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From medley to magnificence: Developing problem-solving skills in biochemistry

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Abstract

Background: Medical students need problem-solving skills because these are crucial in diagnosing cases in the future. This study aimed to improve medical students' problem-solving abilities through analysis, reasoning, and application.

Methods: A four-month prospective cross-sectional study was conducted at MNR Medical College and Hospital (March to June 2021). Six case scenarios were developed and created in PowerPoint. Each scenario was broken down into the following sections: title, history, clinical findings, investigations, and treatment. The slides were arranged randomly to produce a medley which was then shown to the students. They were tasked with sorting the slides and diagnosing each case. Student responses were gathered using a Google Forms questionnaire.

Results: The number of participants who completed the activity within the stipulated time was 132. The majority of students (85%) scored over 80% in the activity. The activity was interesting (63.6%), promoted active learning (65.2%), helped students correlate the different aspects of the case scenario and make a diagnosis (69.7%), helped build problem-based skills, and activated prior knowledge (71.2%), improved clinical orientation to the curriculum (65.2%), exposed students to aspects of the diseases not dealt with in the classroom (40.9%), students felt such an activity should be required of future students (68.2%).

Conclusion: This novel learning method of integrating case scenarios using a digital platform provided multiple opportunities for testing and developing skills necessary for clinical practice. The fact that the activity was well received by students strengthens the argument to create additional activities of this type that may be applied to any topic.

Introduction

The Medical Council of India (MCI) revised the medical curriculum with a vision in a 2015 announcement to increase medical students' exposure to innovative teaching and learning approaches such as challenge-based learning (CBL) and problem-based learning (PBL).[1] However, the MCI directive has not been applied in any meaningful way in medical schools in India.[2] Cognitive psychologists, educational psychologists, learning scientists, neuroscientists, and discipline-based education experts all are interested in how pupils solve problems. PBL helps students independently develop desirable skills and reasoning processes. It demands students to take responsibility for their learning and is an important innovation of adult learning in professional courses. It is a student-centered pedagogy in which students experience learning about a subject through solving an open-ended problem found in the trigger material. The present generation of students responds well to learning methods associated with creativity and digital technology, making this approach ideal for increased student involvement and engagement.

This study aimed to improve problem-solving abilities through analysis, reasoning, and application. , The experiment employed a novel digital paradigm to achieve these goals.

Materials and Methods

This prospective cross-sectional study was conducted at MNR Medical College and Hospital, Sangareddy, Telangana, India, over four months (March to June 2021) after obtaining clearance from the institutional ethical review committee.

The study focused on the first-phase students in

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Bachelor of Medicine/Bachelor of Surgery (MBBS) (n=150) who were undergoing the competency-based medical education curriculum implemented by the National Medical Commission (NMC) of India. All students were enrolled in the study.

Six case scenarios were developed and then created in PowerPoint. Each case scenario was divided into the following sections: title, history, clinical findings, investigations, and treatment. A clinician assessed the content and construct validity of the case scenarios, and refinements were made. The slides were randomized into a medley and delivered to students online using the Microsoft Teams platform. They were tasked with sorting the slides in the correct order for each scenario and diagnosing each case. The desired outcome was the completion of the given task by all the students individually. To avoid bias, all students were given equal time and performed the task under supervision during the practical class.

Instructions for the participants

There were 24 slides in a PowerPoint file called "Medley" in a folder named "Biochem" on the desktop. Students were told to select the slide sorter view and then determine six-case titles in it: (1) A 44-year-old female at the emergency department; (2) A 23-year old male patient treated for malaria; (3) A 1-month-old male infant born of consanguineous marriage; (4) A child aged 5 years was brought with history of delayed eruption of teeth; (5) A 52-year-old chronic alcoholic male patient; and (6); A 40-year-old obese female presents with icterus, intolerance to fatty food. They were then asked to perform the following tasks:

1. Arrange the numbered case- title slides in their correct sequence in a fresh PowerPoint presentation, including their roll number.
2. Using copy and paste, get through the remaining slides in the slide sorter view and arrange them below their respective titles in the correct sequence: case history, clinical findings, investigations, and treatment. The case title was consistent with the other components of the case.
3. While all case scenario components were aligned

in the correct order, students were asked to make the diagnosis for each case on a separate slide after the 'treatment' slide. As a result, each student's presentation would have six additional slides

4. Save the file thus created.
5. The time allotted to complete the task was one hour.
6. They were then asked to rename the file cover with their name and roll number and email it to a given email address within the stipulated time.
7. After completing the challenge, a brief questionnaire appeared on their desktop to collect their feedback on this activity. They were asked to respond and submit the questionnaire.

The slides and questionnaire replies given by the students were automatically saved in a master computer and retrieved for further research.

