RESEARCH
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INNOVATIVE LEARNING VIA QUIZ; A GAME-BASED TOOL FOR UNDERGRADUATE MEDICAL STUDENTS IN MEDICAL MICROBIOLOGY

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Abstract
Background: The integration of technology into education requires the use of various tools and applications in the classroom. One such student response tool is "Kahoot," which may be applied to formative assessment, gamification, and active learning strategies. These kinds of applications are becoming increasingly necessary in order to gamify medical education. Technologies are rapidly thriving day by day and have brought a remarkable proficiency in the field of education.
Methods: This study was carried out on the second year MBBS students in the department of microbiology. The students were given a pre-validated questionnaire at the end of the session. Responses were collected using a Likert scale. SPSS (Statistical Package for Social Sciences) was used for data analysis. A p-value below 0.05 is considered significant within a 95% confidence interval.
Result: A total of 100 students took part in this study, with a majority being female (58%) and male (42%). More than 90% of the students agreed or strongly agreed that learning with Kahoot was enjoyable and effective. The highest rating (Mean 4.82, SD 0.383) was for the learning with Kahoot was fun, indicating that it is well-received as an enjoyable learning activity. The Cronbach's alpha was 0.904 which indicates a very a high satisfactory level of internal consistency.
Conclusion: Incorporating educational games like Kahoot into the classroom setting can transform the learning environment. By minimizing distractions, improving engagement, and providing practical assessment tools, such games contribute significantly to the overall quality of education.
Keywords: Kahoot, Quiz, Game- based learning, Assessment.

1. INTRODUCTION

In current competency based medical education curriculum students may feel burdened by the amount of knowledge they need to gain in short period of time. In the majority of medical schools, microbiology is taught through didactic lecture, where students are passive listeners and are expected to retain, and apply a vast quantity of information [1]. The majority of teachers also admit that maintaining students' interest, drive, and focus throughout a lecture can be difficult. As literature reveals that retention of knowledge with lectures is just 5% [2]. A lack of motivation can result in poor In- depth learning and a negative classroom environment.

In higher education, where classes are large and contact is minimal, the issue is considerably more severe. Research has indicated that interactive learning fosters student collaboration, strengthens empathy and attentiveness, and advances logical

decision-making in novel circumstances. These competencies are critical for preparing medical students to become skilled and compassionate healthcare professionals. There are now more opportunities for classroom interaction mainly due to the development in technical infrastructure and the fact that the majority of the students bring their own digital devices to class [3].

Game-based learning is another development in educational technology; well-made games are effective learning tools because they engage and motivate students in ways that make learning more interesting. Gamification is a relatively new strategy in medical education that seeks to utilize the inherently engaging aspects of online gaming to enhance and evaluate students' knowledge integration, understanding, and confidence. Games can be beneficial for academic achievement, motivation, and classroom dynamics [4].

Of all the teaching and learning techniques available, quizzes are thought to be among the most successful. Quizzes can be used as a tool for evaluation or as a way to encourage students to learn via competition [5]. The competitive quiz programs promote self-learning and motivates students to be more attentive.

With the help of the free online gamification tool and learning platform Kahoot!, teachers may develop and distribute interactive tests, polls, discussion topics, and jumble games to an unlimited number of students in the classroom. Kahoot! is commonly used as a quiz game-based online digital assessment tool that can engage students in its learning. Kahoot! can be used as a break from routine classroom activities, a formative evaluation tool, or a refresher of students' knowledge [6]. Nowadays, the majority of students have access to smartphones, and there is a drive to use this technology to improve student knowledge, performance, engagement, and involvement. Hence Quiz sessions were planned as interactive teaching learning method and to evaluate the students' perceptions on a Kahoot! Session.

2. MATERIALS AND METHODS

2.1 Study Setting and Population

This a cross sectional study which was conducted in the department of microbiology involving second-year MBBS students. A total of 100 students participated in the study. The objective of Kahoot session was to assess the students' knowledge and understanding of Rheumatic fever and Infective Endocarditis infection following a small group discussion on the same topic. The topic for the discussion and the subsequent quiz was communicated to the students one week in advance to allow ample preparation time. Each quiz session included 10–25 multiple choice (MCQ), Jumble and true/ false questions. Kahoot sessions were conducted every year on different topics since 2020. One online session during COVID-19 pandemic and three offline sessions were conducted. All the students gave consent to participate in the study and ethical clearance for the study was obtained from the institutional review board.

2.2 Preparation for Kahoot! Quiz Game

The following steps were taken to develop the Kahoot quiz: Visit Kahoot! account on https://create.kahoot.it web page for free. We have to sign in using email address, make a password, using 'create' option we can create a new quiz. Test name and a title of the quiz should be given; each question in the quiz should have four answers; based on each item's complexity and level of difficulty, time has to be allotted for each answer; select the correct response, click to save this item, and then proceed stepwise to add each item one at a time until the set is complete; and then the quiz is saved.

