Original Article

Blended learning approach for teaching and learning anatomy: Students' and teachers' perspective

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ABSTRACT

Introduction: Anatomy education is facing challenges mainly due to reduced curriculum time and lack of cadavers. In order to overcome these constraints, there is a need to introduce technology-assisted self-regulated learning methods such as blended learning along with the traditional face-to-face classroom teaching method.

The aim of the present study is to develop and implement blended learning module to support traditional didactic lectures for teaching/learning gross anatomy and to get students' and faculty perception regarding its usefulness.

Methodology: A blended learning module (BLM) comprising lesson plans for three topics in gross anatomy was developed and implemented. Feedback was taken from the students and faculty regarding their perception of BLM using separate semi structured, self-administered questionnaires.

Results: Majority of the students responded that BLM increased their interest in the subject, encouraged them in developing independent learning skills. They experienced better understanding of the subject and higher level of interaction with the teacher during face-to-face sessions. Most of the faculty members agreed that blended learning motivated students to do self-study, helped them in developing higher cognitive skills and enhances learning.

Discussion: Students' and faculty perception was that blended learning facilitates understanding of the subject, motivates students for self-directed learning and provides access flexibility to learning resources.

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1. Introduction

It is a well known fact that anatomy has been a cornerstone of medical education for hundreds of years. Knowledge of anatomy is essential for clinical examination, surgical procedures and interpreting medical imaging. However, anatomy education faces challenges such as reduced curriculum time and lack of cadavers. With diminishing time and resources devoted to anatomical education, it is imperative to integrate technology based learning methods with the traditional classroom teaching methods to make the teaching of anatomy effective and efficient.

Combining the advantages of online learning and traditional classroom learning environments has led to a new learning environment often referred to as "blended learning". Blended learning (BL) integrates face-to-face interaction with technologically mediated interactions among students, teachers and learning resources.[1] Usually there is some element of self-directed learning and the learner has control over time, place, and/or pace of learning to some extent. Blended learning strategy shifts teaching from a largely teacher-centered activity to a more student-centered activity as it encourages students to be active in the experience of learning rather than being passive learners.[2] Other advantages of this approach include a better learning experience, more consistent content delivery, greater flexibility and student satisfaction.[3] It enables the students to become more motivated and more involved in the learning process, thereby enhancing their commitment.[4,5]

In the current literature, very few studies are available on the use of blended learning and its effectiveness in context of teaching anatomy to medical students.[6,7] The purpose of this study,

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therefore, was to (a) to develop and implement a blended learning module mainly focussing on using online learning to complement the traditional face-to-face teaching methods, (b) to obtain students' perception regarding usefulness and effect of blended learning method on their learning experience, (c) to assess the effectiveness of blended learning in terms of students' performance and (d) to take feedback from the faculty regarding usefulness and impact of blended learning method on students' learning.

2. Methodology

Approval for the study was obtained from the Institutional Ethics Committee. A blended learning module (BLM) based on rotation model was developed and implemented to teach gross anatomy to 2nd semester MBBS students ($n = 103$) at School of Medical Sciences & Research (SMS&R), Greater Noida, India. It comprised of three lesson plans from the region of the pelvis (bony pelvis, uterus and pelvic diaphragm). The content delivery mode for each lesson plan included both face-to-face and online learning sessions, the latter through the website. A website was created using 'WiX Html Editor' and used for the purpose of providing online learning resource material in the form of text, images, videos, quizzes and case based problems (Fig. 1). Faculty members ($n = 9$) of department of Anatomy at SMS&R also participated in the study to observe the usefulness and impact of BLM on students' learning and provide their feedback. One week prior to implementation of the BLM, students and the faculty were briefed about the details of the module, and how to use the website.

Lesson plan for each topic was divided into 3 parts:

Part 1: Online session (self-learning of basic concepts): Prior to each face-to-face session the students were asked to go through the learning resource material provided online under the heading Phase I so as to become familiar with the new terms and basic concepts pertaining to that particular topic (Fig. 1).

Part 2: Face-to-face session: The face-to-face session started by quizzing the students about the basic concepts (10 min) of the topic. This was followed by 25–30 min of didactic lecture to explain in details some of the important and clinically relevant aspects of the topic. The session concluded by answering student's queries if any, and summarisation of the topic by the students (10–15 min).

