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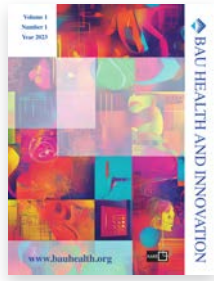

Original Article

Determination of the Effect of Kahoot Application in Blood Gas Analysis of Nursing Students

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Abstract

Objectives: The aim of the study was to determine the effect of Kahoot application on arterial blood gas assessment of nursing students.

Methods: The study was conducted in a quasi-experimental design with a study and control group with the students of the Surgical Diseases Nursing lecture of a foundation university who took the subject of arterial blood gas assessment and acid-base imbalances.

Results: The average age of participants was 20.50±1.55 years. Of the students, 87.2% were female, and 12.8% were male. A significant difference was found between the study and control groups in achievement levels after the Kahoot application (t[76]=6.404; p=0.000 <0.05). The study group showed a significant improvement in achievement after using Kahoot compared to their pre-Kahoot performance (t=-6.133; p=0.000 <0.05; d=1.037; 95% confidence interval=-3.233/-1.624).

Conclusion: The study found that students' achievement improved significantly after using Kahoot. Their attitudes and motivation toward gamification were also positive. It is recommended to incorporate Kahoot into the nursing education curriculum to enhance student learning.

Keywords: Achievement, attitude, blood gas analysis, gamification, motivation, nursing student.

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Arterial blood gas results can help to assess the patient's ventilation and acid-base balance.[1] It is very important for nurses to be able to interpret patients' acid-base balance and blood gas values to provide appropriate treatment to the patient.[2] Knowledge of blood gas interpretation is taught to nurses in nursing schools during their student years. It is vital for a student nurse to know how to interpret blood gas values to improve the quality and impact of health care, as correct interpretation can be critical to patient survival. However, blood gas analysis and interpretation can be a difficult and daunting concept to grasp, even for the most experienced students.[1,3] Nowadays, arterial blood gas interpretation can be made more enjoyable for students, as well as nurses and nurse educators, using game-based applications that have been developed with the advancement of technology.[3] These applications also allow for play while learning and thus can capture the interest of the user.[4] One of the game-based learning methods that is one of the technologies that will make learning fun and continuous for students is the Kahoot application.[5] Kahoot is an easy-to-use educational game application used by more than 2.5 billion people in 180 countries and requires only the user's own mobile phone.[2,6,7] The literature reports that the Kahoot application has numerous positive effects, such as improving classroom interaction and collaboration, while increasing student

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engagement, lecture performance, motivation, and grades.[5,8–17] It allows students to identify their own knowledge gaps, clarify misconceptions, and review key concepts.[18] With the innovations brought about by the globalizing world, it is inevitable to actively adopt new methods in nursing education.[19] When searching the literature in line with these data, Boyd et al.[20] found a study evaluating the effect of gamification in arterial blood gas assessment, while no study on this subject was found in our country. The aim is for nursing students to learn about arterial blood gas analysis using the online tool called Kahoots.

Materials and Methods

Ethical Considerations

The necessary approvals were obtained from the Ethics Committee of the university where the study was conducted (Ethics Committee No = 2022/146–21 September 2022). The study was conducted in accordance with the Declaration of Helsinki.

Study Design

The study was a quasi-experimental study consisting of a study group and a control group. The population of the study consisted of students (n=82) who took the arterial blood gas assessment course in the Surgical Diseases Nursing course in the undergraduate program of a university, and the sample consisted of students (n=78) who volunteered to participate in the study. Data were collected between March and May 2023.

Implementation of the Study

The content of the study was explained to the students and informed consent was obtained from those students who agreed to participate in the study. Subsequently, arterial blood gas assessment was explained in the context of the Surgical Nursing lecture, and at the end of the lecture, a success questionnaire containing various questions in line with the objectives and outcomes of the lecture was administered to all students who agreed to participate in the study. Students who agreed to participate in the Kahoot application were included in the study group (n=35) and students who did not agree to participate in the Kahoot application were included in the control group (n=43). According to Yapici and Karakoyun,[21] Kahoot should be used after the subject has been taught. Repetition at the end of the lecture provides reinforcement and makes the subject more memorable. Based on these data, the Kahoot application prepared by the researchers on arterial blood gas assessment was administered to the students in the study group 3 times in the following weeks. A login code was sent to the students' mobile phones, allowing them to log into the system and earn points by answering the questions one at a time. In all three applications, the winners were announced to ensure competition, and the winners were celebrated as a class. One week after these three Kahoot applications, the performance questionnaire was administered again. Immediately afterward, the Kahoot Application Evaluation Questionnaire, the Gamification Method Motivation Scale, and the Gamification Application Attitude Scale were also administered. No questionnaires were administered to the students in the control group as no intervention took place.

