

Blended Learning: An effective approach for Online Teaching and Learning

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Abstract:

The present education system has been disturbed due the COVID-19 pandemic and has imposed a greater challenge on educational institutions to seek out alternative approaches in the teaching-learning process. Most of the educational institutions took several initiatives to impart education with the aid of digital technology. In Today's world knowledge construction in students can be enhanced by combining technology with the traditional way of lecture delivery. Blended learning is a technique which integrates digital media and technology along with traditional classroom activity. It also provides more flexibility for students to customize their learning experiences. Both online and offline will complement each other by using their individual strength. This paper presents a Blended learning approach using Modular Object-Oriented Dynamic Learning Environment (Moodle) as Learning Management System (LMS) platform. Asynchronous videos were created in studios using Lightboard and uploaded on LMS and subsequent Synchronous classes were handled using the MS Teams platform. Learners Centric Blended learning model includes interactive videos, Frequently Asked Questions (FAQs), post-tests, additional study materials, Quizzes, Assignment submissions, etc. This model is effectively implemented for all the courses in our institution and is illustrated in this paper using the Numerical Methods and Differential Equations (NMDE) course at second Year Biotechnology. An online survey was conducted to understand the perception of the students about the blended learning approach through LMS. The results of feedback revealed that the blended learning approach is more flexible and provides independent opportunities for students to learn. More than 82% of the students have given positive feedback towards this technological transformation in teaching and learning.

Keywords: Blended Learning, Asynchronous and synchronous mode, Online Teaching-Learning, Lightboard, Learning Management System.

1. Introduction

One way of achieving learning objectives in education is to modify or restructure the learning system. Blended learning or technology-based learning is becoming highly prominent for higher education students. Blended learning will

enhance face-to-face interaction between students and teachers, using digital technology. The blended learning strategy sets a methodical framework for the appropriate use of online resources, digital tools, and technologies to support face-to-face interaction between students and teachers. The major benefits of Blended learning are its flexibility and better learning experience (Jayanthi. R, 2019; Rashpinder Kaur, *et al.*,2021).

Blended Learning is judiciously designed and integrated by considering the amount of time spent for learning on Asynchronous mode versus time spent on synchronous mode. Blended Learning Approach (Deepa M, *et al.*,2021) facilitates teachers and students to collaborate and interact with each other through LMS. Blended learning provides interactive, student centric learning environment fostered by the current and advanced technologies. The blended learning approaches give us a clear indication of the most appropriate sequence of steps in developing the skill sets of the students (Lalima and Dangwal, 2017; Lekha Das and Megha Sharma, 2020; Sharanappa A *et al.*,2018).

In this paper, the blended learning approach is illustrated using the Numerical Methods and Differential Equations (NMDE) course for second-year undergraduate students of Biotechnology Engineering.

Objectives of Blended Learning

1. Improve the student's involvement in the learning process
2. Enhancement of the effectiveness of online teaching-learning
3. Effective handling of problems raised in education sector due to pandemic

2. Methodology

Design of Blended Learning Approach:

The proposed methodology of blended learning approach comprises of a three-stage procedure as shown in Fig 1.

- 1) Asynchronous mode/delivery
- 2) Post Test
- 3) Synchronous mode/delivery

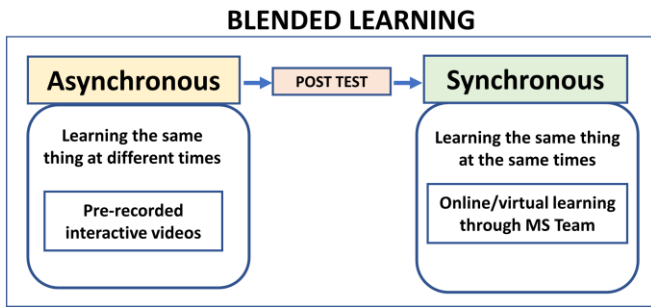


Fig 1. Blended Learning Approach

Asynchronous (Lightboard) Teaching:

Asynchronous mode is delivered on the LMS Platform through Pre-recorded videos. Video shooting of the lecture is carried out in the studio using Lightboard.

Preparation of videos

The sequence of steps involved in the preparation of asynchronous videos are chunking, script writing and video shooting.

Chunking:

Chunking is an act of breaking a component into smaller units called “chunks” of related information. It involves breaking a large topic into smaller, more digestible “chunks” of information and presenting these chunks of content one at a time to learners. It’s important to take the time to think purposefully about the best way to chunk, sequence, and organize instructional materials, learning activities, and assessments.

