



## Exploring the impact of Kahoot! as a collaborative gamified mathematics learning platform for Jordanian junior school gifted students



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### ABSTRACT

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This research delves into the distinctive challenges faced by educators of gifted students in Jordan, specifically focusing on the intricacies of delivering compelling lectures that foster academic excellence. To tackle this challenge, the study explores the potential of integrating game elements into the educational framework, with a particular emphasis on harnessing the popular platform Kahoot! to enhance engagement and academic achievement among gifted students. The primary goal is to evaluate the effectiveness and enjoyment of Kahoot! as a learning approach for gifted students in Jordan. Employing a quantitative methodology, the research analyzes data from 112 gifted students actively involved in using Kahoot! as an integral part of their learning experience. The investigation aims to scrutinize Kahoot!'s impact on the academic achievements of gifted students while assessing the potential benefits associated with integrating gamification elements into pedagogical strategies. The findings significantly contribute to determining the suitability of Kahoot! as a teaching strategy that incorporates gamification elements, especially in enhancing the academic accomplishments of gifted students in Jordan. Furthermore, the study explores innovative solutions to engage gifted students by infusing gaming elements into the instructional process, providing valuable insights for broader applications of gamification techniques to enhance engagement, motivation, and knowledge retention among gifted students within the Jordanian educational landscape.

**Contribution/ Originality:** This research tackles the engagement challenge among gifted students in Jordan by integrating game elements, focusing on Kahoot! The study provides empirical evidence on Kahoot!'s effectiveness in enhancing academic achievements, offering practical insights for educators and policymakers aiming to boost engagement, motivation, and knowledge retention among gifted students in Jordan.

## 1. INTRODUCTION

Incorporating game design elements into gaming situations, known as gamification, has attracted significant attention from academic and industry circles [1]. One known example of a learning tool is Kahoot!, which has gained widespread recognition. This platform enables users to easily create, share, and participate in learning and trivia games. Its effectiveness becomes particularly evident when several participants use it. The game host displays questions on a screen and gives players a PIN to join the game. Participants can answer these questions using their devices. A shared screen displays the responses [2].

Furthermore, educators can use Kahoot! challenges for assigning homework or facilitating training sessions. As a game-based learning tool, Kahoot! empowers teachers to gather valuable data and customize lesson plans to cater to students' individual needs [3]. In summary, Kahoot! is a prominent gamified learning tool that allows for the creation and engagement in learning and trivia games. It offers a seamless experience for both participants and hosts, with features such as unique PINs and shared screens.

Moreover, Kahoot! Challenges provide additional flexibility for educators to assign homework or conduct remote training sessions. By harnessing the power of gamification, Kahoot! It enables teachers to collect data and adapt their teaching to better meet their students' needs.

Within the context of Jordanian education, Kahoot! serves as a gamified learning platform that aids educators in addressing the distinctive characteristics of their students. Individuals and groups can use it to cultivate a lifelong passion for learning, curiosity, and enjoyment. Recognizing the limitations of traditional teaching methods in effectively engaging contemporary students, numerous educational institutions have embraced gamification, emphasizing leveraging Kahoot! to enhance mathematics education and reap many benefits [4]. Teachers have diligently endeavored to develop engaging teaching strategies that offer advantages and support learning while catering to the specific requirements of their students. Conventional education often relies on a one-way communication model, resulting in students' disengagement due to their limited ability to actively contribute to learning discussions [5]. Educators can create interactive and participatory learning environments by incorporating gamification elements through platforms like Kahoot! thereby cultivating heightened student engagement and fostering meaningful learning experiences.

Traditional education often prioritizes lectures and neglects student interaction, resulting in boredom, student dissatisfaction, and a decline in academic performance. To address this issue, remote learning has emerged as a solution to engage gifted Jordanian students and prevent classroom boredom. However, teachers may require support in creating engaging classroom content. As a result, many educators have embraced innovative approaches to enhance student achievement and satisfaction, with gameplay as a teaching tool being one such method [6].

In today's era, students must adapt to skill changes and adjust [7]. Incorporating technology in classrooms has fostered increased participation from both students and teachers. With the growing prevalence of technology, computer-assisted learning has. Researchers have explored its potential advantages in teaching mathematics [8, 9]. Educators and assessment experts appreciate technology because it enables effective evaluation of students' mathematical abilities compared to conventional paper-based methods [10]. However, when introducing gamification in areas including education, it is crucial to consider the users' characteristics [8].

