ORIGINAL ARTICLE

Real-Time Reflection by Gamification as Teaching-Learning-Assessment Tool in Competency-Based Medical Education

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Background: In order to improve student's learning skill, digital instructional approaches such as gamification are used in routine practice. The present researchers aimed to obtain systematic experience on the feasibility of Kahoot app (a game based learning platform), when utilized in addition to traditional classroom education for students as aTeaching-Learning-Assessment tool.

Method: This prospective study conducted at department of biochemistry, MNR Medical College & Hospital, Sangareddy India during the year 2020 from January to February. The students included were of phase I medical students, dental students and physiotherapy students. The students were taught with four different topics and after their completion, the groups were switched. Before switching groups, they were given the multiple choice questions of two topics. The Multiple Choice Questions test (MCQ) was of total 50 marks. The satisfaction survey in Google form was collected.

Results: Among 344 students, 221 (64.2%) were medical students, 79 (23%) were Dental and 44 (12.8%) were physiotherapy 1yr students. There was significant higher mean test scores in group A (Kahoot based MCQ) compared to group B (traditional paper based MCQ) and group D (Kahoot based MCQ) from group C (traditional paper based MCQ). Students strongly agreed that Kahoot helps to retain the knowledge (60.5%), simplifies complex subject (41.9%), makes learning funny (74.4%), enhances the understanding of subjects (53.5%), andtotally 90.7% responded they want the Kahoot based learning frequently.

Conclusion: The study showed the utility of game based learning apps like Kahoot used in competency based medical education as real-time Teaching-Learning-Assessment (TLA) is beneficial. Improvement in the learning ability and simplifying the complex subjects was the perception of the students.

Keywords: Medical Education, Medical Graduate, Gamification, Real-Time Reflection

الانعكاس في الوقت الحقيقي بواسطة التلعيب كأداة لتقييم التدريس والتعلم في التعليم الطبي القائم على الكفاءة

الخلفية: من أجل تحسين مهارة تعلم الطالب ، يتم استخدام مناهج تعليمية رقمية مثل التحفيز في الممارسة الروتينية. يهدف الباحثون الحاليون إلى الحصول على خبرة منهجية حول جدوى تطبيق Kahoot (منصة تعليمية قائمة على الألعاب) ، عند استخدامه بالإضافة إلى التعليم التقليدي في الفصول الدراسية للطلاب كأداة للتعليم والتعلم والتقييم.

الطريقة: أجريت هذه الدراسة المستقبلية في قسم الكيمياء الحيوية ، كلية ومستشفى MNR الطبية، Sangareddy الهند خلال عام ٢٠٢٠ من يناير إلى فبراير. كان الطلاب المشمولون من طلاب المرحلة الأولى في الطب وطلاب طب الأسنان وطلاب العلاج الطبيعي. تم تعليم الطلاب في أربعة مواضيع مختلفة وبعد الانتهاء منها ، تم تغيير المجموعات. قبل تبديل المجموعات ، تم إعطاؤهم أسئلة الاختيار من متعدد لموضوعين. بلغ إجمالي اختبار أسئلة الاختيار من متعدد 50 (MCQ) درجة. تم جمع استبيان الرضا في نموذج Google.

النتائج: من بين ٣٤٤ طالبًا، كان ٢٢١ (٦٤,٢٪) من طلاب الطب ، و ٧٩ (٢٣٪) من طلاب طب الأسنان و ٤٤ (١٢,٨٪) من طلاب العلاج الطبيعي في السنة الأولى. كان هناك متوسط درجات أعلى في الاختبار في المجموعة أ (MCQ على أساس Kahoot) مقارنة بالمجموعة B (MCQ المستندة إلى الورق التقليدي) والمجموعة D (MCQ القائمة على Kahoot) من المجموعة C (الورق التقليدي المستند إلى MCQ). اتفق الطلاب بشدة على أن Kahoot يساعد في الاحتفاظ بالمعرفة (٦٠,٥٪) ، ويبسط موضوعًا معقدًا (٤١,٩٪) ، يجعل التعلم مضحكًا (٧٤,٤٪) ، يعزز فهم الموضوعات (٥٣,٥٪) ، وإجمالي ٩٠,٧٪ أجابوا أنهم يريدون أساس Kahoot التعلم بشكل متكرر.