2.3 Running Kahoot! in the classroom

After covering the topic in the Microbiology theory class, a quiz game was designed based on the material. Students were instructed on how to use Kahoot! to answer the quiz. The quiz was displayed on a projector along with a code. Students needed to log in to kahoot.it on their mobile devices, enter the unique pin code shown on the screen, and use their respective names. The names of students who successfully joined the quiz were displayed on the projector for all to see.

In Kahoot game questions appear on the projector according to the predetermined timings. Students earned points for correct answer and quick responses. Once the time for a question elapsed, students could no longer answer. Instant feedback was provided on each student's device, indicating whether their response was correct or incorrect. After each question, the names of the top five students were shown, and the names of the overall winners were displayed on the podium at the end of the session, based on the percentage of correct answers. The top three students were rewarded. At the end of the quiz session, each question was discussed in detail.

Images and videos can also be included in quiz questions to enhance student comprehension and engagement. Each question on Kahoot! is limited to a maximum of 95 words, and each of the four answer choices is limited to 60 words. Instead of being numbered, the answer options are represented by four buttons in different colors, and students are only allowed to select one button per question.

2.4 Data collection:

Pre-validated questionnaire were given to students to gather their perception on Kahoot! At the end of the session [7]. Data collection was done through Google forms online survey platform. The questionnaire aimed to assess whether Kahoot! improved classroom dynamics and reinforced learning. Responses were collected using a Likert scale, with values ranging from 5 (strongly agree) to 1 (strongly disagree), as shown in Table 1.

2.5 Data Analysis

Data was analysed using SPSS Version 25. A descriptive statistical analysis was performed on the responses. P-values with a 95% confidence interval of less than 0.05 are regarded as significant.

	Items	Percentage (%)				
		Strongly Agree	Agree	Not Sure	Disagree	Strongly disagree
1	Kahoot! triggered positive attention and focus on the Microbiology subject	49.1	38.2	12.7		
2	Kahoot! helps to retain my knowledge	41.8	52.7	3.6	1.8	
3	Kahoot! is an effective method to correct my misconceptions on the subject	43.6	52.7	3.6		
4	Kahoot! is an effective method for reflective learning	52.7	43.6	3.6		
5	Learning with kahoot! is fun and I always looked forward for playing it.	61.8	34.5	1.8	1.8	
6	Kahoot! is an effective method to provide feedback	49.1	45.5	5.5		
7	Kahoot! helps me to focus on the details of the Microbiology subject	50.9	47.9	1.8		

3. RESULTS

A total of 100 students participated in the quiz and only 85 students responded to the questionnaire and majority were female (58%) and male (42%). The data indicates that Kahoot! is highly effective and positively received by students. Majority of the participants (>90%) agreed or strongly agreed Kahoot! is engaging, fun, and beneficial for attention, focus, knowledge retention, feedback, reflective learning, and correcting misconceptions. This strong endorsement highlights Kahoot!'s potential as a valuable educational tool in various learning environments.(Table 1) other aspects such as attention, knowledge retention, feedback, and focus on details also received high scores, suggesting that Kahoot!'s overall effectiveness in the learning process.

The data in the table 2 suggests that participants found Kahoot! to be a highly engaging and effective tool for learning. The highest rating (Mean 4.82, SD 0.383) was for the learning with Kahoot was fun, indicating that it is well-received as an enjoyable learning activity.

The Cronbach's Alpha value was used to determine the reliability of the questionnaire. The Cronbach's alpha was 0.904 which indicates a very a high satisfactory level of internal consistency. The questionnaire was reliable and all items highly correlated with their intention to measure as evidenced by the validity tests. (Table 3)

Table:1 The students' perception towards Kahoot.

Table2: Mean score and Standard Deviation for each item

Sl. No	Items	Mean ± SD	N
1.	Kahoot! triggered positive attention and focus on the Microbiology subject	4.69 ± 0.618	85
2.	Kahoot! helps to retain my knowledge	4.58 ± 0.605	85

3.	Kahoot! is an effective method to correct my misconceptions on the subject	4.53 ± 0.628	85
4.	Kahoot! is an effective method for reflective learning	4.65 ± 0.55	85
5.	Learning with Kahoot! is fun and I always looked forward to playing it.	4.82 ± 0.383	85
6.	Kahoot! is an effective method to provide feedback	4.69 ± 0.535	85
7.	Kahoot! helps me to focus on the details of the Microbiology subject	4.54 ± 0.682	85

