students' emotions (mean=3.91), cognitive (mean=3.90) and behavioral (mean=3.80) engagement. More than 80% of students were actively involved in learning by showing higher focus, motivation and cooperation. Thematic analysis identified four main themes, fun in learning, positive competition, engaging visuals, and meaningful interaction that illustrate the motivational and social effects of gamification-based learning. The study concluded that the use of Kahoot! positively encouraged active learning, reduced passive behavior, and improved students' understanding of science concepts. This method also assisted teachers manage the classroom and evaluate students' understanding in actual time, in line with 21st century learning practices. These results propose that gamification-based plans can be used as an innovative and inclusive alternative to address student engagement problems in remote schools and create digitally well-educated students.

1. Introduction

The inauguration of the Digital Education Policy by the Ministry of Education marks the government's assurance to reinforce the incorporation of technology in education. In line with this policy, applications such as Kahoot! are used to support active learning strategies that increase student focus and engagement in science subjects in a creative and innovative way [1]. However,

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https://doi.org/10.37934/cjiep.3.1.2531

rural schools such as those in Sarawak still face constraints in terms of facilities and technological skills [2]. This requires teachers to be more proficient in technology-based teaching, especially for the Alpha generation who are more attracted to digital learning [3]. In this regard, the active learning approach outlined in the KSSR [4], is a focus to increase student focus and engagement [5]. Studies show that Kahoot! can increase student motivation and understanding through interaction-based learning, concept reinforcement, and self-assessment [6,7].

In today's digital era, teaching and learning need to be adapted to the needs of the Alpha generation who are more inclined towards interactive learning based on technology [8]. However, in the Science subject, there are still many students who show a lack of focus and active involvement during teaching and learning. Observations at this school found that Year 4 students showed passive behavior, such as not paying attention, chatting, playing with stationery, and not responding or communicating in group discussions. This shows that students are more passive observers than active participants in learning. This problem is believed to be caused by the incompatibility of traditional teaching methods with the Alpha generation's learning style, which requires a more interesting and interactive approach. In addition, the absence of interactive and structured remedial modules causes teachers to be less consistent in helping weak and passive students. Therefore, this study was conducted to evaluate the effectiveness of using the Kahoot! application as a collaborating method in growing student engagement and success in the Science subject.

The purpose of this study was to expand the efficiency of learning in the Science subject among Year 4 students with the Kahoot! application as a gamification-based learning instrument. The use of Kahoot! is probable to stimulate students' intrinsic motivation, create a more interactive and enjoyable learning environment, and reduce dependence on traditional teacher-centered teaching methods [9]. In addition, this study also aims to achieve more comprehensive learning objectives by forming a positive perception of the Science subject, increasing mastery of basic concepts, and improving students' academic performance. Through this approach, students are expected to be more actively involved in teaching and learning sessions, thus overcoming the issue of lack of focus and engagement that is often a major challenge in teaching and learning.

This study is hoped to provide practical guidance to science teachers in strengthening existing teaching methods to be more interesting, effective, and appropriate to the cognitive level of students. This study is also hoped to be a useful reference in the future in empowering 21st century pedagogical practices and providing alternative solutions to the issue of passive students in the classroom. In increasing the focus and involvement of year 4 students in science subjects. This study was conducted to achieve three study objectives, 1. Increase the level of focus of year 4 students in science teaching and learning through Kahoot! Activities, 2. encourage the active involvement of at least 80% of students in the learning session and 3, evaluate the effectiveness of using Kahoot! technology as an active learning strategy.

The conceptual framework of this study serves as a basis for thought that connects the main theories and explains the relationships between the variables studied. Two main theories are used in this study, specifically Passive Behavior Theory and Active Learning Theory. Passive Behavior Theory [10]. describes that individuals with passive behavior inclined to evade conflict, do not express views, and fail to demonstrate active participation. In education setting, it raises students who do not request questions, do not contribute to discussions, and are only observers. Active Learning Theory as highlights by Bonwell *et al*., [11] said effective learning needs students to be dynamically involved through activities such as discussions, questioning, simulations, and cooperative learning. This method can increase student engagement and decrease passive behavior in the classroom. However, this study has limitations such as involving only one class over a short period of time, different levels

of technology skills of teachers and students, and infrastructure issues such as lack of devices and unstable internet connections.