This research seeks to comprehensively explore the implementation of gamification in education. As indicated in Field's study [9] gamification in education utilizes game mechanics to captivate students' interest and enhance their engagement. The integration of specific components is aimed at creating a learning experience that mirrors games, facilitates game-like actions, and cultivates a sense of enjoyment, ultimately promoting sustained focus on learning [11].

Kahoot! is a viral platform that effectively integrates game elements into education. Originally designed for universities and colleges, Kahoot! It combines playfulness with learning and potentially motivates students, particularly in distance learning settings [12]. Schools, campuses, or homes can utilize it to enhance learning outcomes and participant engagement, among other benefits. Many universities in the United States use Kahoot! For purposes such as assessing student comprehension or facilitating deeper exploration of subjects. Additionally, it can serve as a fun icebreaker activity at the beginning of a class, with open-ended questions used to assess students' knowledge [13].

Despite the integration of technology into various aspects of education, its widespread adoption is not yet universal in all areas. The use of technology in schools may still be optional and not consistently implemented. This phenomenon requires investigation, considering factors such as the recent increase in media prices influencing

technology adoption [14]. With the continuous evolution of the internet and the accessibility of low-cost cellular technologies, mobile learning is advancing. Teachers are intrigued by the potential of technology as it allows for incorporating games, videos, music, and other media into the learning process. However, despite the availability of numerous educational apps, teachers' limited usage of classroom computers and other technologies remains an issue. Students often use phones and other technologies for entertainment and socializing, which can negatively impact their academic performance [15].

Within Jordanian classrooms, this research aims to assess the practicality, user-friendliness, and engagement level of Kahoot! as an instructional tool for students. The research aims to investigate whether Kahoot! An educational platform that uses games to enhance students learning experiences, should be introduced in classrooms. Kahoot! Utilizes game-based learning techniques to boost students' academic performance. It is crucial to conduct an assessment to ascertain its efficacy. The findings of this evaluation suggest that incorporating gaming elements into instruction can foster student interest and facilitate the application of learned material. Mathematics, an integral part of everyday life, plays a significant role in problem-solving, decision-making, and foresight [16]. Developing cognitive skills to solve mathematical problems, including recognizing symbols and comprehending mathematical language, is crucial. It is essential to investigate students' mastery of mathematical concepts and skills and understand how well they comprehend the presented information [17].

The research conducted by Fitri [18] and Pomalato, et al. [19] highlights the close connection between mathematical word problems and real-world situations. These word problems present students with challenges that require the application of mathematical concepts in practical contexts. Mathematical language can solve narrative-based questions, which mimic everyday scenarios [20]. Consequently, students must comprehend the problems and engage in reasoning to solve them successfully. Word problems often pose difficulties for students [21]. Many students require assistance when it comes to solving these types of problems in mathematics. Yanuarto and Romadona [22] suggest that students' struggles with learning mathematics stem from a tendency to memorize formulas without genuinely understanding the underlying concepts. Mistakes made by students in solving word problems often result from challenges in applying mathematical principles. Lack of understanding and an inability to fully comprehend the issue's essence can also lead to mistakes [23].

The primary objective of this study is to identify and address errors made by students to enhance their performance through the Kahoot! platform. By gaining insights into the mistakes made by students, educators can assess their understanding of mathematics. Furthermore, teachers can provide customized assistance to those students who may need it [24]. Analyzing the types of errors made by students not only reveals the specific areas where mistakes occur but also provides valuable information on their comprehension of the subject matter.

## 2. METHODOLOGY

**Participants:** This study included Jordanian teachers and gifted students. The sampling technique involved selecting one teacher and five gifted students randomly assigned from each school. This resulted in the recruitment of 112 gifted students from various colleges and schools in Jordan.

### 2.1. Data Collection

1. Questionnaire Administration (First stage):
  - A questionnaire was administered in the first stage to gather perspectives of gifted students and teachers on the use of Kahoot! in online education.
  - The questionnaire consisted of game-based questions to assess cognitive abilities.
  - Both gifted students and teachers received the same questionnaire for consistency.
  - Gifted students' questionnaire had two parts: five open-ended statements and ten closed-ended statements.
  - Teachers' questionnaire comprised ten closed-ended questions and seven open-ended questions.

