

BLENDED LEARNING AS AN INTERACTIVE TEACHING LEARNING METHOD FOR MEDICAL UNDERGRADUATES

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Abstract

Background: Blended learning is the combination of online and face-to-face learning experience. In the recent years it has grown rapidly to be commonly used in education. Nonetheless, the effectiveness of this learning approach has not been completely quantitatively synthesized and evaluated in health education. Through this study we aimed to identify its strengths, weaknesses, from both student' and lecturers' viewpoint so that this innovative teaching and learning methods can help improve the students skills in critical thinking and academic achievement in medical education. **Objective:** The aim of the study was to assess the efficacy of blended learning compared to face-to-face learning. The objectives were to evaluate the perceptions of students on blended learning, to evaluate the perceptions of faculty on blended learning and to evaluate the interdependencies of face to face and online learning in the blended learning course. **Methods:** The study design and sampling method was prospective interventional study, cluster sampling. The study included 150 students of phase 1 MBBS of 2021-2022 batch and faculty of biochemistry. The students were sensitized to the blended learning module-acid base balance. Consent of the students was taken and importance of research in medical education was explained. The questionnaire used was adapted from the questionnaire in Sagarra and Zapata's (2008) study. The questionnaire has two parts; one for the students and the other for the faculty. The one for the students has two sections; the first section contains 16 questions which students answered on a 5 point Likert scale. The second section includes one short answer question. The second part has 6 questions for the faculty which were also answered on a 5 point Likert scale. **Results:** This evaluation showed that blended learning model helped students improve the critical thinking and retaining power because traditional time/place barriers were removed. However, new barriers related to technology by both students and teachers were noted. **Conclusions:** This study demonstrated different factors that affected the intention to use blended learning in undergraduate medical students and it has also highlighted that the blended way of study was more helpful rather than purely face to face or online learning.

INTRODUCTION

In the recent years, due to advancements in medical knowledge and changes in health service delivery, traditional methods of medical education can no longer meet the needs and requirements of current medical students.^[1] Novel and innovative teaching

and learning methods such as blended learning have become the latest trend in medical education which can improve student skills in critical thinking and academic achievements in medical education.^[2,3]

Blended learning has shifted the education towards more student-centered with increased interaction between students and teachers leading to improved

and effective learning.^[4] It has shown to be more advantageous over traditional learning because of its easy accessibility at any place and any time and can study at their own pace.^[5,6]

Research on blended learning has been reported since the 1990s.^[7] Study conducted by Smyth, Houghton, Cooney & Casey (2012) also addressed benefits and challenges of blended learning. As per Sano & Kagawa, cost of technology can be barrier though it's important.^[8] Whereas, studies done by

MATERIAL & METHODS

The blended course was on the topic acid base balance. It was designed for 150 students of phase 1 MBBS of 2021-2022 batch. The duration of the course lasted for 3 weeks. The content in this module was largely delivered by didactic lectures with supporting tutorials. In every week, students had to complete three hours of didactic lectures and two hours of online learning by themselves. Figure 1 shows the specific learning objectives of the topic and were divided into online self-directed learning and face to face learning. In total we dedicated 9 hours of face to face and 6 hours of online learning. The aim of the blended learning course was not to reduce the number of hours but to create a thorough understanding of the subject.

The content of e learning videos was shared by the faculty to the participants.

ACID-BASE BALANCE-SPECIFIC LEARNING OBJECTIVES

- Define Acid, Base, pH, buffer system, acidosis and alkalosis
- Importance of Henderson-Hasselbalch equation
- Explain role of buffer systems in regulation of body pH
- List the disorders of acid-base balance in the body
- Define titratable acidity, anion gap and delta ratio
- Explain the compensatory response to acid-base disorders
- Write down the steps for the analysis of acid-base disorders
- What are the normal ranges of pH, pCO₂ & HCO₃⁻?

Instrument

The questionnaire used was adapted from the questionnaire in Sagarra and Zapata's (2008) study. The questionnaire has two parts; One for the students and the other for the faculty. The one for the students has two sections; the first section includes 16 questions which students answered on a 5 point Likert scale. The second section includes one short answer question. The second part has 6 questions for the faculty which were also answered on a 5 point Likert scale.

Data collection and analysis

eis *et al.* and Costado Dios MT *et al.*, showed students preferred face to face to online and blended learning.^[9,10] In the present study, we aim to study the effectiveness of blended learning compared to traditional learning in health education and objectives were to evaluate the views of students and faculty on blended learning and interdependencies of face to face and online learning in the blended learning course.