Data Collection Instruments

Achievement questionnaire

Ten questions were prepared using the literature on arterial blood gas assessment.[1,2] The case questions, which gave the patients' arterial blood gas results, asked what acid-base imbalance was present in the patients. The questions were asked after the theoretical lecture on the application and then the same questions were asked again after the Kahoot application was performed 3 times to the students in the study group. The reliability of the success questionnaire was found to be as high as Cronbach's Alpha = 0.806.

Kahoot application evaluation questionnaire

The questionnaire, which was based on the literature, asked students what they thought about the Kahoot application, whether it had an effect on their success, what they liked and disliked about it, their preference for this application for the current lecture, and other lectures, and their suggestions for the application.[17,22–26] The questionnaire was administered to the students in the study group after the Kahoot application.

Gamification method motivation scale

To determine the effect of using Kahoot on students' motivation, the Motivation Scale developed by Shi and Cristea[27] based on self-determination theory and adapted into Turkish by Türkan[28] was used. The scale consists of 12 5-point Likert items. The 1st, 2nd, 3rd, and 4th items of the motivation scale consist of questions that aim to determine the autonomy status of students. The 5th, 6th, 7th, and 8th questions of the scale consisted of questions aimed at determining the students' level of competence. The 9th, 10th, 11th, and 12th questions of the scale consist of questions to determine the relationship levels of the pupils. The scale was administered to the students in the study group after the Kahoot application. In the study, the reliability of the Motivation Gamification Method Scale was found to be high as Cronbach's Alpha = 0.856.

Table 1. Normal distribution

	Kurtosis	Skewness
Achievement status before Kahoot application	-0.812	0.036
Achievement status after Kahoot application	-1.318	-0.203
Gamification application attitude scale score	0.755	1.010
Gamification method motivation scale	-1.196	-0.159
Autonomy	-0.527	-0.676
Competence	-1.282	-0.033
Relationship	-0.187	-0.599

Gamification applications attitude scale

To determine students' attitudes toward the Kahoot application, the "Gamification Attitude Scale," adapted to gamification by Türkan[28] from the "Augmented Reality Applications Attitude Scale" developed by Yilmaz et al.,[29] was used. The scale has 15 items in a 5-point Likert type. Scores between 15 and 75 can be obtained from the scale. A high score can be interpreted as a positive attitude toward the course. The scale was applied to the students in the study group after the Kahoot application. In the study, the reliability of the Gamification Application Attitude Scale was found to be high as Cronbach's Alpha = 0.943.

Data Analysis

The data obtained in the study were analyzed in a computer environment using the statistical program Statistical Package for the Social Sciences for Windows, Version 22 (IBM SPSS Statistics for Windows, Version 22. Armonk, NY: IBM Corp). Frequency and percentage analyses were used to determine the descriptive characteristics of the students who participated in the study, and mean and standard deviation statistics were used to examine the scale. Kurtosis and skewness values were analyzed to determine whether the research variables were normally distributed. The variables were found to be normally distributed (Table 1).[30,31] Parametric methods were used to analyze the data. Differences between the rates of categorical variables in independent groups were analyzed using Chi-squared and Fisher exact tests. Differences in scale scores between groups were analyzed by dependent groups t-test, and changes between repeated measurements were analyzed by dependent groups t-test. The relationships between the dimensions determining the scale scores were analyzed using Pearson correlation analyses.

Results

The mean age of the students participating in the study was 20.50±1.55 years, 87.2% were female and 12.8% were male. There was no significant difference between the groups in terms of gender and mean age (p>0.05) (Table 2).