Part 3: Online session (self-assessment and application of knowledge): Students were asked to refer to the online resource material under the heading Phase III (MCQs, quizzes) to test, reinforce and apply the anatomical knowledge learnt in previous

Fig. 1. Screenshot of website showing home page, page from Phase I and Phase III.

sessions. A section on applied anatomy was available with case based problems to develop higher cognitive skills i.e. application of knowledge of anatomy to understand the anatomical basis of relevant clinical conditions (Fig. 1).

Online sessions were carried out asynchronously by the students outside the scheduled class time. To ensure that students go through Phase I and III of the study, they were divided into small groups of 10–11 students, each with a group leader to motivate the students to use the website. To interact with the group members the group leaders used 'WhatsApp' facility.

Following the implementation of BLM, the usefulness and effectiveness of BL was assessed by:

a. **Feedback from students:** Feedback from students was obtained regarding their perception of the BL as teaching learning methodology and its effect on their learning experience by administering a semi structured, self-administered questionnaire consisting of close ended statements with 5 point Likert scale options for each (Strongly agree, Agree, Neutral, Disagree and Strongly disagree) and open ended questions. The questionnaire was framed to assess the following aspects of the module: (a) students' satisfaction, (b) quality of online learning resource material, (c) usefulness, (d) the most effective and the least effective aspects of the module and (e) limitations. The question-naire was designed after reviewing the literature and finalised after consulting senior faculty members and pilot testing.

b. **Feedback from faculty:** Feedback from faculty was taken regarding their perception of usefulness and effectiveness of the BLM by administering another semi-structured, self-adminis-tered questionnaire.

Feedback questionnaires were distributed to the students after completion of the BLM. Only those students ($n = 86/103$) were included in the study who attended all the face-to-face sessions, visited website for online sessions, appeared in the written examination, and completed the feedback questionnaire. All the faculty members ($n = 9$) gave their feedback. The feedback questionnaires were collected, data were compiled using Excel and analyzed.

2.1. Data analysis

The students and faculty responses for close ended questions were analyzed using descriptive statistics. For open ended question text analysis was done using qualitative analysis using the following steps: (1) read through responses, (2) develop categories, (3) assign each response to a category, (4) review the categories if needed and (5) identify the main salient points that emerged.

3. Results

(a) Students perception of blended learning

A total of eighty-six 2nd semester MBBS students partici-pated in all the sessions of blended learning module. Fig. 2 shows students' response regarding BLM. Almost 90% of the students were satisfied (Strongly agree/Agree) in general with the BLM and the quality of learning material provided on website. Three fourth of the students responded that BLM increased their interest in the subject and helped them in developing independent learning skills. Majority of the students experienced better understanding of the subject and higher level of interaction with the teacher during face-to-face session. A little more than 75% of the students stated that they prefer blended learning than traditional didactic lectures. On the other hand, one third of the students felt that BL increased their workload and about 20% of the students reported that they did not have enough time to go through the whole content of the website.

Students' response to the open ended questions helped in identifying the most effective, the least effective aspect of BLM, limitations and suggestions to improve. Following salient points emerged after qualitative analysis of the responses of the students.

  i. **Most effective aspect of BLM:** Students expressed that Phase I helped them in getting acquainted with the new terms prior to the lecture and it was easier to understand the topic. They felt that the pictures/video available on website not only made the concepts clear but also got them