- Closed-ended questions utilized a validated Likert scale, ensuring reliability and validity.

## 2.2. Treatment Phase

- The study involved two groups of students: the experimental group and the control group.
- The control group received traditional instruction on utilizing the internet and smartphones for accessing course materials.
- The experimental group utilized Kahoot!, a game-based learning application, for online instruction.

## 2.3. Examination Process

- A specific group of students participated in the study project, undergoing a pre-test and a post-test for the final examination.
- The pre-test assessed students' knowledge or ability before instructional intervention.
- The post-test evaluated mastery of content after receiving instruction.
- The post-examination included a thinking exam (Weighted at 75 points) and a numerical test (Weighted at 25 points), totaling a maximum score of 100 points.
- The test's reliability coefficient of 0.85 indicates a high level of consistency in its results.

Data Analysis: Quantitative data analysis methods were employed, following the approach outlined by AlAli and Al-Barakat [25]. We conducted statistical analyses, including descriptive statistics and inferential analyses, to evaluate the influence of Kahoot! on the academic performance of gifted students. The three-stage research design aligned with the methodological recommendations of Cohen, et al. [26].

## 3. FINDINGS AND DISCUSSION

This section focuses on analysing quantitative and qualitative data obtained from the questionnaire responses of gifted students. We conducted a comprehensive analysis of the questionnaire responses, meticulously recording each respondent's answers to each question. Prior to implementing Kahoot! for online learning, the researcher gathered data from gifted students to gain insights into their specific needs.

The data analysis revealed that gifted students expressed a need for assistance in finding suitable online learning methods. They found the traditional instruction format monotonous, as teachers predominantly relied on a limited range of media. Table 1 presents the findings that textbooks and worksheets were the most frequently employed teaching methods among most teachers, with 61.2% and 22.1% of teachers considering them effective, respectively. Teachers rarely utilized game-based online learning platforms. The preference for textbooks can be attributed to their availability and perceived usefulness, as they are an integral part of the Curriculum 2017, endorsed by the Ministry of Education.

**Table 1.** Media utilized in online learning and forms of entertainment in educational media.

Statement	Forms of entertainment and percentage			
Teachers employ various types of media to support instruction during the online learning process.	Textbook (61.2%)	Students' worksheet (22.1%)	Presentation slide (9.9%)	Game (6.5%)
Participants' opinions on the most suitable form of amusement to be incorporated into instructional materials.	Game (48.7%)	Comic (31.3%)	Video (13.4%)	Music (6.4%)

However, teachers acknowledged the immense potential of game-based learning platforms for enhancing online education. This recognition underscores the benefits of incorporating interactive and engaging methods into the learning process, as observed by the teachers in this study.

The importance of having effective teaching methods and incorporating enjoyable elements into online learning cannot be understated. This necessitates using modern platforms like Kahoot! to enhance the learning experience. The enthusiastic responses from students regarding their preferred forms of amusement in educational media further validate this need. According to the data presented in Table 1, 48.7% of online learners preferred gaming as a source of entertainment. However, it is essential to note that meeting the needs of gifted students requires more than just gaming. This issue stems from teachers' lack of knowledge and experience and concerns about the potential financial implications of incorporating educational media [27].

Over the years, the academic community has developed numerous educational platforms [15, 28]. Researchers have recognized educational games as effective tools for enhancing student learning among these platforms [28]. Following the implementation of Kahoot! for online learning, a subsequent questionnaire was administered to gifted students to evaluate their experience with the platform. The questionnaire aimed to assess their satisfaction with Kahoot! and determine the impact of incorporating engaging and enjoyable elements in online education. Out of the 112 gifted students surveyed, an overwhelming majority of 91.7% believed that online education should include exciting and enjoyable elements. This finding underscores the importance of incorporating a sense of joy and engagement in the classroom environment, as it helps maintain student involvement.