The achievement of the control group was measured once. The post-lesson achievement of the study group was compared with both the post-Kahoot achievement and the post-lesson achievement of the control group. No significant difference was found between the study and control groups in terms of post-lesson achievement (p>0.05). Both groups showed similar performance after the lesson. However, the achievement of the study group after the Kahoot application ($\bar{x}$=6.086) was significantly higher than the achievement of the control group after the lesson ($\bar{x}$=2.837). A significant difference was found between the two groups after the Kahoot application (t[76]=6.404; p=0.000 <0.05). The achievement of the study group also increased significantly after Kahoot compared to before Kahoot (t=-6.133; p=0.000 <0.05; d=1.037; 95% CI[L/U]=-3.233/-1.624) (Table 3).

The mean of the "Gamification Application Attitude Scale" of the students who applied Kahoot was 52.086±9.748 (min=35; max=75), the mean of the "Gamification Method Motivation Scale" was 49.086±8.813 (min=32; max=60), the mean of "autonomy" was 16.629±3.309 (min=9; max=20), the mean of "competence" was 16.143±3.069 (min=11; max=20), the mean of "relationship" was 16.314±3.471 (min=7; max=20) (Table 4).

Table 2. Descriptive characteristics

	Study group		Control group		Total		p
	n	%	n	%	n	%	
Gender							
Male	6	17.1	4	9.3	10	12.8	X^2=1.061
Female	29	82.9	39	90.7	68	87.2	0.245
	Mean	SD	Mean	SD	Mean	SD	
Age	20.740	1.704	20.300	1.406	20.500	1.552	0.215

Chi-squared test; Independent groups t-test. SD: Standard deviation.

Table 3. Distribution of achievement status by groups

Gruplar	Study group (n=35)		Control group (n=43)		t[a]	p
	Mean	SD	Mean	SD		
Post-lecture achievement status	3.657	1.282	2.837	2.400	1.820	0.058
Achievement status after Kahoot application to the study group	6.086	1.991	2.837	2.400	6.404	0.000
t[b]	-6.133		–			
p	0.000		–			

[a]: Independent groups t-test, [b]: Dependent groups t-test. SD: Standard deviation.

Table 4. Gamification applications attitude and gamification method motivation score averages

	n	Mean	SD	Min	Max
Gamification applications attitude score	35	52.086	9.748	35.000	75.000
Gamification method motivation score	35	49.086	8.813	32.000	60.000
Values related to gamification method motivation scale items					
Autonomy	35	16.629	3.309	9.000	20.000
Competence	35	16.143	3.069	11.000	20.000
Relationship	35	16.314	3.471	7.000	20.000

In student evaluations, 85.7% found Kahoot to be a good tool, positively impacting their success. They also preferred using it in current and future courses. In addition, 60% believed Kahoot improved their attitude toward the course and felt the reward system increased their motivation. A small percentage (2.9%) suggested adding more visual content, increasing question variety and length, and avoiding grade impacts (Table 5).

A medium, positive correlation was observed between achievement before and after Kahoot (r=0.692; p=0.000 <0.05). A weak, negative correlation existed between gamification application attitude and post-Kahoot achievement (r=-0.391; p=0.020 <0.05). Motivation and attitude toward the gamification method showed a medium, positive correlation (r=0.598; p=0.000 <0.05). Autonomy was positively correlated with both attitude (r=0.525; p=0.001 <0.05) and motivation (r=0.879; p=0.000 <0.05). Competence had medium, positive correlations with attitude (r=0.538; p=0.001 <0.05) and very high, positive correlations with motivation (r=0.930; p=0.000 <0.05). Autonomy and competence also had a high, positive correlation (r=0.767; p=0.000 <0.05). The relationship subscale showed medium, positive correlations with attitude (r=0.543; p=0.001 <0.05) and autonomy (r=0.600; p=0.000 <0.05), and a high, positive correlation with competence (r=0.747; p=0.000 <0.05). Relationship and motivation were strongly correlated (r=0.879; p=0.000 <0.05). Correlations among other variables were not statistically significant (p>0.05) (Table 6).