Previous studies at home and abroad have shown that the use of Kahoot! as an interactive learning tool can increase the focus, motivation, and engagement of primary school students in various subjects such as Bahasa Melayu, Mathematics, and Science [12-14]. In Malaysia, studies have found that gamification approaches such as Kahoot! and interactive card games have successfully encouraged students to be more courageous, active, and interested in learning [15]. Overseas studies have also shown a positive impact on students' motivation and conceptual understanding, where the use of Kahoot! increases their achievement scores and cognitive and emotional engagement [16-18]. However, there are gaps in existing research as most studies focus more on general motivation and achievement aspects, and less on students' passive behavior, especially in science subjects and rural contexts [19,20]. Therefore, this study was conducted to fill this gap by evaluating the effectiveness of Kahoot! -based active learning strategies in addressing the problem of passive engagement of Year 4 students in a more contextual and targeted manner.

2. Methodology

This study used a mixed methods action research design that combined quantitative and qualitative data to evaluate the effectiveness of the Active Learning strategy using Kahoot! in increasing the engagement of Year 4 Science students. Guided by the Kemmis and McTaggart model [21], the study was implemented through four phases, planning, action, observation and reflection in two cycles to ensure continuous improvement. Quantitative data was collected through questionnaires, to get the mean interpretation, researchers use Nunnally & Berstein's table of mean score interpretation [22], mean scale form 4.01 to 5.00 refers to high level, mean scale from 3.01 to 4.00 refers to medium high, mean scale from 2.01 to 3.00 refers to medium low, while mean scale from 1.00 to 2.00 refers to low level.

Qualitative data was collected through structured observations, semi-structured interviews and teacher reflection journals [23]. The study sample consisted of 25 Year 4 students and two teachers who were selected through purposive sampling [24]. The study instruments included an adapted Student Engagement Questionnaire [25] observation sheet, reflection journals, and Kahoot! quizzes used during the sessions. Data was analyzed using descriptive, frequency, and thematic analysis to identify the level of student engagement and the effectiveness of the strategy [26]. A pilot study was also conducted to assess the reliability of the instrument [27]. In terms of ethics, the study emphasized aspects of informed consent, confidentiality of information, and voluntary participation in line with the principles of research ethics [28]. In general, this design permits a valid empirical assessment of the usefulness of using Kahoot! in increasing student engagement and establishing teachers' reflective and current teaching practices.

3. Findings

This study initiates that the practice of Kahoot! as an active learning approach had a substantial positive influence on the focus and engagement of Year 4 students in science subjects. Based on a questionnaire conducted on 23 students, most respondents displayed a high level of agreement on the efficiency of using Kahoot! in the teaching and learning process. The mean values for the three main aspects are high, emotional engagement (3.91), SD=.708, cognitive engagement (3.90), SD=.730 and behavioral engagement (3.80), SD=.676 as shown in Table 1. It displayed an important increase compared to before the application of the intervention. This result shows that the practice of

gamification elements positively improved students' focus, interest and motivation to learn more actively and enjoyably.

Table 1
Mean value of three aspects of engagement

Engagement	Mean	Standard Deviation	Interpretation
Emotional	3.9	.708	Medium High
Behavioral	3.8	.676	Medium High
Cognitive	3.9	.730	Medium High
N=23			

In addition, the results of observations and semi-structured interviews found that students were more focused during session when learning activities were carried out using Kahoot! Students seemed to pay more attention to the screen display, were willing to answer questions, and showed a quick response to the tasks given. The teachers interviewed also confirmed that students who were previously passive now showed positive changes in terms of communication, courage to give answers and level of cooperation in the group. The atmosphere also became more conducive, dynamic and fun when elements of healthy competition were introduced through interactive quiz activities.

Thematic analysis of the qualitative data also identified four main themes that explained the impact of using Kahoot! on students, namely fun in learning, positive competitive elements, attractive visual design, and meaningful interaction between teachers and students, as shown in Table 2. Students stated that learning using Kahoot! was more entertaining because it was not tedious and offered chances for all students to join. The time and scoring elements in the game enlarged students' motivation to contest in a healthy way, while the attractive visuals and colors facilitated them comprehending science concepts more certainly. Teachers also found that this activity preserved students' focus through the teaching and learning session and offered a chance to evaluate their level of understanding directly.

Table 2
Main themes, categories, responses and interpretation of qualitative findings

Main Themes	Categories/Codes	Example of Response	Interpretation
1. Fun in learning	-Fun learning environment -No tedious -New experience	*"Kahoot! Interesting"* (Student 18) "*I like Kahoot, it is not boring, just like playing game*" (Student 1)	Students were enjoyed and excited in teaching and learning. Kahoot! made meaningful learning.
2. Positive competitive element	-Healthy competition Motivasi -Fast response	"*I want fail those group*" (Student 6) "*I feel enjoy becoming a winner* (Student 14)	Games elements and competition increased motivation and concentration. Creating active and collaborative teaching and learning.
3. Attractive visual design	-Interesting colours and graphics -Question in different forms -Use of alternative tools	"*I like colours and pictures in quiz (Student 10)* *"I like multiple choices questions, specifically true and false" (Student 5)*	Visual design and colorful elements attracted students' curiosity and enhanced understanding in science concept.

