

Role of E-learning Platform in Formative Assessment of Undergraduate Students

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ABSTRACT

INTRODUCTION: Blended learning, which incorporates personalization and assistance, has been shown to be more effective than standard curricula. This study aimed to use e-learning platforms for conducting and evaluating formative assessment tools that are difficult to evaluate through manual classroom evaluation.

OBJECTIVES: The primary objective was to implement a learning management system for evaluating formative assessments in preclinical competency-based medical education (CBME) curriculum and analyze and compare formative assessment performances in the learning management system.

MATERIAL AND METHODS: The study involved 110 first-year undergraduate medical students attending physiology classes, aged 18-30 years, of both genders, who provided informed consent for voluntary participation. Data collection involved obtaining written responses for formative evaluation about key subject matter addressed during physiology lectures, with approximately 15 formative session scores recorded over the academic year.

STATISTICAL DATA ANALYSIS: A statistical analysis was conducted to analyse students' formative assessment scores obtained by the learning management system, using Bonferroni Post-hoc-Tests between the three groups of formative assessment sessions.

RESULTS: The study found that Quiz/Multiple choice questions sessions had a higher mean value of attendance and formative assessment scores compared to other two types. This suggests that students are more interested in taking quizzes and concept mapping compared to writing essays.

CONCLUSION: The study found that students are predominantly in favour of using LMS as a supplementary tool to conventional teaching methods, they express considerable apprehension over its viability as a replacement for in-person instruction. The limitations of the study findings may stem from insufficient experience with web-based instruction.

Key words: E-learning, formative assessment, competency based medical education, online quizzes

INTRODUCTION

Medical education has seen a significant shift recently, characterized by the growing

use of e-learning platforms that have fundamentally altered the acquisition and dissemination of information and skills. The

COVID-19 pandemic has expedited this trend, compelling educational institutions to transition to remote and technology-enhanced learning to maintain the continuity of medical education.

A primary benefit of e-learning platforms in medical education is its capacity to provide learners flexible and accessible educational options. E-learning enables students to learn at their own speed, in any location and at any time, therefore transcending the constraints of conventional classroom education. This flexibility is especially advantageous for medical professionals, who frequently possess rigorous schedules and must reconcile their education with practical obligations.

Furthermore, e-learning systems include several elements that can augment the educational experience, including interactive multimedia material, simulations, and immediate feedback. These technologies facilitate students' comprehension of intricate medical ideas and processes, hence enhancing learning outcomes and fostering critical thinking and problem-solving abilities [1].

The use of e-learning platforms into medical education has demonstrated potential in enhancing accessibility and scalability. By utilizing digital technology, educational institutions may expand their reach to a broader audience, including individuals in rural or underdeveloped regions, and deliver high-quality educational content to a greater number of students.

The effective execution of e-learning in medical education presents several problems. Ensuring the quality and authenticity of instructional information, alongside the security and privacy of student data, are critical issues. The shift to e-learning necessitates sufficient infrastructure, faculty training, and administrative support for seamless and successful integration.

Notwithstanding these problems, the significance of e-learning platforms in medical education is expected to expand, as the advantages of this methodology get

greater acknowledgment. As medical education evolves, institutions must thoughtfully evaluate the incorporation of e-learning platforms, weighing the benefits against essential considerations to guarantee the provision of high-quality, accessible, and effective education for future healthcare professionals [2].

Numerous studies, encompassing both quantitative and qualitative methodologies, have demonstrated that individualized or adaptive learning, alongside interactive or collaborative learning—both enhanced by e-learning technologies—has led to increased learner satisfaction, knowledge enhancement, and conceptual comprehension, among other favourable results. Nevertheless, the learning process is most effective when it incorporates both personalization and assistance. In this context, after the extensive availability of Web 2.0 resources, blended learning has emerged as a cornerstone in higher education. Numerous result comparison studies have demonstrated that blended curricula exhibit either superior or comparable improvements relative to standard curricula.

Our study intended to use e-learning platform for the conduct and evaluation of formative assessment tools that are cumbersome to be evaluated through manual classroom evaluation by the instructor.

OBJECTIVES OF THE STUDY:

- 1) The primary objective was to implement learning management system for evaluation of formative assessment in preclinical competency based medical education (CBME) curriculum.
- 2) The secondary objective was to analyze and compare various formative assessment performances in learning management system.

MATERIALS AND METHODS

STUDY DESIGN

The study employed a cross-sectional design to compare formative assessments

performance, following the implementation of learning management system.