Discussion

The study shows that students' use of Kahoot increased their success in blood gas assessment analysis. Based on the results of the study, it can be said that the use of Kahoot has a positive effect on student success. In Warsihna et al.'s[32] study of undergraduate psychology students, Kahoot was applied to a single group, and pre- and post-test scores were compared, and it was found that Kahoot application can increase learning success by finding a significant difference in scores. In Kinder and Kurz's study[33] with nursing students, Kahoot was applied to one group at the end of the lecture and all students took the same final examination, and it was found that the research group had higher test scores than the control group. In the study conducted by Öz and Ordu[34] on nursing students, the experimental group was given Kahoot application, the control group was given face-to-face training, and it was found that the mean knowledge score of the experimental group was higher than that of the control group. In El-Aziz Mohamed et al.'s[6] study, the group of nursing students who used Kahoot had higher learning outcomes than the control group. Yu's[35] meta-analysis study investigating

Table 5. Distribution of Kahoot application evaluations

	Frequency (n)	Percentage
What do you think of the Kahoot method after lecture?		
A beautiful application	30	85.7
Good	2	5.7
Tutorial	2	5.7
Normal	1	2.9
Did the application have a positive impact on your achievement?		
Yes	30	85.7
No	5	14.3
What do you like and dislike about the app?		
Nothing I don't like	17	48.6
A beautiful application	9	25.7
Neutral	2	5.7
Too long	2	5.7
Creates stress	1	2.9
I like it	1	2.9
I don't like that it's a classic question	1	2.9
Being slow	1	2.9
It's fun	1	2.9
Did the Kahoot App positively affect your attitude toward the lecture?		
Yes	21	60.0
No	14	40.0
Would you prefer this application for the current lecture and other lecture?		
Yes	30	85.7
No	5	14.3
Did the reward given at the end of the practice motivate you toward the lecture?		
Yes	21	60.0
No	14	40.0
Write down your suggestions for application		
No suggestions	31	88.5
Did not want their grades to be affected	1	2.9
Increase question variety	1	2.9
More visuals	1	2.9
Duration may be increased	1	2.9

the effect of using Kahoot shows that both academic achievement and student performance are significantly higher in the experimental group than in the control group. It is believed that the instant feedback feature of the Kahoot application we used encourages student participation, improves classroom dynamics, and thus can close students' knowledge gaps and improve their learning.

In the study, it was found that students' attitudes toward gamification applications were positive and students' motivation toward the gamified lesson was high. When examining the scores obtained by the students from the sub-dimensions of the motivation scale of the gamification method, it can be said that the desire to develop personal achievement and positive attitude, the ability to interact effectively with and adapt to the environment, to be in contact with others, and to feel a sense of belonging to the social environment in which they are located are high. Similar to this study, Ertan's dissertation study[17] found that the average motivation and attitude of students were high after using Kahoot and Socrates gamification in the English classroom of university students. In Sun and Hsieh's study,[36] it was found that the system combining gamification components improved students' intrinsic motivation through its fun, interactive, and innovative features. In the literature review conducted by Wang and Tahir,[5] the application of Kahoot improved teacher–

Table 6. Correlation analysis

	Total achievement status before Kahoot	Total achievement status after Kahoot	Gamification applications attitude scale score	Gamification method motivation scale score	Autonomy	Competence	Relationship
Total achievement status before Kahoot							
r	1.000						
p	0.000						
Total achievement status after Kahoot							
r	0.692**	1.000					
p	0.000	0.000					
Gamification applications attitude scale score							
r	0.217	-0.391*	1.000				
p	0.211	0.020	0.000				
Gamification method motivation scale score							
r	-0.112	-0.185	0.598**	1.000			
p	0.522	0.288	0.000	0.000			
Autonomy							
r	-0.073	-0.205	0.525**	0.879**	1.000		
p	0.679	0.238	0.001	0.000	0.000		
Competence							
r	-0.144	-0.257	0.538**	0.930**	0.767**	1.000	
p	0.409	0.136	0.001	0.000	0.000	0.000	
Relationship							
r	-0.087	-0.047	0.543**	0.879**	0.600**	0.747**	1.000
p	0.617	0.790	0.001	0.000	0.000	0.000	0.000

*: <0.05, **: <0.01, pearson correlation analysis.