Design of module

- What are the causes of respiratory and metabolic acidosis and alkalosis
- What are the complications associated with acidosis and alkalosis.
- ABG analysis

Online Self directed learning

- Define Acid, Base, pH, buffer system, acidosis and alkalosis
- Explain role of buffer systems in regulation of body pH
- List the disorders of acid-base balance in the body
- Define titratable acidity, anion gap and delta ratio
- Explain the compensatory response to acid-base disorders
- What are the normal ranges of pH, pCO₂, HCO₃⁻?
- What are the causes of respiratory and metabolic acidosis and alkalosis
- What are the complications associated with acidosis and alkalosis.

Face to face learning

- Importance of Henderson-Hasselbalch equation
- When and how anion gap and delta ratio is used in interpreting ABG
- Write down the steps for the analysis of acid-base disorders
- ABG analysis
 - o What is the acid-base abnormality?
 - o Compensation: no/ partial /full; explain?
 - pH=7.43, pCO₂=57mmHg, HCO₃=38
 - pH=7.28, pCO₂=58mmHg, HCO₃=22
 - pH=7.31, pCO₂=35mmHg, HCO₃=16, Na=136 and Cl=111

Prior to their participation, the students were asked to sign an informed consent form. Questionnaire was distributed to the students in class and then collected after the participants had finished them. The respondents were asked to choose a response to each statement from a 5 point Likert scale. The data was then statistically analysed in the computer with SPSS.

Results

Reliability of the questionnaire

The reliability coefficient was calculated on 22 questions.

The Cronbach's alpha value of these 22 questions was 0.84, which indicates that the questionnaire was a reliable instrument for the study.

Questionnaire for blended learning

The following feedback is solely for the purpose of academic research and will not affect your assessment in anyway. Kindly respond to the questionnaire objectively and honestly. Mark your answers as per the scale 1 to 5

1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree

Part-1

Section-1 Perceptions of student's on blended learning and interrelation of face to face and online learning

1. Onsite teaching/learning was more interactive among students than online mode?
2. Online teaching/learning was more interactive between students and teachers than online mode?
3. Instructions regarding platform to be used online were clear?
4. Instructions regarding devices to be used online were clear?
5. Online learning facilitated the onsite learning session?
6. Online learning followed by onsite learning made the topic interesting?
7. Online learning followed by onsite learning made the topic mode effective?
8. Student activity was monitored by the teacher in both onsite and online modes?

Ethical approval was obtained from the Research and Ethics Committee of the Deccan College of Medical Sciences.(2022/38/005)

9. Combined mode of online and onsite teaching facilitated understanding?
10. Combined mode of online and onsite teaching increased your knowledge?
11. Onsite mode followed by online mode provided motivation for further reading?
12. Learning material given online was adequate?
13. Learning material given onsite was adequate?
14. The topic was summarized by the teacher?
15. The topic was facilitated by e-moderator?
16. The learning experience was comfortable with both onsite and online mode combined?

Section-2

1. How can blended learning be more effective?

Part-2

Questionnaire on perceptions of faculty on blended learning.

1. Was the online navigation comfortable in delivering the lecture?
2. Were you able to facilitate online interaction with the students?
3. Were you able to interact effectively with the students post online sensitization?
4. Was the content in blended learning manageable?
5. Teaching core topics on line facilitated on site teaching?
6. Is blended mode a better way of learning when compared to face to face or online alone?

Ethical Approval

RESULTS

The results are presented in two sections as follows:

In this part, 16 questions on a 5 point Likert scale was drafted to know student's perception on blended learning.

Table 1: Perception's of student's on blended learning.

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Onsite teaching/ learning was more interactive among students than online mode:	1.80%	3.60%	21.50%	39.10%	33.90%
Instructions regarding platform to be used online were clear:	4.80%	12.70%	24.80%	37%	20.60%
Onsite teaching/ learning was more interactive between students and teachers than online mode:	3.60%	2.40%	23.90%	39.70%	30.30%
Instructions regarding devices to be used online were clear:	6.70%	10.30%	24.80%	35.20%	23%
Online learning facilitated the onsite learning session?	3.00%	1.70%	11.0%	27.80%	55.50%
Online learning followed by onsite learning made the topic interesting?	8.50%	12.0%	26.70%	16.40%	36.40%
Online learning followed by onsite learning made the topic more effective?	1.40%	3.60%	10.90%	28.70%	53.40%
Student activity was monitored by the teacher in both onsite and online modes?	10.30%	17.60%	25.50%	33.30%	13.30%
Combined mode of online and onsite teaching facilitated understanding?	5.50%	20.60%	9.10%	28.50%	36.30%
Combined mode of online and onsite teaching increased your reading time?	3%	1.80%	12.80%	27.90%	54.50 %
Onsite mode followed by online mode provided motivation for further reading?	8.50%	12.10%	26.70%	36.40%	16.30%
Learning material given online was adequate?	4.20%	21.20%	37%	11.50%	26.10%