One of the gifted students raised a thought-provoking question: "Would the inclusion of entertaining learning media, such as the Kahoot! platform, significantly impact the issue of losing concentration during learning?" This question garnered support from the majority of students, with only 6.14% expressing disagreement. Previous research conducted by Daryanes and Ririen [29] also supports the idea that media-enhanced learning is more engaging for students. Moreover, it is noteworthy that 75.04% of the 112 students surveyed disagreed with the statement, "Even though I use Kahoot! which is fun, I still find it more difficult to understand the subject matter." This further highlights the significance of Kahoot! -based learning for Jordanian gifted students, emphasizing its positive impact on their learning experience.

**Table 2.** Primary reasons cited by students for choosing Kahoot! in the online learning environment.

Statement	Forms of entertainment and percentage			
I am curious about the rationale behind your choice of employing Kahoot! for numerous online learning activities.	Facilitating students to enhance their understanding of the material (20.3%)	Infusing enthusiasm and diversity into the online learning experience (41.2%)	Augmenting students' concentration on their studies (10.5%)	Boosting student motivation to learn through assistance (27.8%)

Kahoot! has the potential to play a crucial role in educational activities due to a variety of factors. Statistical data indicates that most gifted students believe incorporating at least one game into their online education would make it more enjoyable. These students view Kahoot's entertainment value as a beneficial factor that enhances learning and makes the educational experience more engaging. Additionally, gifted students express the belief that Kahoot! has the potential to enhance their learning outcomes. Table 2 reveals that a significant number of gifted students strongly believe in integrating Kahoot! Online instruction would effectively reduce boredom.

Furthermore, these students believe in the effectiveness of the game-based platform Kahoot! It can help them study more efficiently and derive greater enjoyment from learning. The survey results overwhelmingly support the use of Kahoot! for online learning, with the majority of gifted students endorsing its implementation as a mandatory tool. This research highlights the inclination of online gifted students to seek engaging learning experiences to combat monotony. Therefore, depending on individual perspectives, the game-based platform of Kahoot! It can potentially assist gifted students in avoiding the monotonous aspects of online learning.

Concurrently, an evaluation is being conducted to compare the problem-solving skills of gifted students using Kahoot! The comparison begins by summarizing the normality and homogeneity tests conducted on the experimental and control groups. We then examine the mathematical problem-solving abilities of the gifted students in both groups before and after the intervention. A pre-test is administered to assess their problem-solving skills, and following the intervention, the post-test scores of the experimental and control groups are compared to evaluate their proficiency in solving mathematical problems. The subsequent sections (Table 3) present the statistical data test results, providing further insights and analysis on this comparison.

**Table 3.** Statistical data results of students' worksheets in the learning of mathematics.

Test	Group	Statistics test	df	Sig. value
Pre-test	• Learning with Kahoot!	0.81	82	0.07
	• Kahoot! In the online educational setting	0.83	82	0.12
Post-test	• Learning with Kahoot!	0.84	82	0.06
	• Kahoot! In the online educational setting	0.86	82	0.13

According to a study, the Kahoot! platform has been found to outperform online learning in terms of learning efficacy. There are notable differences in the effectiveness of these two approaches. As shown in Table 3, the study's findings reveal a significant 8.27-point difference in post-test scores between the experimental and control groups, indicating a meaningful interaction. A comparative analysis of the results further supports this conclusion. Prior research has shown that Kahoot! can potentially reduce the achievement gap between students learning online and those attending traditional in-person classes. Specifically, a study conducted in Jordan found that Kahoot! significantly benefited gifted students in the online learning environment.

Surprisingly, despite the challenges of online learning, gifted students use Kahoot! Achieved better academic outcomes compared to their peers who relied on traditional textbooks or conventional learning methods. This finding emphasizes the importance of integrating Kahoot!'s interactive learning environment [30] supporting previous research in this area.

Additionally, the research reveals that gifted students not only enjoy learning through Kahoot! But they also demonstrate significant progress in their learning outcomes. Given Jordan's emphasis on online education and the positive reception of the Kahoot! It is crucial for Kahoot! to enhance its support for gifted students in adapting to diverse online learning environments further. The platform should be flexible enough to accommodate each student's unique learning strategies and preferences. Consequently, gaining a comprehensive understanding of the learning preferences of gifted students becomes essential to advancing online education in Jordan.