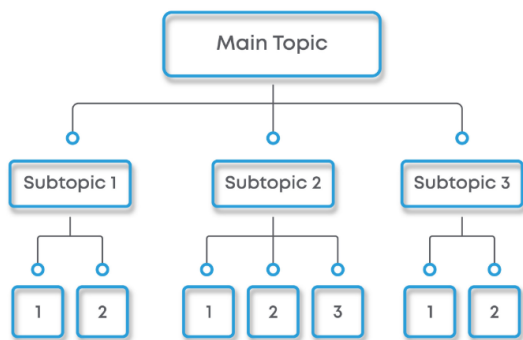


Fig 2. Tree diagram to organize chunks

In every course, each main topic is divided into sub-topics and further each sub-topic is divided into deliverable smaller chunks (Fig. 2). Chunks are prepared considering the attention span of students. A sample chunking of a topic Interpolation is shown in Table I.

Table I. Illustration of Chunking

Chunk No.	Description	Content Type	Instruction method	Resource format	Duration
1	Overview of Numerical methods and Interpolation	Principle	Presentation	Passive video	9 min
2	Polynomial Interpolation and Forward difference	Concept	Presentation	Interactive video	10 min
3	Backward and Central Difference	Concept	Presentation	Interactive video	12 min
4	Interpolation with equal intervals- Forward difference	Concept/ Numerical	Presentation/ Chalk and board	Interactive video	12 min
5	Interpolation with equal intervals- Backward difference	Concept/ Numerical	Presentation/ Chalk and board	Interactive video	10 min

Script preparation for video lecture:

Writing scripts is an important but sometimes overlooked step in creating audio and video recordings. It also helps keep recordings focused on key concepts and learning objectives. Scripts for video lectures are prepared as per the chunking plan.

Video recording with the Lightboard:

Lightboard is a teaching tool often used by the instructors to sketch diagrams, write notes and incorporate PowerPoint slides while lecturing and being recorded on camera. The text and information are reversed and oriented appropriately; thus, viewers see a presenter facing them allowing text and information readable by the students.

Fig 3 shows the clipping of recording of video lecture using the light board.

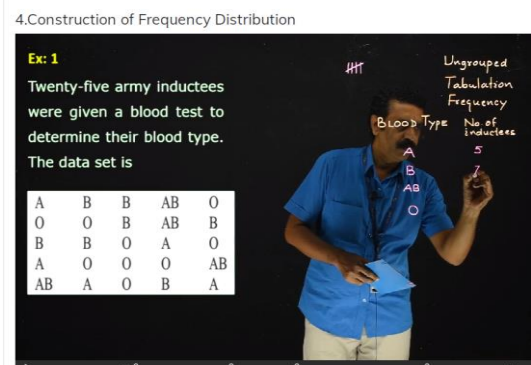


Fig 3. Video recording using Light Board

The Lightboard recordings can help reduce this transactional distance mimicking traditional classroom teaching and

providing the teaching presence that is important when teaching online. The technology is particularly valuable for instructors in science, math, or technology who often must work through formulas or explain complex processes using illustrations. One of the main uses of the Lightboard is to demonstrate complicated material, such as a mathematical formula or diagram. The presenter can write or draw as they explain the content, providing helpful visuals that can improve understanding.

The advantage of Lightboard Teaching is that viewers can pause, fast-forward, and rewind videos, which gives them the control to learn at their own pace. These unique functionalities are an advantage that video has over live in-class instruction.

Semester Delivery Plan

The asynchronous and synchronous mode of delivery during blended learning approach is done as per the semester delivery plan. A sample delivery plan for first two weeks of the semester is as shown in Fig 4.

WEEK 1						WEEK 2					
Mon	Tue	Wed	Thu	Fri	Sat	Mon	Tue	Wed	Thu	Fri	Sat
W1.1	W1.2	W1.3	W1.4	W1.5	W1.6	W2.1	W2.2	W2.3	W2.4	W2.5	W2.6
1st set Release of Videos	Watch Video	Watch Video	Watch Video	Post test on 1st set of videos Released		2nd set Release of video and SYNC Session on 1st set of videos Released	SYNC Session on 1st set of videos Released	SYNC Session on 1st set of videos Released	SYNC Session on 1st set of videos Released		Post test on 2nd set of videos Released

Fig 4. Semester delivery plan for Blended Learning Approach

In week-1 first set of videos was released on Monday. Students watch these videos up to Thursday. Post-tests are conducted on Friday and Saturday. In week-2 second set of videos is released on Monday and Synchronous session on the first set of videos released in week-1 is conducted, followed by the post-test on the second set of videos on the weekend. This schedule is continued for the entire semester.