TYPE OF STUDY:

Analytical Cross-Sectional Study

STUDY PARTICIPANTS

The study had 110 first-year undergraduate 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 Research Committee at Trichy SRM Medical College Hospital and Research Centre, Irungalur, Trichy, Reference number: 211/TSRMMCH&RC/ME-1/2022- IEC No: 078, dated 14-03-2022. 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 [3].

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

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 Trichy SRM Medical College Hospital and Research Centre, Irungalur, Trichy and was conducted during the academic year March 2022 to February 2023. 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 15 formative session scores were recorded over the academic year. Out of the 15 formative sessions, five sessions were evaluated by One minute/one sentence essay, five sessions were evaluated by Quiz/One word answer/Multiple choice Questions and five sessions were evaluated by Analogy prompt/Concept map.

STATISTICAL DATA ANALYSIS

A statistical study was conducted to analyse students' formative assessment scores that were obtained by learning management system. The study used Bonferroni Post-hoc-Tests between the three groups of formative assessment sessions, with a p-value below 0.05 indicating statistical significance.

RESULTS

Table 1 shows the various formative assessment sessions conducted during the academic year through Learning Management system. There were three types of formative assessment tools used -One minute/one sentence essay, Quiz/One word answer/Multiple choice Questions and Analogy prompt/Concept map. Attendance of sessions ranged between 88.18 to

99.09%. Formative assessment scores ranged between 0(minimum) to 10(maximum). All the sessions belonged to Knowledge domain with level of competency Knows How. All the topics that were assessed by formative assessment sessions belonged to core competency. Number of participants varied from 97(minimum) to 108(maximum). None of the sessions had all the 110 participants.

Table 1: Formative assessment sessions conducted during the academic year

Session Number	Competency/ Topic	Domain/Level/ Core	Number of Participants (n)	Type of assessment	Session Attendance %	Formative Score (out of 10) Mean \pm SD
1.	PY1.5: Transport mechanisms	K/KH/Y	97	One minute essay	88.18%	6.89 \pm 2.79
2.	PY2.4: Erythropoiesis	K/KH/Y	101	One minute essay	91.81%	6.99 \pm 2.24
3.	PY2.10: Types of immunity.	K/KH/Y	105	Quiz	96.36%	8.53 \pm 1.58
4.	PY3.6: Myasthenia gravis	K/KH/Y	104	Concept map	94.54%	8.09 \pm 2.32
5.	PY3.9: Molecular basis of skeletal muscle contraction	K/KH/Y	107	Quiz	97.27%	5.11 \pm 1.48
6.	PY4.1: Enteric nervous system	K/KH/Y	109	Quiz	99.09%	8.54 \pm 1.48
7.	PY5.1: Conducting system of heart	K/KH/Y	106	Concept map	96.36%	5.72 \pm 1.93
8.	PY5.8: Local cardiovascular regulatory mechanisms	K/KH/Y	108	Quiz	98.18%	8.8 \pm 1.54
9.	PY6.2: Mechanics of normal respiration	K/KH/Y	105	Quiz	95.45%	8.39 \pm 1.96
10.	PY7.9: cystometrogram	K/KH/Y	108	One minute essay	98.18%	6.35 \pm 1.79
11.	PY8.4: Thyroid function tests	K/KH/Y	104	Concept map	94.54%	7.83 \pm 2.23
12.	PY9.3: Control of spermatogenesis	K/KH/Y	105	One minute essay	95.45%	7.05 \pm 2.28
13.	PY10.2: Properties of receptors	K/KH/Y	105	Concept map	95.45%	7.13 \pm 2.05

14.	PY10.3: Sensory tracts	K/KH/Y	101	One minute essay	91.81%	5.9 ± 2
15.	PY10.15: Auditory pathways	K/KH/Y	102	Concept map	92.72%	7.43 ± 2.17
Domain addressed: Knowledge(K); Skill(S); Attitude(A); Communication(C) Level of competency required based on the Miller’s pyramid: Knows(K); Knows How (KH); Skill (S); Show How (SH); Perform independently (P) Competency is core (Y) or non-core (N) Source: https://www.nmc.org.in/information-desk/for-colleges/ug-curriculum/						

Figure 1 shows the mean values of attendance and formative assessment scores of One minute/one sentence essay, Quiz/One word answer/Multiple choice Questions and Analogy prompt/Concept map sessions. Quiz sessions had a higher mean value of attendance and formative assessment scores compared to other two types of sessions.