Researchers conducted a small-scale study in a fictional teacher education program to explore the experiences of using Kahoot! as a gamified formative assessment tool. The initial quantitative findings revealed that most participants hadn't previously used a computer-based response system for in-class evaluations. Nevertheless, they were learned from using Kahoot! They were so impressed that they even suggested all teachers use it. The participants views on using Kahoot! as a formative assessment tool were positive and beneficial. These results align with studies conducted on electronic response systems such as Kahoot! For instance, Frisnoiry, et al. [31] stated that a significant percentage of preservice teachers found Moodle e-exams beneficial and supportive of their learning, and they desired to use them in other sessions. The conclusions drawn in this study were based on the responses of preservice teachers who had firsthand experience with electronic tests.

Further research conducted by Prieto, et al. [32] demonstrated the use of Kahoot! Using gamification to evaluate students' progress resulted in outcomes including increased attendance, intrinsic motivation, and attentiveness. Kahoot! has become widely popular as a response system. According to Saraçoğlu and Kocabatmaz [33] Kahoot! showed higher levels of emotional and behavioural engagement among students compared to other platforms, like ClassDojo, Facebook, Survey, and Padlet.

This study effectively integrates game-based learning into the education of gifted students. Teachers can captivate students by incorporating game elements into the course content using Kahoot! a recognized platform for gamification of education. By infusing fun challenges and healthy competition, gamification enriches the learning journey. The integration of gamification within the learning platform positively impacted perceived usefulness and satisfaction. Moreover, evidence suggests that gamification may improve academic achievement and enhance understanding of subjects. By offering gifted students' comfort and satisfaction, gamification has the potential to impact them positively on an individual level. The research study also revealed that gifted students evaluated Kahoot! Positively in terms of its effectiveness as a gamified formative assessment tool.

The effectiveness of Kahoot! It can have an impact on its usage by students. This research demonstrates that the individual impacts, such as improved grades and better comprehension of course content, can influence the desire to continue using Kahoot! The study has generated empirical findings that suggest teachers need to strategically and efficiently integrate Kahoot! Into the classroom to predict gifted students' continued usage. Teachers who utilize Kahoot! as an educational tool should consider the facility and infrastructure conditions, including internet bandwidth and the accessibility of phones and laptops for gifted students. The availability of adequate infrastructure and amenities can impact the satisfaction of gifted students. Teachers can administer questionnaires before class to assess student amenities and infrastructure availability.

Furthermore, this research offers guidance on incorporating Kahoot! Points into grading and recommends that gifted students clearly understand how this grading system impacts their performance. Additionally, the research assists teachers in predicting the duration of exams by considering the difficulty of the questions and the resources and infrastructure available to gifted students.

A thorough examination of the open-ended responses provided by gifted students revealed that Kahoot!'s primary strength lies in its capacity to improve information retention while functioning as a formative assessment tool. It lies in its capacity to improve information retention while functioning as a formative assessment tool. These two aspects together establish Kahoot! as a precious tool for formative evaluation in the education of gifted students. Researchers conducted a five-week study using Kahoot! For gamified formative assessment that showed improvement in gifted students' midterm exam scores when compared to other students who did not participate in the five-week gamified formative evaluation. Previous research using student self-reports or experimental studies has also indicated a positive impact on academic success. For instance, in the study conducted by Pais, et al. [34] it was discovered that a significant majority of university students (86.5% out of 139) reported that Kahoot! helped them conceptualize course material.

Similarly, Rajendran and Shah [35] found that 74% of the 127 students surveyed stated that e-exams, such as those facilitated by Kahoot!, helped them identify and address gaps in their knowledge. Moreover, Sagala and Rezeki [36] conducted a study where 74% of the participating students found Kahoot! Beneficial in their exam preparation. Field Umboh, et al. [37] reported that 75% of the respondents in their study extended their study time to prepare for pre-lesson Kahoot! quizzes, indicating the platform's positive impact on student engagement and motivation. Oktaria, et al. [27] conducted research specifically focusing on aspiring mathematics teachers and found that Kahoot! facilitated learning of computer-related topics by making the material more readily accessible, improving retention, and accelerating the learning process. Furthermore, AlAli and Al-Barakat [28] observed that the platform led to improvements in test performance for all participants in their study on the effects of Kahoot! on science terminology test scores among six students with learning disabilities. This finding highlights the inclusive nature of Kahoot! as an educational tool that can benefit students with diverse learning needs.