الخلاصة: أظهرت الدراسة فائدة تطبيقات التعلم القائمة على الألعاب مثل Kahoot المستخدمة في التعليم الطبي القائم على الكفاءة حيث أن تقييم التدريس والتعلم في الوقت الحقيقي (TLA) مفيد. تحسين القدرة على التعلم وتبسيط المواد المعقدة كان تصور الطلاب.

الكلمات المفتاحية: التعليم الطبي ، خريج الطب ، التلعيب ، التفكير في الوقت الحقيقي

بازخورد بلادرنگ با بازی وارسازی به عنوان ابزار آموزش-یادگیری-ارزیابی در آموزش پزشکی مبتنی بر شایستگی

زمینه و هدف: به منظور بهبود مهارت یادگیری دانشجویان، از رویکردهای آموزشی دیجیتالی مانند بازی وارسازی در تمرینات روتین استفاده می شود. هدف ما به دست آوردن تجربه سیستماتیک در مورد امکان سنجی استفاده از اپلیکیشن کاهوت (یک پلتفرم یادگیری مبتنی بر بازی)، علاوه بر آموزش کلاسی سنتی برای دانشجویان به عنوان ابزار آموزش-یادگیری-ارزیابی بود.

روش: این مطالعه آینده‌نگر در بخش بیوشیمی، کالج پزشکی و بیمارستان ام ان آر، سن گاردی هند طی ماه های ژانویه تا فوریه ٢٠٢٠ انجام شد. دانشجویان شامل دانشجویان فاز یک پزشکی، دندانپزشکی و فیزیوتراپی بودند. چهار موضوع مختلف به دانشجویان آموزش داده شد و پس از اتمام، گروه ها تعویض شدند. قبل از تغییر گروه، سوالات چند گزینه ای دو مبحث به آنها داده شد. آزمون سؤالات چندگزینه ای (MCQ) در مجموع ٥٠ نمره داشت. نظرسنجی رضایت مندی در فرم گوگل جمع آوری شد.

یافته‌ها: از بین ٣٤٤ دانشجو، ٢٢١ نفر (٦٤,٢٪) دانشجوی پزشکی، ٧٩ نفر (٢٣٪) دندانپزشکی و ٤٤ نفر (١٢٨٪) دانشجوی سال اول فیزیوتراپی بودند. میانگین نمرات آزمون به طور معنی‌داری در گروه A (سوالات مبتنی بر کاهوت) بیشتر از گروه B (سوالات مبتنی بر کاغذ سنتی) و در گروه D (سوالات مبتنی بر کاهوت) بالاتر از گروه C (سولات مبتنی بر کاغذ سنتی) بود. دانشجویان موافق بودند که برنامه کاهوت به حفظ دانش کمک می کند (٦٠,٥٪)، موضوعات پیچیده را ساده تر می کند (٤١,٩٪)، سرگرم کننده است (٧٤,٤٪)، سبب افزایش درک موضوعات (٥٣,٥٪) می شود و ٩٠,٧٪ پاسخ دادند که خواهان یادگیری مبتنی بر کاهوت هستند.

نتیجه‌گیری: کاربرد اپلیکیشن‌های یادگیری مبتنی بر بازی مانند کاهوت در آموزش پزشکی مبتنی بر شایستگی به عنوان ابزار آموزش- یادگیری- ارزیابی بلادرنگ مفید است. افزایش قدرت یادگیری و ساده سازی دروس پیچیده از جمله نظرات دانشجویان بود.

واژه های کلیدی: آموزش پزشکی، فارغ التحصیل پزشکی، بازی وار سازی، بازخورد بلادرنگ

قابلیت پر مبنی میڈیکل ایجوکیشن میں ٹیچنگ لرننگ-اسسمنٹ ٹول کے طور پر گیمیفیکیشن کے ذریعے حقیقی وقت کی عکاسی

پس منظر: طالب علم کی سیکھنے کی مہارت کو بہتر بنانے کے لیے، ڈیجیٹل انسٹرکشنل اپروچز جیسے گیمیفیکیشن کو معمول کی مشق میں استعمال کیا جاتا ہے۔ موجودہ محققین کا مقصد کہوٹ ایپ (ایک گیم پر مبنی لرننگ پلیٹ فارم) کی فزیبلٹی پر منظم تجربہ حاصل کرنا تھا، جب اسے طلباء کے لیے روایتی کلاس روم کی تعلیم کے علاوہ بطور ٹیچنگ لرننگ-اسسمنٹ ٹول کے طور پر استعمال کیا جائے۔