Learning Management System (LMS):

This Blended Learning Model is implemented through Moodle’s (Modular Object-Oriented Dynamic Learning Environment) Learning Management System (LMS). Moodle is an accessible, adaptable, and affordable Learning Management System that supports learning and training for the delivery of educational courses (Prapulla S B *et al.*,2020; Pratibha S. Yalagi, *et al.*,2021; Sharanappa Achappa *et al.*,2020).

LMS is a platform providing a course management facility for the teaching-learning process. It is a secure All-in-one tool providing flexibility and scalability. It is user-friendly and highly configurable also. It has features like:

- Course creation
- Course Overview

- Course Outcome
- Prerequisite for the course
- Course Content
- Lesson Plan
- Chapter-wise plan
- Pre-session: containing Asynchronous Videos (Interactive Videos)
- In session: Links containing recordings of MS Team synchronous sessions for slow learners to watch at their convenience.
- Post Session containing Post Tests (Assignment, Study Material, Practice Exercises, Additional examples, Data Tables, etc.)
- FAQs at the end of each chapter
- Post Test report

Teachers and students can easily use this platform for the teaching-learning process effectively. Teachers and students are enrolled in our LMS through this server which is available 24X7 to all. Every individual teacher can create and manage their courses effectively (Carla Limongelli, *et al.*,2016; Charles Dziuban, *et al.*,2018). An example of a course created is shown in Fig. 5.

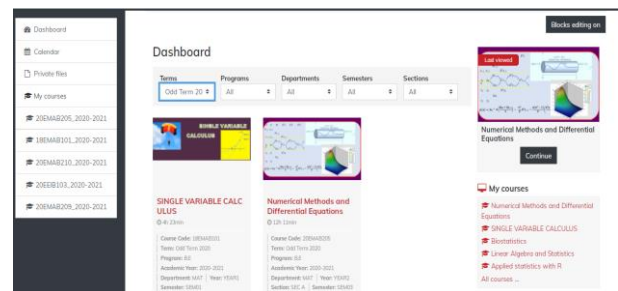
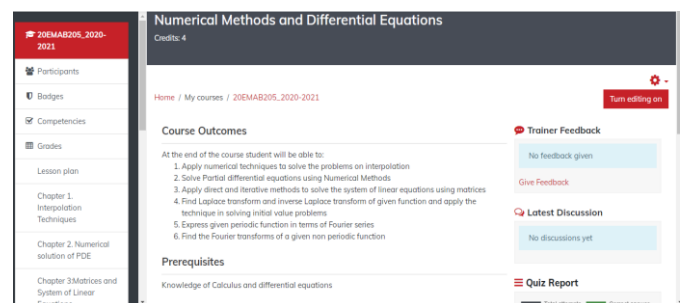


Fig 5. Example Course Created on Moodle

The course is created on LMS, it includes Course Overview, Course Outcome, Prerequisite for the course. Course Content, Lesson Plan, Chapter wise plan, and model question papers are also added as shown in Fig 6 and Fig 7.



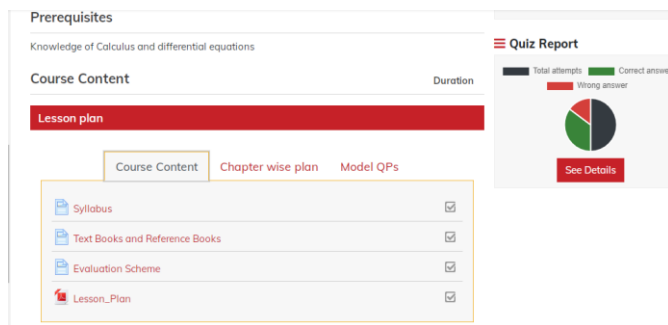


Fig 6. General view of Course dashboard

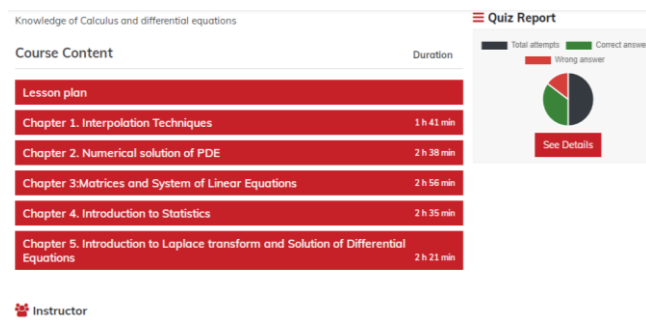


Fig 7. View of Course Content

For each chapter, there will be 3 tabs: Pre-session, In-session, and Post Session.