According to the present study's findings, researchers frequently described Kahoot! as an enjoyable, entertaining, and even amusing tool [3, 9, 30]. Furthermore, according to a study conducted by Pratama, et al. [8] it was found that individuals who participated in Kahoot! Games, known for their competition, showed a sense of inner motivation. Another study conducted by Resmayani and Putra [13] revealed that the gamification aspect of

Kahoot! effectively encouraged learners, resulting in decreased absenteeism from classroom lectures and seminars. Rahmi and Ariawan [5] reported incorporating competitive gamified exercises using Kahoot! enhanced student engagement with the course material. This suggests that Kahoot's gamification feature creates an interactive and socially engaging learning environment.

Consequently, the formative assessment functions of Kahoot! significantly influenced participants' enjoyment and sense of fun. As a game, Kahoot! fosters a spirit of healthy competition, which may explain this phenomenon. Nevertheless, it is essential to note that the perception of competitiveness varies among individuals. The competitive atmosphere of Kahoot! encouraged students to participate or study more to achieve success.

#### 4. CONCLUSION

In conclusion, this research highlights the importance of perceived utility, individual impact, enjoyment, and competitiveness in influencing gifted students' continued usage of Kahoot! The findings emphasize the role of satisfaction and perceived usefulness in determining whether gifted students will continue to use the platform. The gamification elements of competitiveness and enjoyment contribute to gifted students' perceptions of usefulness, while the enjoyment component directly influences their satisfaction. These findings suggest that incorporating gamified elements, such as those found in Kahoot! into the educational process can enhance gifted student engagement and motivation.

The practical implications of this research are significant, particularly for teachers and educators considering integrating Kahoot! into their instructional practices. The study provides insights into the factors influencing students' sustained platform usage and offers recommendations for effectively incorporating it into the learning environment. By leveraging the gamification features of Kahoot! teachers can create an engaging and interactive classroom experience that promotes student participation and enjoyment.

However, it is essential to acknowledge the limitations of this research. The study participants' geographical distribution may limit the findings' generalizability to other regions. Future research should aim to include a more diverse sample of students from different universities across Indonesia to ensure broader applicability. Additionally, this study focused on evaluating Kahoot! as a platform; there is potential for further exploration by examining other gamified assessment tools like Mentimeter, Quizizz, Quizlet, and Schoology. Comparing different platforms could provide a more comprehensive understanding of the gamification approach in educational settings.

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**Transparency:** The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

**Competing Interests:** The authors declare that they have no competing interests.

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#### REFERENCES

- [1] Y. Wirani, T. Nabarian, and M. S. Romadhon, "Evaluation of continued use on Kahoot! as a gamification-based learning platform from the perspective of Indonesia students," *Procedia Computer Science*, vol. 197, pp. 545-556, 2022. <https://doi.org/10.1016/j.procs.2021.12.172>
- [2] K. E. K. Adnyani, I. W. Adnyana, N. N. Murniasih, N. Komang, and A. Suwastini, "Implementing Kahoot! for Japanese language learning in Indonesian high school," *Journal of Education*, vol. 6, no. 2, pp. 217-225, 2022.
- [3] Z. Yu, "A meta-analysis of the effect of Kahoot! on academic achievements and student performance," *Research Square*, vol. 42, no. 3, pp. 553-568, 2021.