4. Meaningful interaction between students and teachers	-Learn by playing. -Focus during teaching and learning -Fast/quick response	"*Like playing games but it is learning"* (Student 14) "*Easy to understand because teacher asks and I can answer quickly*" (Student 19)	Kahoot! activity made students more focus, active and involved directly in learning.

4. Discussions

The findings of this study show that the use of Kahoot! as an active learning strategy has successfully increased the focus, engagement and motivation of Year 4 students in the Science subject. The results of the questionnaire, observation and interview found that students responded very positively to this gamification-based method. This finding is in line with earlier finding which stated that the use of Kahoot! can attract students' attention through interactive elements and healthy competition that stimulate focus and engagement in learning. In the context of rural schools like this school, this approach functions as a catalyst for teaching innovation that can maintain students' interest in science, especially when traditional learning activities are often considered boring.

In addition, substantial growths in emotional, cognitive and behavioural engagement show that applying active learning approaches can decrease passive behaviour among students. Based on the theory of Bonwell and Eison active learning requires students to do more than just listen, they need to think, discuss and participate in activities that require social interaction and reflective thinking. The results of this study show that students are more fun, confident and active during Kahoot! activities. This supports the discovery by Jones *et al*., [29] who initiate that gamification increases students' intrinsic motivation by delivering fun and meaningful learning practices. In this situation, Kahoot! is not just a gaming platform, but functions as a digital educational tool that shapes students' self-self-confidence to interact and reflect critically.

From a cognitive viewpoint, students presented an increase in their understanding of science ideas through active engagement in asking and questioning activities. This result is in line with a study by Licorish *et al*., [30] which found that primary school students who used Kahoot! showed a significant increase in comprehension scores compared to the control group. The immediate feedback element provided by Kahoot! helps students identify their strengths and weaknesses directly, thus reinforcing self-directed learning [31]. In the context of the 21st century classroom, this approach is very relevant to the needs of the Alpha generation who are more responsive to technology and visual learning [32].

In addition, the finding that more than 80% of students were actively involved during teaching and learning shows that the gamification approach can create a positive collaborative atmosphere. This finding supports the results of studies by Azita *et al*., [33] and Kamarudin and Hassan [34] who found that Kahoot! increases social interaction, teamwork and a healthy competitive spirit among students. In the context of teachers, this approach also helps them control the class more effectively and assess the level of student understanding in real time [35,36]. This is in line with the intention of the Ministry of Education Malaysia through the Digital Education Policy to empower the use of technology to produce students who are creative, collaborative and digitally literate.

Overall, this discussion emphasizes that the active learning strategy based on Kahoot! can increase student focus, motivation and engagement in science. This technique is not only in line with the 21st century learning method but also has great possible to be extensively implemented in rural primary schools to address the problem of inactive students who are less attracted in science. Hence,

this study recommends that teachers remain to develop their teaching and learning practices with the incorporation of gamification such as Kahoot! to reinforce teaching efficiency and build a fun and interactive learning setting.

5. Conclusion

This action research showed that the practice of active learning approaches based on Kahoot! positively improved the attention, engagement, and enthusiasm of Year 4 students in science subjects in rural schools, particularly in this school. The results displayed that students were more emotionally, cognitively, and behaviourally involved, in addition to display positive changes in attitude and attention during teaching sessions. This method makes the learning more fun, collaborative, and active compared to traditional approaches. In addition, the practise of Kahoot! benefits teachers control the class more simply and measure student understanding directly through real-time feedback. The classroom atmosphere becomes more active and cooperative, in line with the requirements of 21st century education. Students display higher curiosity and self-confidence, while teachers can improve technology-based teaching approaches that suit the requests of the digital generation.

This research also has significant consequences for pedagogical practice, specifically in the setting of rural schools that face infrastructure restrictions and low student motivation. The efficiency of this plan shows that the gamification method can be an advanced alternative to expand the quality of science learning and bridge the hole between urban and rural schools. In general, the findings of this study support the efforts of the Ministry of Education Malaysia to reinforce the incorporation of technology and foster student-centred learning. It is expected that the Kahoot! -based method can be extended across other subjects to support the progress of active, inspired, and digitally well-educated students.

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