student and student–student interaction, and the student actively participated in the lecture and was willing to answer the questions. In the study by El-Aziz Mohamed et al.,[6] with nursing students, it was reported that students showed high levels of motivation, participation, and enjoyment in the use of Kahoot. It has been shown that Kahoot application as a game-based learning method has detailed promising effects on online game-based learning instruments, and student engagement and motivation in different disciplines such as Pharmacy,[37] Veterinary Medicine,[38] Medicine,[39] and Nursing.[6]

In the study, the majority of students reported that the Kahoot application had a positive effect on their success, that it had a positive effect on their attitude toward the lecture, that they would prefer to use this application in the current lecture and other lectures, that the reward at the end of the Kahoot application (first place ranking) increased their motivation toward the lecture, and almost half of them reported that there was nothing they did not like about the Kahoot application. In Licorish et al.'s study,[22] students found the Kahoot application enjoyable and stated that the application motivated them to pay attention, and all reported that using the Kahoot application in the lecture had a positive effect on the knowledge and skills they acquired. In the study by Pinna et al.[24] with undergraduate students, the use of Kahoot was rated as a positive experience for the students as it increased their engagement and motivation. Wang and Tahir[5] reported that students felt positive about using Kahoot. In Coveney et al.'s[26] study of nursing students, students reported that the Kahoot application was easy to use and helpful for learning. In Ertan's[17] study with undergraduate students using Kahoot and Socrates applications, students stated that the gamification application was fun and motivating, their participation in the lecture increased due to gamification, their learning became easier; they liked the sense of competition created by gamification, the fact that it was done over social media, that it provided socialization,

that it increased the feeling of flow and self-confidence, and they wanted to use the application in the lecture and other lectures. In the same study, almost all students reported that they did not see any negative aspects of the gamification application. In Hershorin's[25] study of nursing students' experiences with the Kahoot application after the pediatrics lecture, it was found that all students found the Kahoot application easy to use, reported that the application was fun and interactive, and enjoyed the competitive nature of the application. In the Kahoot workshop conducted by Sabandar et al.,[23] it was found that participants were enthusiastic during the application due to the challenging and competitive nature of the Kahoot application, found the application fun, increased their knowledge of the application, and recommended the application to others. In the study by Pinna et al.,[24] the ability of the Kahoot application to encourage and motivate learning by promoting fun, participation, and competition in the lecture were identified as positive aspects of the application. In Kahoot, the correct answers are hidden until all students have given their answers. This increases attention, concentration, and motivation by making students curious.[5] It is also reported to increase competition in the classroom as students see their names at the top of the leaderboard.[22] Thus, in a competitive and fun environment, students are encouraged to actively learn and play to achieve better academic success.[14]

The study found a positive correlation between students' scores on the Gamification Application Attitude Scale and the Gamification Method Motivation Scale when using Kahoot. It was found that students who had more positive attitudes toward the gamified aspects of Kahoot tended to have higher levels of motivation when interacting with the application. This finding highlights the potential of gamification as an effective educational instrument, where positive attitudes toward gamified elements can increase students' motivation and engagement in the learning process, leading to more productive and enjoyable educational experiences. When assessing the relationship between the motivation of gamification methods and their subdimensions, the increase in autonomy can lead to an increase in students' intrinsic motivation and satisfaction. As students receive feedback and their performance is valued, their competence and consequently their motivation may increase. In terms of relatedness, students may feel more motivated if they have the opportunity to compete with each other and share their achievements in a supportive community. In the areas of autonomy, competence, and relatedness, it can be said that students' personal achievements, their interactions with their environment (peer-teacher), and their sense of belonging to the environment they are in have increased with the use of Kahoot and they are willing to use it because of all these positive aspects. This situation can contribute positively to students' motivation to learn and their success in school. It can also minimize students' anxiety about learning concepts that are difficult to understand. By incorporating these subdimensions of motivation into the Kahoot application, educators can make the application more engaging and motivating for students.

Limitations

The study is limited to students attending the Surgical Nursing course at a single center of a university and cannot be generalized. The performance questionnaire was administered to the students in the control group after the course and no comparison could be made between pre- and post-test measurements. Therefore, the inability to collect more data for the control group is among the limitations. It is recommended that future studies should increase the sample size and conduct research with randomly assigned groups.