- [4] S. N. Şad and Ö. Niyazi, "Using Kahoot! as a gamified formative assessment tool: A case study," *International Journal of Academic Research in Education*, vol. 5, no. 1-2, pp. 43-57, 2019.
- [5] A. Y. Rahmi and R. Ariawan, "Development of mathematics learning media using kahoot application," *Jurnal Prinsip Pendidikan Matematika*, vol. 4, no. 1, pp. 65-72, 2022. <https://doi.org/10.33578/prinsip.v4i1.104>
- [6] I. Suryati, R. Permatasari, A. P. Rofiana, R. N. Miftah, and W. S. Musthofa, "Game based assessment for learning during the pandemic: Kahoot!," *Jurnal Terapan Abdimas*, vol. 7, no. 1, pp. 60-67, 2021.
- [7] S. Saraswati, I. Rodliyah, and N. D. Rahmawati, "Higher order thinking skills: The process of developing questions with Kahoot asisted," *Inomatika*, vol. 4, no. 2, pp. 224-238, 2022. <https://doi.org/10.35438/inomatika.v4i2.345>
- [8] L. D. Pratama, E. Faizah, M. Putra, and D. Ramadhan, "Kahoot: Is it effective for online learning in Indonesia?," *Journal of Advanced Research Design*, vol. 6, no. 1, pp. 35-49, 2022.
- [9] M. Wahyuni, M. Fauziddin, and L. M. Rizki, "The effects of using Kahoot! on understanding the concept of mathematical symbols in higher education," *Al-Ishlah: Jurnal Pendidikan*, vol. 13, no. 3, pp. 1539-1545, 2021.
- [10] I. N. Fadillah, W. Susilawati, H. Sugilar, and R. Kariadinata, "Efektivitas Kahoot sebagai mathematics learning media on learning outcomes during the Covid-19 pandemic the effectiveness," *Jurnal IPA & Pembelajaran IPA*, vol. 12, no. 3, pp. 86-90, 2022.
- [11] N. H. Nadeem and H. A. Al Falig, "Kahoot! quizzes: A formative assessment tool to promote students' self-regulated learning skills," *Journal of Applied Linguistics and Language Research*, vol. 7, no. 4, pp. 1-20, 2020.
- [12] M. Mansur and D. Fadhilawati, "Applying kahoot to improve the senior high school students' vocabulary achievement," *Voices of English Language Education Society*, vol. 3, no. 2, pp. 164-173, 2019. <https://doi.org/10.29408/veles.v3i2.1591>
- [13] N. P. A. Resmayani and I. N. T. D. Putra, "Gamification: Using kahoot! to make students love the class from the very beginning," *Linguistics and ELT Journal*, vol. 7, no. 1, pp. 10-18, 2020.
- [14] M. Nasikhah, A. N. Dewi, A. W. Yulanta, N. Tasbihah, and F. Rahmawati, "The effectiveness of the speed test method using Kahoot! on three dimensional learning," *Journal of Authentic Research on Mathematics Education*, vol. 3, no. 1, pp. 1-9, 2021. <https://doi.org/10.37058/jarme.v3i1.2340>
- [15] H. Liberna, Y. B. Bhakti, and I. A. D. Astuti, "The innovation of learning mathematics on introduction of number for pre-school students," *Formatif: Jurnal Ilmiah Pendidikan MIPA*, vol. 11, no. 1, pp. 71-82, 2021.
- [16] V. R. Hidayati, S. Subanji, and S. Sisworo, "Students' mathematical connection error in solving PISA circle problem," *Jurnal Ilmiah Pendidikan Matematika*, vol. 8, no. 2, pp. 76-84, 2020.
- [17] H. Aiso and K. Reiss, "Mistake-handling activities in the mathematics classroom: Effects of an in-service teacher training on students' performance in geometry," *Uma Ética Para Quantos?*, vol. 33, no. 2, pp. 81-87, 2018.
- [18] M. Fitri, "Analysis of student errors in working mathematical problems in calculated operation materials fractions based on newman stages from adversity quotient (Case study in SMP Negeri 2 Sekampung)," *Journal Research of Social Science, Economics, and Management*, vol. 1, no. 7, pp. 754-758, 2022.
- [19] S. W. Pomalato, L. Ili, B. A. Ningsi, H. A. T. Fadhilaturrahmi, and K. H. Primayana, "Student error analysis in solving mathematical problems," *Universal Journal of Educational Research*, vol. 8, no. 11, pp. 5183-5187, 2020. <https://doi.org/10.13189/ujer.2020.081118>
- [20] F. C. Lai, "Error analysis in mathematics," *Behavioral Research and Teaching*, vol. 32, no. 2, pp. 1-9, 2018.
- [21] H. A. Priyani and R. Ekawati, "Error analysis of mathematical problems on TIMSS: A case of Indonesian secondary students," *IOP Conference Series: Materials Science and Engineering*, vol. 296, no. 1, pp. 22-36, 2018.
- [22] W. Yanuarto and F. Romadona, "Analysis of students' mathematical errors based on newman error analysis (NEA) in terms of learning style," *Jurnal Pendidikan Matematika*, vol. 3, no. 1, pp. 1-10, 2021.
- [23] R. Johar and K. R. Lubis, "The analysis of students' mathematical representation errors in solving word problem related to graph," *Jurnal Riset Pendidikan Matematika*, vol. 5, no. 1, pp. 96-107, 2018.