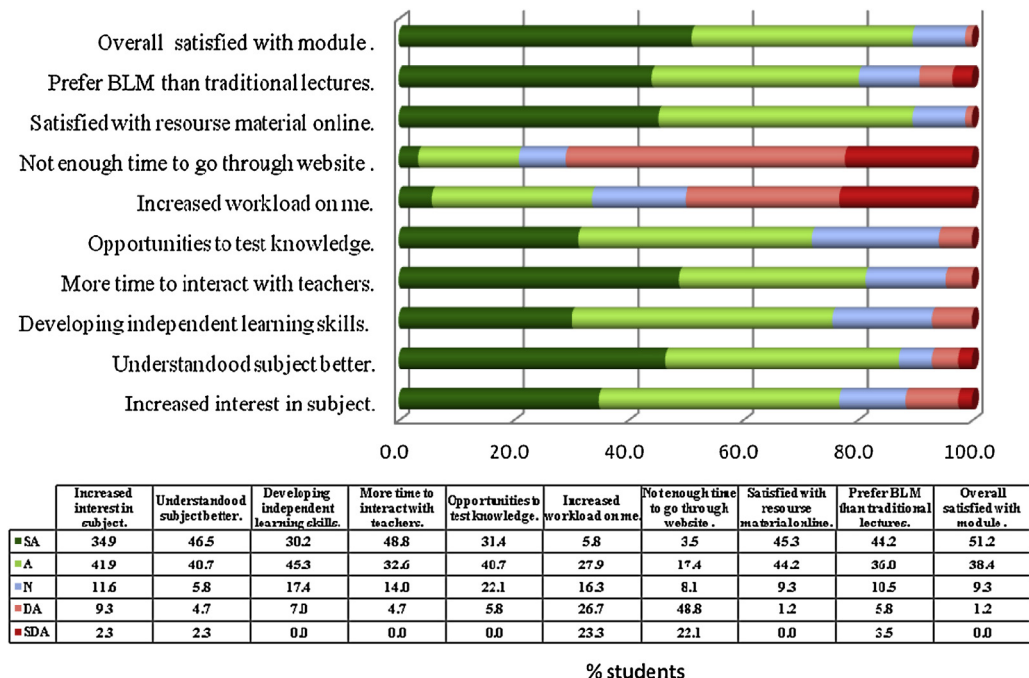|	Increased interest in subject.	Understandood subject better.	Developing independent learning skills.	More time to interact with teachers.	Opportunities to test knowledge.	Increased workload on me.	Not enough time to go through website.	Satisfied with resource material online.	Prefer BLM than traditional lectures.	Overall satisfied with module.
SA	34.9	46.5	30.2	48.8	31.4	5.8	3.5	45.3	44.2	51.2
A	41.9	40.7	45.3	32.6	40.7	27.9	17.4	44.2	36.0	38.4
N	11.6	5.8	17.4	14.0	22.1	16.3	8.1	9.3	10.5	9.3
DA	9.3	4.7	7.0	4.7	5.8	26.7	48.8	1.2	5.8	1.2
SDA	2.3	2.3	0.0	0.0	0.0	23.3	22.1	0.0	3.5	0.0

% students

Fig. 2. Students' perception of blended learning module. SA, strongly agree; A, agree; N, neutral; DA, disagree; SDA, strongly disagree.

more interested in the topic. According to most of the students, during face-to face session there was more time available to interact with the teacher and to clear their doubt. Some students felt that the quizzes available on website were very helpful as they helped them in self-evaluation.

ii. **Least effective aspect:** Few students mentioned that the face-to-face session was difficult to understand as they had not gone through the whole content of website (Phase I). Some of the students felt stressed to answer correctly in class during the question–answer session at the beginning of the lecture.

iii. **Limitations in using website:** Majority of the students did not face any problem in navigation of the site; however, students who used mobile phones reported that pictures and videos took time to load on phone. Few students faced network problems and others said they did not get sufficient time to go through the content of the site.

iv. **Suggestions to improve:** Most of the students were satisfied with the module. One of the suggestions was to add more information and videos on website. Some of the students (21%) opine that discussion forum should be included so that the students can interact with the teacher in case the students need any clarification or face any problem while going through the website.

(b) **Feedback from faculty**

The responses of the faculty members to close ended statements are shown in Fig. 3. Majority of the faculty members agreed that blended learning motivates students to do self-study helps in developing higher cognitive skills and enhances learning. Six out of nine faculty members stated that they were willing to use blended learning method for teaching in future. Table 1 lists the salient points that emerged from the responses of faculty to open ended questions. Faculty opined that some of the most effective aspects of BLM were that it promoted self-directed learning and was useful in self-evaluation. According to them the precise to the point content and simple descriptive illustrations/video helped in better understanding. However, they felt that proper assessment of effectiveness of blended learning is possible only after more modules are implemented.