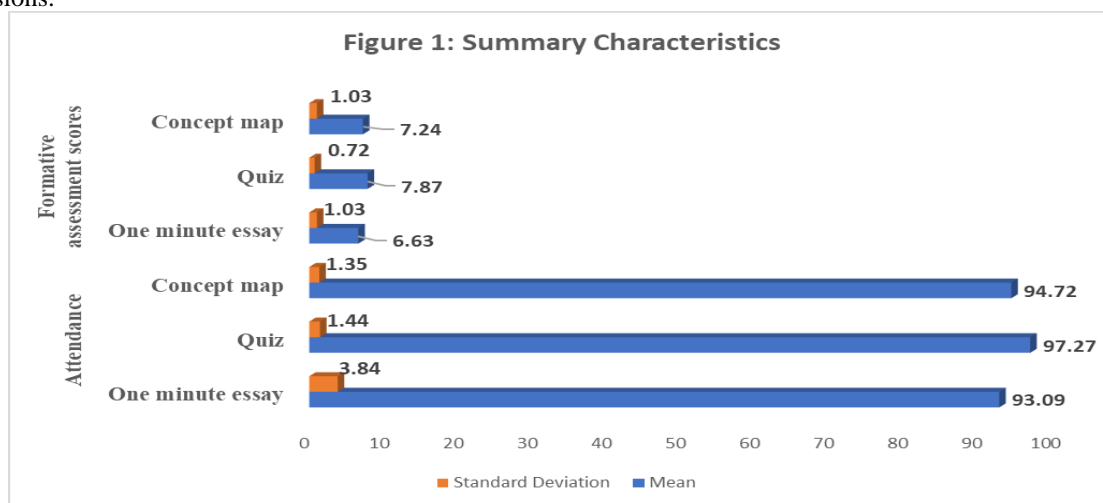


Table 2 shows the results of statistical analysis of Bonferroni Post-hoc-Tests between the three groups of formative

assessment sessions showing statistically significant differences since p-value is less than 0.05. Here p-value is less than 0.001.

Table 2: Comparison of Formative assessment performance of One minute essay/One sentence essay vs Quiz/One word answer/MCQs vs Analogy prompt/Concept map (n=110)

	Mean difference	Standard Error	t	p-value	95% Confidence interval	
					Upper limit	Lower limit
One minute essay vs Quiz	-1.24	0.126	-9.81	<.001	-1.55	-0.93
One minute essay vs Concept map	-0.6	0.126	-4.78	<.001	-0.91	-0.3
Quiz vs Concept map	0.63	0.126	5.03	<.001	0.33	0.94

DISCUSSION

In our study, the mean values of attendance of various formative assessment sessions showed higher participation rate for Quiz/Multiple choice questions sessions (97.27±1.44) compared to Analogy prompt/Concept map (94.72±1.35) and one minute essay/One sentence essay (93.09±3.84) sessions. Similarly, the formative assessment scores obtained were

higher in Quiz/Multiple choice questions sessions (7.87±0.72) compared to Analogy prompt/Concept map (7.24±1.03) and one minute essay/One sentence essay (6.64±1.03) sessions. This finding suggests that students are more interested in taking Quizzes and concept mapping compared to writing essay. This also reinforces that Online Quizzes are effective formative assessment tool as they assessed the

knowledge of students as same as the summative assessment exams [4].

Learning Management System (LMS) facilitate engagement with educational materials that can augment student interest and motivation. Furthermore, it enhances flexibility in the educational process. The LMS enables students to determine the time and location of their study, perhaps fostering tighter relationships between instructors and students. Student opinion reveals that while they are predominantly in favour of utilizing LMS as a supplementary tool to conventional teaching methods, they express considerable apprehension over its viability as a replacement for in-person instruction.

Limitations of the study findings is due to the reluctance of students to fully embrace the online technique may stem from insufficient experience with web-based instruction. Following years of education in traditional formats and settings, the perceived necessity of in-person learning may have become entrenched in their thoughts. Consequently, educators must recognize that transitioning from traditional teaching to an online approach should occur in meticulously planned phases rather than as a sudden change in instructional medium.

CONCLUSION

Our first assessment indicates that using the freely accessible Learning Management System (LMS) platform into our first-year medical physiology curriculum offered several benefits. The LMS platform was intuitive, offered several interactive elements to augment students' learning experiences, and provided greater flexibility in instruction. Students demonstrated a willingness to utilize LMS outside formal instructional hours, including weekends and holidays. If the LMS provides enhanced incentives for teaching, is it thus permissible to substitute conventional teaching methods with online learning. We endorse LMS as a

viable alternative for physiology instructors seeking to integrate LMS into their instructional practices.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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