- [24] J. P. Makonye, "Learner mathematical errors in introductory differential calculus tasks: A study of misconceptions in the senior school certificate examinations," *Journal for Research in Mathematics Education*, vol. 3, no. 4, pp. 285–298, 2019.
- [25] R. AlAli and A. Al-Barakat, "Using structural equation modeling to assess a model for measuring creative teaching perceptions and practices in higher education," *Education Sciences*, vol. 12, no. 10, p. 690, 2022. <https://doi.org/10.3390/educsci12100690>
- [26] L. Cohen, L. Manion, and K. Morrison, *Research methods in education*, 6th ed. London and New York: Routledge Falmer, 2007.
- [27] A. A. Oktaria, L. Rohmayadevi, and D. Murwantono, "Online game quiz “Kahoot” in teaching english for students of SMP Muhammadiyah Yogyakarta," *Project (Professional Journal of English Education)*, vol. 4, no. 2, pp. 290–296, 2021.
- [28] R. M. AlAli and A. A. Al-Barakat, "Instructional illustrations in children’s learning between normative and realism: An evaluation study," *Plos One*, vol. 18, no. 9, p. e0291532, 2023. <https://doi.org/10.1371/journal.pone.0291532>
- [29] F. Daryanes and D. Ririen, "Effectiveness of using the Kahoot application as an evaluation tool for students," *Journal of Natural Science and Integration*, vol. 3, no. 2, pp. 172–186, 2020. <https://doi.org/10.24014/jnsi.v3i2.9283>
- [30] L. Lisnani and G. Emmanuel, "Analysis of the use of Kahoot applications in IPA learning," *Jurnal IPA & Pembelajaran IPA*, vol. 4, no. 2, pp. 155–167, 2020. <https://doi.org/10.24815/jipi.v4i2.16018>
- [31] S. Frisnoiry, T. M. Siregar, and I. Taufik, "E-Learning technology: Kahoot application as a learning evaluation tool," *Solid State Technology*, vol. 63, no. 5, pp. 4396–4404, 2020.
- [32] M. C. Prieto, L. O. Palma, P. J. B. Tobías, and F. J. M. León, "Student assessment of the use of Kahoot in the learning process of science and mathematics," *Education Sciences*, vol. 9, no. 1, pp. 443–458, 2019.
- [33] G. Saraçoğlu and H. Kocabatmaz, "A study on Kahoot and socratic in line with preservice teachers’ views," *Educational Policy Analysis and Strategic Research*, vol. 14, no. 4, pp. 31–46, 2019. <https://doi.org/10.29329/epasr.2019.220.2>
- [34] S. Pais, A. Pires, and L. Chagas, "Enhancing student motivation with Kahoot! - a case study in English and mathematics," *Edulearn18 Proceedings*, vol. 1, no. 1, pp. 5518–5522, 2018.
- [35] T. Rajendran and D. M. Shah, "Students perception on gamification: The use of Kahoot," *International Journal of Scientific and Research Publications*, vol. 10, no. 05, pp. 773–783, 2020. <https://doi.org/10.29322/ijsrp.10.05.2020.p10190>
- [36] R. W. Sagala and T. I. Rezeki, "The utilization of MOOCs using Kahoot and student engagement in digital learning during Covid-19 pandemics," *SALTeL Journal (Southeast Asia Language Teaching and Learning)*, vol. 5, no. 1, pp. 01–07, 2022. <https://doi.org/10.35307/saltel.v5i01.82>
- [37] D. Umboh, D. Tarusu, A. Marini, and M. S. Sumantri, "Improvement of student mathematics learning outcomes through Kahoot learning games application at elementary school," *Journal of Physics: Conference Series*, vol. 1869, no. 1, pp. 135–149, 2021. <https://doi.org/10.1088/1742-6596/1869/1/012124>

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