



INTEGRATING RULE BASED CHATBOT IN LEARNING MANAGEMENT SYSTEM OF UNDERGRADUATE STUDENTS

Medical Education

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ABSTRACT

Introduction: E-learning platforms, such as learning management systems (LMS), can enhance teaching learning outcome in medical education. Rule-based chatbots, designed to simulate human-user interaction, can be integrated in LMS. **Objectives:** The study aimed to study the efficacy of a rule-based chatbot after a teaching-learning session as an effective adjunct teaching tool in preclinical competency based medical education (CBME) curriculum. **Material and Methods:** The study employed a cross-sectional design to examine the correlation between performance on formative assessments before and after the implementation of a rule-based chatbot in the LMS. The study comprised 110 first-year medical students. Data collection involved acquiring written responses for formative evaluation about the key subject matter addressed during Physiology lectures. **Statistical Data Analysis:** A statistical t-test was conducted to analyse students' formative assessment scores before and after deploying a rule-based chatbot in a LMS. **Results:** The mean values of formative assessment scores obtained after the implementation of rule-based chatbots were significantly higher than those obtained before the implementation. **Conclusion:** Overall, the integration of chatbots in learning management systems has shown promising results in improving student engagement and academic performance.

KEYWORDS

Rule Based Chatbot, Formative Assessment, Competency Based Medical Education, Learning Management System

INTRODUCTION

The use of technology to promote learning has gained popularity and is now playing an important part in the teaching, learning, and evaluation processes in the field of medical education. It is important to have access to formative assessments at an early stage in the learning process so that feedback may be as effective as possible. It has been established that providing students with personalized feedback and corrective action leads to improved learning outcomes when it comes to students. When applied to a larger student group, remedial intervention in the form of one-on-one interaction is the most effective but also the most time-consuming technique. Instruction and learning outcomes are improved when formative assessment is carried out using an e-learning platform.

A software program called a learning management system (LMS) is used to administer, track, record, document, automate, and provide training, educational, and learning and development programs. A chatbot is a computer program designed to simulate human-user interaction, especially via the internet. Chatbots may be categorized into two types: rule-based and AI-powered. Rule-based chatbots are designed to reply to user inquiries by adhering to a set of predetermined rules and patterns. Whether it be as a standalone program, a component of a website or messaging platform, or as a virtual assistant within a smartphone application, chatbots may be used in its various forms. Chatbots integrated to LMS can help in resolving classroom-based queries by the students thus enhancing teaching and learning outcome [1].

This study intended to study the efficacy of rule based chatbot after a teaching-learning as an effective adjunct tool to classroom teaching for enhancing teaching learning outcome.

Objectives of the Study:

- 1) The primary objective was to implement rule-based chatbot in learning management system and to use rule based chatbot as an adjunct tool for teaching learning method in preclinical competency based medical education (CBME) curriculum.
- 2) To analyze and compare formative assessment performance before and after the implementation of rule based chatbot in learning management system.

MATERIALS AND METHODS

Study Design

The study employed a cross-sectional design to compare formative assessments performance, before to and following the implementation of a rule-based chatbot in the learning management system done via multiple-choice questions.

Type Of Study:

Analytical Cross-Sectional Study

Study Participants

The study had 110 first-year medical students attending physiology classes.

Inclusion Criteria:

First-year medical students enrolled in pre-clinical physiology courses, aged 18-30 years, of both genders, who have provided informed consent for voluntary participation

Exclusion Criteria:

Students unwilling to participate are omitted from the research. Students who are with attendance below 75%, are excluded from the research.

Ethical Clearance

The research project received approval from the Institutional Ethics Committee on Human Subjects at Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Reference number: IECHS/IRCHS/DSMCH/Cert/515, dated 26-03-2024. Participants were briefed about the risk and benefits involved before the start of the study.

Sample Size Calculation

The sample size was determined based on a correlation coefficient of 0.27 between e-learning performance and in-course assessment performance, as indicated in the study by Gupta S et al [2].

$$n \geq \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{\frac{1}{2} \log_e \frac{1+r}{1-r}} \right)^2 + 3$$

The required sample size calculated was 105. To account for a non-participation rate of about 5% the final required sample size would be 110.

Data Collection

The present study comprised first-year medical students from Tamil Nadu Dr. MGR Medical University enrolled at Dhanalakshmi Srinivasan Medical College and Hospital in Siruvachur, Perambalur. No ethical approval was required in the authors' country as the study did not involve medical testing, patient surveys, or epidemiological research. Nonetheless, the study adhered to the Helsinki standards. The Medical Education Unit of the Institution was informally informed about the study and granted approval to undertake it during physiology teaching hours. Prior to the commencement of the research, all students were informed that they had the option to abstain from participation, and that this decision would not influence their subsequent examinations or their overall medical education. Students who participated made a statement of informed consent for anonymised involvement and dissemination.

The data collection entailed acquiring written responses for formative evaluation about the key subject matter addressed during Physiology lectures. Approximately ten formative session scores were recorded over the academic year research period. Out of the 10 formative sessions, 5 were assessed before to the introduction of the rule-based chatbot in the learning management system, and 5 were reviewed subsequent to its implementation. All sessions were evaluated using multiple-choice questions.

Statistical Data Analysis

A statistical study was conducted to analyze students' formative assessment scores before and after deploying a rule-based chatbot in a learning management system. The study used t-tests and Pearson correlation analyses to compare attendance and scores, with a p-value below 0.05 indicating statistical significance.

RESULTS

Table 1 shows the formative assessment scores obtained before the implementation of rule based chat bot in learning management system with mean values of 6.64 ± 1.03 and after its implementation with mean values of 7.24 ± 0.75 .

Table 1: Comparison of Formative assessment performance before and after implementation of rule based chatbot in Learning management system

Parameter	Mean	Standard Deviation	Standard Error Mean	95% Confidence Interval of differences		p-value	Cohen's d
				Lower limit	Upper limit		
Formative assessment score before implementation	6.64	1.03	0.1	6.44	6.83	<0.001	0.49
Formative assessment score after implementation	7.24	0.75	0.07	7.1	7.39		

DISCUSSION

The usage of chatbots is becoming increasingly prevalent in a wide range of industrial sectors, including the healthcare industry, which has just lately begun to implement them. However, the application of chatbots in medical education is mostly unproven. A greater understanding of the ways in which a chatbot may be included into a medical curriculum is gained as a result of this study.

In our study, the formative assessment scores obtained after the implementation of rule based chatbots had higher mean values (7.24 ± 0.75) than that of the scores (6.64 ± 1.03) that were obtained before the implementation of it. The p-value of independent t-test was less than 0.05 and was statistically significant.

Liu et al.'s study showed chatbots improved mental health outcomes in college students, highlighting their potential for addressing mental health issues [3]. Larango et al.'s study found chatbots promising for patient education, highlighting their efficiency and cost-effectiveness. However, critical issues like individualized content and continuous assessment of effectiveness need to be addressed for effective use [4].

Similarly, our study observed a significant relationship in the improvement of formative assessment scores obtained by the students after the implementation of rule based chatbot in the curriculum as an adjunct tool for teaching learning method.

CONCLUSION

Overall, the integration of chatbots in learning management systems has shown promising results in improving student engagement and support. As technology continues to advance, it is crucial for educational institutions to stay updated with the latest Artificial Intelligence developments and incorporate them into their chatbot systems to better cater to the diverse needs of students. This will not only enhance the overall learning experience but also pave the way for more personalized and efficient student support services in the future.

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