Each correctly formed case scenario with a correct diagnosis received ten points, with eight points awarded for appropriately assembling the four slides of each case in sequence (2 points for arranged correctly for each slide in sequence and two additional points for the correct diagnosis).

Each student's PowerPoint presentation was worth a maximum of 60 points (10 points each for 6 cases).

A questionnaire was created using Google Forms to obtain feedback from students.

Statistical analysis: all the responses were evaluated and represented as mean, standard deviation, frequency, and percentage. Responses to the Google Form questionnaire were assessed by exporting to an Excel spreadsheet. The analysis was performed using SPSS 21.

Results

In all, 150 students of MBBS phase 1 were included in the study; 112 were females, and 38 were males, with a mean age of 18.12±1.1years. A total of 132 participants completed the activity within the stipulated time. The majority of students (112; 85%) received higher than 80% on this activity. Responses to individual items are shown in Table 1.

Response to the feedback questionnaire is discussed below. The items with the highest percentage of the agreement were: Helped to build problem-based skills

Table 1. The response to the questionnaire

Item	Agree Strongly	Agree	Neutral	Disagree	Strongly disagree
The activity was interesting	6 (4.5%)	2 (1.5%)	6 (4.5%)	36 (26.9%)	84 (62.7%)
The activity promoted active learning	6 (4.5%)	2 (1.5%)	2 (1.5%)	38 (28.4%)	86 (64.2%)
The activity required us to correlate the various components of the case scenario and provide a diagnosis.	10 (7.5%)	0	8 (6%)	24 (17.9%)	92 (68.7%)
Helped to build problem based skills and activate prior knowledge	6 (4.5%)	4 (3%)	8 (6%)	20 (14.9%)	96 (71.6%)
Improved clinical orientation to the curriculum	4 (3%)	8 (6%)	6 (4.5)	28 (20.9%)	88 (65.7%)
Exposed to parts of the condition that were not covered in class	10 (7.5%)	4 (3%)	16 (11.9%)	50 (37.3%)	54 (40.3%)
Allotted time was adequate	14 (10.4%)	18 (13.4)	48 (35.8%)	38 (28.4%)	16 (11.9%)
Require such activities in future	8 (6%)	0	6 (4.5%)	30 (22.4%)	90 (67.2%)

and activate prior knowledge (71.2%), helped students correlate the different aspects of the case scenario and give a diagnosis (69.7%), and students felt such an activity should be required of future students (68.2%). Other items above 60% agreement were: promoted active learning (65.2%), improved clinical orientation to the curriculum (65.2%), and the activity was interesting (63.6%). Almost half of the students (40.9%) felt the activity exposed them to aspects of the diseases not dealt with in the classroom (40.9%).

Though students found value in this activity and successfully brought order to the 'medley' most of the time, their success in achieving 'magnificence' was limited, which could be improved by repeated engagement with such inventive methods.

Discussion

It is commonly understood that well-designed computer-assisted exercises allow students to take a self-directed approach to learning, which promotes deep, retentive learning. It also provides teachers with unique presentational capabilities, allowing them to learn from other media. Text, graphics, music, and moving images can all be used to create inputs through several senses.

The fact that all students who got the correct diagnosis in all instances had grouped the slides in the correct sequence emphasizes the importance of using the correct method when presenting a case or a patient. For students who correctly organized the slides but had incorrect diagnoses, this could be due to a lack of recall and application of knowledge. This may be because all of the topics picked for creating the case scenarios included characteristics of the various conditions that may not have been covered in the curriculum.[3,4]

In the opinion of the instructors, the study achieved its goals. Instructors felt the students did well in the first portion of the study, which required organizing the slides and assessing their ability to correlate a case history with appropriate clinical and laboratory tests, culminating in treatment. The students enhanced their problem-solving skills by using analysis, reasoning, and application in a digital mode to achieve these objectives. The study made the case that a digital fun-based method used in solving problem-based case scenarios can be applied to all courses and various phases and can be done in the classroom or a practical or bedside setting during the lecture or post-lecture hours.

Conclusion

This novel learning method of integrating case scenarios using a digital platform provided several opportunities for testing and developing the skills necessary for clinical practice. The fact that the activity was well received by the students strengthens our faculty's desire to create more additional activities that may be applied to any topic.

Authors' contribution
DP, AY conceived the idea, conducted the study, prepared the first draft, and finalized the manuscript for publishing.

Ethical approval
The author has strictly adhered to ethical issues (such as plagiarism, misconduct, informed consent, data fabrication and/or falsification, double publishing and/or submission, redundancy, etc.). The MNR Medical College & Hospital's ethical committee has authorized this study. All participants provided informed consent.

Competing interests
The authors state no conflicts of interest.

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