4. Discussion

Blended learning offers an effective and efficient platform for utilising different teaching strategies and has the potential to maximise the advantages of both face-to-face and online learning.[8] Students can understand the key concepts better and construct their own knowledge when classroom lectures are combined with online activities.[9]
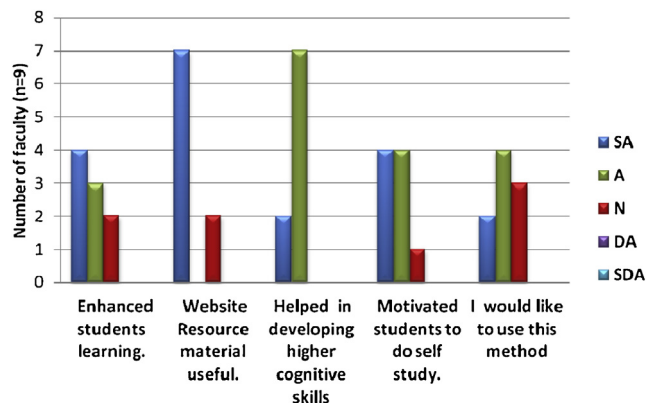
Fig. 3. Response of faculty to close ended questions on blended learning module.

Table 1
Response of faculty to open ended questions regarded blended learning module.

Open ended questions	Faculty response
What was the most effective aspect of BLM?	• Phase 1 helped students in better understanding. • Ready material for students who want to know more. • Useful in learning applied anatomy. • Precise to the point content with descriptive illustrations/video. • Promoted self-directed learning and self-evaluation.
What was the least effective aspect of BLM?	• Increase workload on teacher. • Good network connectivity needed.
Suggestions for improvement	• Introduce online group activities to generate more interest. • Proper assessment is possible only after more modules are implemented.

The findings of the present study revealed that students as well as faculty perceived blended learning as a positive influence on students learning experience. The common views shared by students and faculty regarding BL included better understanding of the subject, motivation of students to do self-study and enhancement of learning. Thus, present study supports the previous research that advocates blended learning as useful and effective method in terms of enhanced learning, student participation, motivation and active and deeper learning.[4,5,10,11,13] Although, the overall students' response was overwhelmingly positive towards use of BL, however, self-discipline and time management skills posed a challenge to some of the students as they responded in affirmative to the statement "I did not get enough time to go through the online content". In fact, some researchers have suggested that blended learning may help in developing time management skills in students as it requires self-discipline and proper time management.[12]

Students identified increased interaction level during face-to-face session as one of the most effective aspect of BLM. Shifting of a significant part of learning material to online sessions in blended learning approach makes more classroom time available for interactive activities. Face-to-face learning is limited by time; therefore, combination of online and classroom instructional delivery methods can provide more time available for interaction between students and teachers. For students BL provides active learning environment and flexibility in using time and learning resources. For faculty, it provides opportunity for improved quality of interaction with students. It has been very aptly stated by Osguthorpe and Graham,[14] that the purpose of using blended learning approach is to find a harmonious balance between online access to knowledge and face-to-face human interaction.

One of the limitations anticipated by the faculty regarding the use of BL was its impact on their workload. Most of the faculty members felt that to prepare lesson plans for BL can be very time consuming as BL entails significant changes in the way learning material is delivered. It is obvious that designing and developing blended learning module requires greater amounts of time than designing classroom instruction. In order to develop blended learning successfully, a good mix of online learning material and content of face-to-face session has to be reached so that they complement each other. Secondly the faculty also felt that proper assessment of effectiveness of BL is possible only after implementation of more BLMs. The results of the current study cannot be extrapolated to predict usefulness of BL in teaching other topics/subjects. Therefore, more BLMs need to be developed and introduced with appropriate mix of teaching/learning methods to reach to a definite conclusion regarding effectiveness of BLM in teaching different topics.

5. What this study adds

Although blended learning is currently gaining attention, it is still not well-developed and used enough to teach medical students. There is a need for evidence about the usefulness of BL in teaching anatomy to medical students and we hope that this study will serve as an early contribution to a much larger and more inclusive effort to conduct research in this field. The study contributes by providing faculty as well as students' point of view regarding usefulness of BL on students learning. The findings of the present study also provide support to the feasibility and benefits of using blended learning in teaching gross anatomy.

6. Conclusions

Blended learning is about ways of providing students with best possible learning and teaching experiences, as well as supporting teachers in their role as facilitators. A blend of traditional methods (i.e. face-to-face classroom teaching), with technology-based instruction can help in overcoming time constraints of traditional classroom teaching and enhance learning. Moreover, in context of medical education, use of multimedia format in BL may facilitate development of constructing an integrated educational model combining basic and clinical subjects.

Conflicts of interest

The authors have none to declare.

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