طریقہ: یہ ممکنہ مطالعہ شعبہ بائیو کیمسٹری، MNR میڈیکل کالج اینڈ ہاسپٹل، سنگاریڈی انڈیا میں سال ٢٠٢٠ کے دوران جنوری سے فروری تک کیا گیا۔ شامل طلباء میں فیز I میڈیکل کے طلباء، دانتوں کے طلباء اور فزیو تھراپی کے طلباء شامل تھے۔ طلباء کو چار مختلف عنوانات کے ساتھ پڑھایا گیا اور ان کی تکمیل کے بعد گروپس کو تبدیل کر دیا گیا۔ گروپس کو تبدیل کرنے سے پہلے، انھیں دو موضوعات کے متعدد انتخابی سوالات دیے گئے۔ متعدد انتخابی سوالات کا امتحان (MCQ) کل ٥٠ نمبروں کا تھا۔ گوگل فارم میں اطمینان کا سروے جمع کیا گیا۔

نتائج: طلباء نے اس بات پر سختی سے اتفاق کیا کہ کہوٹ علم کو برقرار رکھنے میں مدد کرتا ہے (٦٠,٥٪)، پیچیدہ موضوع (٤١,٩٪) کو آسان بناتا ہے، سیکھنے کو مضحکہ خیز بناتا ہے (٧٤,٤٪)، مضامین کی سمجھ میں اضافہ کرتا ہے (٥٣,٥٪)، اور مکمل طور پر ٩٠,٧٪ نے جواب دیا کہ وہ کہوٹ پر مبنی چاہتے ہیں۔ اکثر سیکھنا۔

نتیجہ: مطالعہ نے گیم بیسڈ لرننگ ایپس کی افادیت کو ظاہر کیا جیسے کہوٹ کو قابلیت پر مبنی طبی تعلیم میں استعمال کیا جاتا ہے کیونکہ ریئل ٹائم ٹیچنگ لرننگ اسسمنٹ (TLA) فائدہ مند ہے۔ سیکھنے کی صلاحیت میں بہتری اور پیچیدہ مضامین کو آسان بنانا طلباء کا خیال تھا۔

مطلوبہ الفاظ: میڈیکل ایجوکیشن، میڈیکل گریجویٹ، گیمیفیکیشن، ریئل ٹائم ریفلیکشن

INTRODUCTION

Apart from research, the primary function of medical academic institutions is medical education (1).Alternative didactic approaches, enabled by technological innovation, can provide answers in times of restricted faculty resources (2). Traditional classroom lectures continue to be the primary approach at medical schools, despite the fact that emerging digital possibilities have the potential to profoundly complement and strengthen the medical education received by students (3). To increase students' skills, digital instructional approaches range from short video lessons to complicated 3D-simulation for medical operations(4). Another technique is to learn through game-based tools, sometimes known as "gamification." According to Bigdeli and Kaufmann, the incorporation of gaming features can boost user engagement (4). Gamification is often characterized as "the employment of game design principles in non-game contexts," according to Johnson et al. However, until today, acceptance of gamification as an additional tool in medical education has been minimal (5).

A variety of software platforms are now accessible to gamify course content via online applications such as Kahoot, Quizziz, Quizlet, and Socrative (6).Kahoot is a game based learning platform that makes it very easy to create, share, and play the learning games or quizzes in classroom during and after the lecture or a teaching learning session. Kahoot app is a low-cost educational technology which is a web-based system for analyzing and grading students in the classroom setting. Kahoot web interface debuted in 2013 as a free education platform for teachers and students. As long as an Internet connection is established, access is accessible with any electronic device, such as mobile phones, tablet computers, or desktop computers. According to A.I. Wang and R. Tahir's review in 2020 (based on Google Scholar, Science Direct, Wiley InterScience, Web of Science, Scopus), the use of Kahoot can positively influence learning performance, classroom dynamics, students' and teachers' attitudes, and students' anxiety, whereby the specific integration of Kahoot in corporate training or similar is lacking throughout the life.

The present researchers sought to obtain systematic experience on the feasibility of Kahoot app, when utilized in addition to traditional classroom education using an immediate pre- and post-assessment approach.

METHODS

This prospective observational study was conducted at department of biochemistry, MNR Medical College & Hospital, Sangareddy Telangana, India during the year 2020 from January to February. The students included were of phase I Bachelor of Medicine and Bachelor of surgery (MBBS) students, 1st year dental students and 1st year physiotherapy students. Other year students were excluded from the study, as the subject biochemistry is taught in the 1st year of course. Prior to start of study, ethics clearance was obtained from institutional ethics committee and consent from all the participants were collected.