Conclusion

The study found that students' performance improved after using Kahoot, and their attitudes and motivation toward gamification were positive. The Kahoot application is a gamified learning platform that improves student learning and motivation. It gives students the opportunity to practice on different subjects. Teachers can create Kahoot quizzes by creating questions based on course content for pre-lesson preparation, active class participation, and group work. It is recommended that the Kahoot application be integrated into the nursing curriculum to support teacher and student learning.

Disclosures

Ethics Committee Approval: The study was approved by the Lokman Hekim University Non-interventional Clinical Research Ethics Committee (no: 2022/146, date: 21/09/2022).

Authorship Contributions: Concept – B.P., H.S., A.B.; Design – B.P., H.S.; Supervision – B.P.; Funding – H.S., A.B.; Materials – H.S.; Data collection and/or processing – H.S., A.B., B.P.; Data analysis and/or interpretation – B.P.; Literature search – B.P.; Writing – B.P., H.S.; Critical review – B.P., H.S., A.B.

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References

1. Schneiderman J, Corbridge S, Zerwic JJ. Demonstrating the effectiveness of an online, computer-based learning module for arterial blood gas analysis. Clin Nurse Spec 2009;23(3):151–5.
2. Mohammed MH, Abdelatief AD. Easy blood gas analysis: Implications for nursing. Egypt J Chest Dis Tuberc 2016;65(1):369–76.
3. Barnette L, Kautz DD. Creative ways to teach arterial blood gas interpretation. Dimens Crit Care Nurs 2013;32(2):84–7. Erratum in: Dimens Crit Care Nurs 2013;32(3):117.
4. Sianturi AD, Hung RT. The challenges of using Kahoot! in teaching and learning in higher education: A systematic review. In: Proceedings of the 6th International Conference on Digital Technology in Education. New York (NY): Association for Computing Machinery; 2023. p. 72–7.
5. Wang AI, Tahir R. The effect of using kahoot! for learning – A literature review. Comput Educ 2020;149:103818.
6. El-Aziz Mohamed HNA, Saleh NMH, El-Gilany AH, Alam RR. Effect of Kahoot game based versus nongame based on learning achievements and anxiety among nursing students. Egypt Nurs J 2022;19:157–163.
7. Suryandari G, Al-Ghifari Sudarmanto A. Kahoot! application in medical education: A fact for student motivation level. JMMR 2024;9(2):173–9.
8. Wan Hamzah WMAF, Haji Ali N, Mohd Saman MY, Yusoff MH, Yacob A. Influence of gamification on students' motivation in using e-learning applications based on the motivational design model. Int J Emerg Technol Learn 2015;10(2):30–4.
9. Lister MC. Gamification: The effect on student motivation and performance at the post-secondary level. Issues Trends Educ Technol 2015;3(2):1–22.
10. Poondej C, Lerdpornkulrat T. The development of gamified learning activities to increase student engagement in learning. Australas Educ Comput 2016;31(2):1–16.
11. Alcivar I, Abad AG. Design and evaluation of a gamified system for ERP training. Comput Hum Behav 2016;58:109–118.
12. Cakiroglu U, Basibuyuk B, Guler M, Atabay M, Memis BY. Gamifying an ICT course: Influences on engagement and academic performance. Comput Hum Behav 2017;69:98–107.
13. Ding L, Kim C, Orey M. Studies of student engagement in gamified online discussions. Comput Educ. 2017;115(2):126–42.
14. Parra-Santos T, Molina-Jordá JM, Casanova-Pastor G, Maiorano-Lauria LP. Gamification for formative assessment in the framework of engineering learning. In: Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality. New York: Association for Computing Machinery; 2018. p. 61–5.
15. Baszuk PA, Heath ML. Using Kahoot! to increase exam scores and engagement. J Educ Bus 2020;95(8):548–52.
16. Tan M, Hew KF. Incorporating meaningful gamification in a blended learning research methods class: Examining student learning, engagement, and affective outcomes. Australas J Educ Technol 2016;32(5):19–34.
17. Ertan K. Investigating achievement, attitude, and motivation in a gamified English course [Master's thesis]. Turkey: Hacettepe University; 2020.
18. Sheng R, Goldie CL, Pulling C, Luctkar-Flude M. Evaluating student perceptions of a multi-platform classroom response system in undergraduate nursing. Nurse Educ Today 2019;78:25–31.
19. Aras GN, Çiftçi B. Comparison of the effect of reinforcement with question-answer and kahoot method on the success and motivation levels of nursing students: A quasi-experimental review. Nurse Educ Today 2021;102:104930.
20. Boyd CA, Warren J, Glendon MA. Gaming the system: Developing an educational game for securing principles of arterial blood gases. J Prof Nurs 2016;32(5):S37–41.
21. Yapıcı İÜ, Karakoyun F. Gamification in biology teaching: A sample of Kahoot application. Turk Online J Qual Inq 2017;8(4):396–414.
22. Licorish SA, Owen HE, Daniel B, George JL. Students' perception of Kahoot!'s influence on teaching and learning. Res Pract Technol Enhanc Learn 2018;13(9):1–23.
23. Sabandar GNC, Supit NR, Suryana HTE. Kahoot!: Bring the fun into the classroom! Indones J Inform Educ 2018;2(2):127–34.
24. Pinna G, Mena J, Funes S. Undergraduate students' perceptions about the use of Kahoot as part of the flipped classroom methodology. In: Proceedings of the Seventh International Conference on Technological Ecosystems for Enhancing Multiculturality. New York (NY): Association for Computing Machinery; 2019. p. 619–25.
25. Hershorin, I. (2020). Instructional Gaming: Using Kahoot! for Review. Nursing EducationResearch Conference.–Available at https://sigma.nursingrepository.org/bitstream/handle/10755/20127/Hershorin_AbstractInfoH17.pdf?sequence=2&isAllowed=y.–Accessed July 10, 2023.
26. Coveney K, Somanadhan S, Nicholson E, Piga S, Pizziconi V, D'Elpidio G, et al. First-year nursing students' evaluation of Kahoot! to facilitate learning and testing knowledge: A pilot study in Ireland and Italy. Teach Learn Nurs. 2022;17(2):163–8.
27. Shi L, Cristea AI. Motivational gamification strategies rooted in self-determination theory for social adaptive e-learning. In: Micarelli A, Stamper J, Panourgia K, editors. Intelligent tutoring systems. ITS 2016. Lecture Notes in Computer Science. Cham: Springer; 2016. p. 294–300.
28. Türkan A. The effect of gamification method on the academic achievements, motivations, and attitudes of secondary school students [Master's thesis]. Turkey: Ataturk University; 2019.