Table 3: Reliability and Validity of The Questionnaire

Sl.no	Correlation of different Kahoot questions with Total Score			
		Total	P value	Cronbach's alpha
1.	Kahoot! triggered positive attention and focus on the Microbiology subject	0.652	<0.001	0.904
2.	Kahoot! helps to retain my knowledge	0.842	<0.001	
3.	Kahoot! is an effective method to correct my misconceptions on the subject	0.864	<0.001	
4.	Kahoot! is an effective method for reflective learning	0.846	<0.001	
5.	Learning with Kahoot! is fun and I always looked forward to playing it.	0.727	<0.001	
6.	Kahoot! is an effective method to provide feedback	0.814	<0.001	
7.	Kahoot! helps me to focus on the details of the Microbiology subject	0.869	<0.001	

4. DISCUSSION

The findings of our study indicated that students had a positive perception of Kahoot!. Most of the survey items was rated positively by the students. They all firmly believe that using Kahoot to learn is enjoyable, inspires them to learn more, aids in knowledge retention, and helps them stay focused on the material. Fun, concentration, motivation, facilitation, and the enhancement of active learning are all areas in which Kahoot helps to create a strong, positive learning environment for pupils. This shows that rather than being a distraction, Kahoot! assisted pupils in participating actively in their learning activities. It is explained by the Kahoot gamification effect. The outcomes of this investigation are consistent with those of multiple other Kahoot-based research [7,8].

Kahoot offers numerous advantages for educational settings, making it a versatile and engaging tool for teachers and students. Kahoot is user-friendly and freely accessible, enhancing its appeal and practicality in diverse learning environments. Its compatibility with various devices, including tablets, smartphones, and computers, ensures that students can easily participate regardless of their device [9]. Furthermore, teachers can review and save student responses, providing valuable data for assessing understanding and progress. This study also indicates that students in the present day exhibit a greater inclination to remain involved in educational activities that use technology.

The use of music and vibrant colors adds an element of excitement, helping to engage students more deeply. Another notable feature is the adjustable response time for each question, allowing teachers to tailor the pace of the game to suit the needs of their class. The competitive nature of Kahoot fosters a lively educational atmosphere, motivating students to perform their best. For every quiz, Kahoot! generates a bar graph indicating the proportion of respondents who selected each of the available answers [10]. This visual representation allows both students and teachers to quickly see

which answers were most and least popular, providing immediate feedback on understanding and misconceptions. Since they can instantly compare their performance to that of their friends, students enjoy these large group activities.

Ismail et all reported that game-based learning was more effective and motivational than traditional ways to promote learning [11]. This research further validates this claim, as students found Kahoot to be an enjoyable learning experience.

Kahoot also offers a range of question types to diversify the learning experience. Teachers can create multiple-choice questions, jumble option and true or false, which challenges students to sequence answers correctly rather than simply selecting the correct one. This variety in question types helps to maintain student interest and caters to different learning styles [12]. It is a good tool for formative assessment as it creates a sense of competition and motivates learners into lesson.

When teachers have to cover a lot of content in a short period of time and medical students in the pre-clinical years of a competency-based medical education curriculum may feel overburdened by the quantity of knowledge they need to acquire [13]. Research indicates that students today have a greater inclination to remain active in educational activities that use technology [14]. Microbiology, in particular, is regarded as a challenging medical discipline because it requires students to comprehend, interpret, apply, assess, solve problems, and a substantial quantity of knowledge regarding microorganisms.

Implementation in Medical Microbiology

The incorporation of game-based quizzes into the medical microbiology curriculum.

Formative Assessments

Quizzes can be used as formative assessments throughout the course, allowing students and instructors to gauge progress and understanding. These low-stakes assessments reduce anxiety and create a positive, stress-free learning environment.

Revision and Reinforcement

Before exams, quizzes can serve as an effective revision tool, helping students consolidate their knowledge and practice recall under timed conditions. This is particularly useful in medical microbiology, where there is a vast amount of information to be retained.

Clinical Correlations

Quizzes can incorporate clinical case studies to help students apply microbiological concepts to real-life medical scenarios. This not only enhances understanding but also prepares students for future clinical rotations and examinations. [15].

Limitaions:

The limitations of this study include internet accessibility, which may impact students' performance. Additionally, Kahoot!'s restriction on the number of characters available for creating questions might hinder teachers' creativity in formulating more complex questions.

5. CONCLUSION

This study has demonstrated that game-based quizzes represent an innovative and effective tool for enhancing the learning experience of undergraduate medical students in medical microbiology. By promoting active engagement, improving retention, and fostering critical thinking, these quizzes can transform traditional learning environments into dynamic, interactive spaces where students are motivated to learn. As medical education continues to evolve, integrating such technology-driven methods will be key to preparing future healthcare professionals for the complexities of clinical practice. Consequently, we suggest medical schools to incorporate Kahoot! into lectures and tutorials for making learning more enjoyable.

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None…

Ethical clearance:

This study was approved by the Institutional Ethics Committee of our institution and was carried out according to the guidelines of the Committee vide letter No .MDC/JNMCIEC/343 dated 22-12-2022.

Declaration of competing interest:

The authors declare that there is no conflict of interest.

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