All the included students were taught the regular subject of biochemistry and participants were divided as the two batches that were randomly picked from the whole batch. The randomization was performed as alternate numbers according to their college registration number. The students were taught with four different topics. After completion of two topics the groups were switched. Before switching groups, they were given with the Multiple Choice Questions (MCQs) of two topics which were taught in common.

During the first two topics, Group A students were the one who were given with the Kahoot based MCQs between the lecture hours and group B were given with traditional paper based MCQ between the lecture hours.

The next 2 topics were taught to all the students, and divided into two groups as group C which comprised group A students with traditional paper based MCQ during the lecture hours and group D, which comprised of group B students with Kahoot based MCQ during the lecture hours.

Once both the topics were completed, all the students appeared for the post-completion test (similar questions to pre-test) according to the groups. The MCQ test were of total 50 marks. The time duration required to complete the MCQ in both the format of MCQ and the marks obtained at the end of the lecture hours was assessed. The satisfaction survey in form of questionnaire was designed and all students were requested to fill the questionnaire as Google form. Prior to the study, the satisfaction survey was applied to 30 students and 10 faculty members to verify the intent of the questionnaire. The result of the pilot test run was excluded from the study participant data. The questionnaire composed of 15 questions with some response of yes / no and other were Likert scale from 1 to 5, with 5 as the maximum satisfaction.

Statistical analysis: The response was collected and computed in excel sheet and analysed using SPSS v21 operating on windows 10. The participant's data were presented as frequency and percentage. The questionnaire response in yes or no and Liker scale was represented in table as frequency and percentage. The test scoring was represented as mean $\pm$ standard deviation. The mean difference between the groups was compared using unpaired student t-test, with $p<0.05$ was considered statistically significant.

RESULTS

Total of 344 students involved in the study after obtaining informed consent. Among the included 1st phase students, 221 (64.2%) were MBBS, 79 (23%) were Dental and 44 (12.8%) were physiotherapy (Table 1).

Table 1. Showing the distribution of participants	
	Frequency (Percentage)
MBBS	221 (64.2)
BDS	79 (23.0)
BPT	44 (12.8)
Total	344 (100.0)
MBBS - Bachelor of Medicine and Bachelor of Surgery; BDS - Bachelor of Dental Surgery; BPT - Bachelor of Physiotherapy	

The mean marks obtained by the students in group A (topic 1 - 35.6± 10.2, topic 2 - 34.2 ± 8.1 and overall- 38.7 ± 7.6) was significantly higher than in the group B (topic 1 - 30.2 ± 12.8, topic 2 - 26.4 ± 10.5, overall in 31.1 ± 8.5). (p<0.05).The mean marks obtained by the students in group D (topic 1 - 36.4 ± 5.6, topic 2 - 35.9 ± 5.1 and overall - 38.8 ± 6.0) was significantly higher than in the group C (topic 1 - 31.5 ± 7.9, topic 2 - 29.6 ± 8.1 and overall - 32.1 ± 6.6) in both the topics and overall.(p<0.05) (Table 2).

To response to questionnaire, the students strongly agreed that Kahoot helps to retain the knowledge (60.5%), it simplifies complex subject (41.9%), makes learning funny (74.4%), enhances the understanding of subjects (53.5%), and totally 90.7% responded they want the Kahoot based learning frequently (Table 3).

DISCUSSION

The present study aimed to obtain systematic experience on the feasibility of Kahoot app, when utilized in addition to traditional classroom education using a real-time reflection for students as TLA tool. The study documented the mean score of the participants in the MCQ test were significantly better among the groups with Kahoot based MCQs compared to the participants in the traditional paper based MCQs. The study also documented a higher satisfaction response from the participants with use of game based MCQs like Kahoot in teaching-learning and assessment.

Interestingly, most of the items were rated positively by students on Likert scale of 1 to 5. They strongly agree that learning through Kahoot is fun, an effective platform for

Table 2. Comparison of mean scores between group A, group B, group C and group D using student t-test			
	Group A	**Group B**	**t-test**
Topic 1	35.6 ± 10.2	30.2 ± 12.8	<0.05*
Topic 2	34.2 ± 8.1	26.4 ± 10.5	<0.05*
End test	38.7 ± 7.6	31.1 ± 8.5	<0.05*
	Group C	Group D	t-test
Topic 2	31.5 ± 7.9	36.4 ± 5.6	0.05*
Topic 3	29.6 ± 8.1	35.9 ± 5.1	0.05*
End test	32.1 ± 6.6	38.8 ± 6.0	0.05*
*p-value <0.05 was considered statistically significant.			