29. Kucuk S, Yilmaz RM, Baydas O, Goktas Y. Augmented reality applications attitude scale in secondary schools: Validity and reliability study. Educ Sci 2014;39(176):383–92.
30. Tabachnick BG, Fidell LS. Using multivariate statistics. 6th ed. Boston: Pearson; 2013. p. 497–516.
31. George D, Mallery M. SPSS for Windows step by step: A simple study guide and reference, 17.0 update (10th edition). Boston: Pearson; 2010.
32. Warsihna J, Ramdani Z, Prakoso BH. Using Kahoot to improve students' achievement and critical thinking in undergraduate psychology students. In: 16th International Conference on Cognition and Exploratory Learning in Digital Age; 2019. p. 144–50.
33. Kinder FD, Kurz JM. Gaming strategies in nursing education. Teach Learn Nurs 2018;13(4):212–4.
34. Öz GÖ, Ordu Y. The effects of web based education and Kahoot usage in evaluation of the knowledge and skills regarding intramuscular injection among nursing students. Nurse Educ Today 2021;103:104910.
35. Yu Z. A meta-analysis of the effect of Kahoot! on academic achievements and student performance. Res Square 2021:1–20.
36. Sun JCY, Hsieh PH. Application of a gamified interactive response system to enhance the intrinsic and extrinsic motivation, student engagement, and attention of English learners. Educ Technol Soc 2018;21(3):104–16.
37. Bryant SG, Correll JM, Clarke BM. Fun with pharmacology: Winning students over with Kahoot! game-based learning. J Nurs Educ 2018;57(5):320.
38. Cameron KE, Bizo LA. Use of the game-based learning platform Kahoot! to facilitate learner engagement in animal science students. Res Learn Technol 2019;27:1–14.
39. Aktekin NÇ, Çelebi H, Aktekin M. Let's Kahoot! anatomy. Int J Morphol 2018;36(2):716–21.