Learning material given onsite was adequate?	1.20%	5.50%	23%	44.80%	25.50%
The topic was summarized by the teacher?	3%	7.30%	20.60%	42.40%	26.70%
The topic was facilitated by e-moderator?	6.10%	11.50%	46.0%	26.70%	9.70%
The learning experience was comfortable with both onsite and online mode combined:	12.70%	25.50%	9.10%	20.00%	32.70%
Total					100%

The total number of students who responded to the survey was 150.

Based on the above data 66% of the students agreed that blended mode of learning increased the knowledge. Around 32% of the students agreed for face to face mode of learning and only a minor percentage (1.3%) of the students agreed for online mode of learning.

Table 2: Perceptions of faculty on blended learning.

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Was the online navigation comfortable in delivering the content?	10.00%	30.00%	30.00%	30.00%	0.00%
Were you able to facilitate online interaction with the students?	0.00%	40.0%	30.00%	30.00%	0.00%
Were you able to interact effectively with the students post online sensitization?	0.00%	0.00%	20.00%	60.00%	20.00%
Was the content in blended learning manageable?	0.00%	0.00%	0.00%	70.00%	30.00%
Teaching core topics on line facilitated on site teaching?	0.00%	0.00%	0.00%	70.00%	30.00%

Comparison of responses of faculty members and students regarding preferences of the mode of learning

Mode of learning	Faculty members N=10	Students N=150	Chi ²	Sig (p-value)
Online	2(20%)	2 (1.3%)	13.56	0.001*
Face-to face	2 (20%)	48 (32%)		
Blended	6 (60%)	100 (66%)		

*Statistically significant

The total number of faculty members who responded to the survey was 10 which include faculty members from all academic ranks (professors, associate professors and assistant professors). As per the results of the above data, we conclude that majority of the professors (60%) felt that blended mode was better mode of learning when compared to face to face or online alone.

DISCUSSION

An integration of online with didactic lectures was well accepted by the students. Students reported increased flexibility to study lectures at any time and place provided the digital material had easy to digest content.

The results of the other study found that blended learning promoted comprehensiveness of learning and emphasis on a learner-centered rather than teacher-centered system and utilise modern and virtual methods.^[11] Studies done by Jefferson and Arnold revealed that cost-effective infrastructures can facilitate smooth migration from the traditional teaching model.^[12] On the contrary, study done using SWOT analysis highlighted the inadequacies in the design of the services leading to insufficient learning. Furthermore, the study showed reduced communication between students and lecturers.^[13]

From our view point in present study, the staff noted that it improved their competence and made them more effective educators. The faculty preferred to meet students and conduct assignments in the classroom as they considered that the blend approach to be more beneficial instead of asynchronous mode of learning alone.

We also found that easy access and well structured study material which highlights the core topics

proved beneficial to the students. Several topics were identified by the students which they felt could be delivered in a blended format. As per Kenan *et al.* e-learning opens up a convenient platform for learning skills and gaining knowledge (14). Other studies concluded that e-learning can promote high quality education at lower costs.^[15,16] Studies done by Stockwell *et al.*, suggested that blended learning could deepen understanding by working on learning skills rather than memorize and reproduce for test.^[17] Though the importance of blended teaching was studied for more than a decade now. It was recently adopted by the universities across globe since the advent of COVID-19 pandemic. The outbreak of COVID-19 pandemic has greatly changed the face of medical education and demanded the incorporation of blended learning to ensure best outcomes and better preparedness for the future.^[18] Thus educators must note that the importance of inculcating blending learning in medical students will help to promote quality education.

CONCLUSION

The main purpose of blended learning was to create an effective and efficient learning for medical undergraduates. The study explored that blended

learning was very well accepted by the medical undergraduates in preference to didactic lectures or online alone. The element that enhanced student's engagement with blended learning is well-presented high-quality e-learning material and blend with face to face learning. Moreover, the use of blended learning has helped the students in developing logical thinking, reasoning skills and critical thinking.

Furthermore, the faculty members were open to accept blended learning despite the barriers like investing more time in preparing online material. Hence by this study we conclude that blended learning has helped to increase the level of education and skills in undergraduate medical students. It could be promising and advantageous for future application in medical health profession.

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