Table 3. Response to feedback questionnaire		
Questionnaire		**Frequency(Percentage)**
Have you been exposed to Kahoot quiz gaming app during the academic year	Yes	312 (90.7)
	No	32 (9.3)
Did you enjoy the learning by playing this quiz app	Yes	328 (95.5)
	No	16 (4.7)
Kahoot helps me to focus on the subjects	Median scale - 5	168 (48.8)
Kahoot motivates me to learn more	Median scale - 5	184 (53.5)
Learning with Kahoot is fun	Median scale - 5	256 (74.4)
Kahoot enhances my understanding on the subjects	Median scale- 5	184 (53.5)
Kahoot helps to retain my knowledge	Median scale- 5	208 (60.5)
Kahoot simplifies the complex subjects	Median scale- 5	144 (41.9)
Kahoot facilitates my learning on the subjects	Median scale- 5	168 (48.8)
Kahoot is an effective method to correct my misconception on the subjects	Median scale- 5	192 (55.8)
Kahoot is an effective method to provide feedback	Median scale- 5	168 (48.8)
Kahoot is an effective method for reflective learning	Median scale- 5	168 (48.8)
Kahoot is a better platform than e-learning	Median scale- 5	144 (41.9)
Do you want frequent Kahoot use, after completion of the topics	May be	32 (9.3)
	Yes	312 (90.7)
Your overall experience by learning with Kahoot.	Median scale - 5	176 (51.2)

formative feedback. Kahoot is a popular online learning platform that was created to increase student involvement in the classroom. According to the majority of studies, game-based learning has a beneficial impact on student motivation and involvement in learning. It greatly improves student involvement in learning when compared to traditional learning methods (7,8). One possible explanation is that game-based learning flips the classroom, thereby engaging and motivating students to learn (2).

Correspondingly, this study found that medical students perceived formative assessment through Kahoot as an engaging and motivating activity for their learning, thus supporting the findings of previous studies. In addition, Plump and LaRosa(9) also discovered that the majority of their kids were using Kahoot. They felt Kahoot makes their learning more interesting, user-friendly, and participatory, as well as assists them in better understanding their subjects. Almost certainly, all five criteria that Whitton described to determine learning engagement occur in Kahoot and lead to student involvement (2). In other words, Kahoot motivates them to take up challenges, enables them to control it, absorbs their activity, stimulates their intrinsic interest, so they value the session as a useful activity for learning. It is important to note that children respond positively to learning activities that allow them to connect with their teacher and others while receiving rapid feedback.

Another interesting discovery was that Kahoot can assist students focus on learning, possibly because it fits a range of learning methods.There is a visual stimulus element where the students are looking at the questions – including visuals presented on the main screen and images in the questions. In terms of auditory learners, Kahoot entertains them by incorporating music into the activities. Kahoot also caters to kinaesthetic learners by requiring them to move about while selecting their responses. Addressing multiple learning styles during teaching is critical because students' accomplishment will increase dramatically if they are taught using ways and resources that are compatible with their learning styles (10). With respect to perceived learning retention, Kahoot as a formative assessment facilitates learning process to retain knowledge and to correct misunderstanding on the subject matters.The real-time feedback provides opportunities for teachers in various disciplines to tailor their instructional strategies based on students' understanding on quizzes while Kahoot allows anonymous classroom participation, which will further engage all students (9).

One of the limitations of the study was the use of digital gadgets inside the classroom, where students might be distracted with used of mobile phones during the session. Also the monitoring of the students in the classroom became very much difficult on regular time of teaching learning. However, the study found a significant satisfaction towards the use of innovative methods of TLA among the students.

The study showed a significant higher score among the participants who received the Kahoot based MCQs compared to the traditional paper based MCQs, and also a higher satisfaction among the students. Study found that utility of game based learning apps like Kahoot use in competency based medical education as real-time assessment tool can be beneficial. Improvement in the learning ability and simplifying the complex subjects was the perception of the students towards Kahoot use during the lecture hours and assessment.

Ethical considerations
Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

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