Pre-Session:

Pre-session contains Asynchronous video links. Asynchronous video links are created and uploaded on LMS under Pre-Session Tab. Interactive/popup questions are added in between to keep students engaged while watching the videos. To maintain continuity in the learning process “Access Restrictions” are enabled. “Activity completion” is also enabled for videos to avoid skipping of videos by students. Frequently Asked Questions (FAQs) are designed to clarify the students’ doubts based on their experience of handling the course (Fig 8).

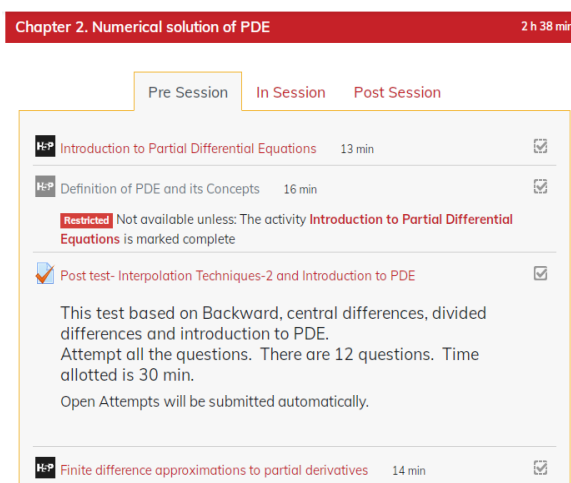


Fig 8. View of Pre-session tab

Post Test:

A post-test was conducted to assess the level of understanding of the concepts covered in the Asynchronous session. This acts as input for the teacher to plan synchronous sessions and to address the difficulties faced by the students. The Question Bank for post-test is prepared according to Bloom's taxonomy. Further mapping of each question with Program Outcome (PO), Outcome element (OE), and Performance Indicator (PI) is done as shown in Fig 9.

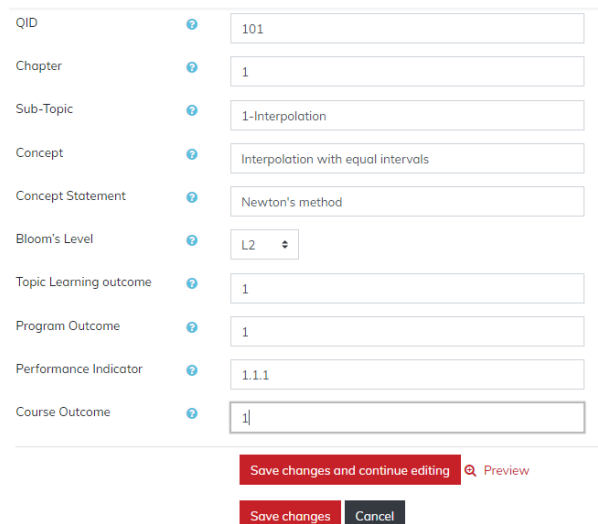


Fig 9. Mapping of Post-Test questions to BL, PO, OE & PI

For each post-test random selection of questions from the question-bank is made by giving proper weightage to the complexity of the question in terms of Bloom's taxonomy. The post-test contributes a significant 20% of the overall assessment of the course.

In Session:

In session contains recorded video links of the synchronous class using the MS Teams platform, which helps the students to re-visit the recorded videos at their own pace.

Post-Session:

Post-session contains Review Questions, additional study materials, Data Tables, Practice examples, Assignment Submissions, etc (Fig 10).



Fig 10. View of Post Session

Synchronous Mode/Delivery:

Analysis of post-tests results on conceptual understanding acts as input for Synchronous delivery of the course. Synchronous delivery of classes is done using the MS Teams platform (Fig 11). The concepts which were not clearly understood by students during the Asynchronous mode are addressed during the synchronous mode. Additional numerical exercises are solved during this session.



Fig 11. View of the synchronous session on MS Team

LMS also facilitates analytics on activity completion, student scores, video ratings to personally monitor the progress of the students (Fig 12).

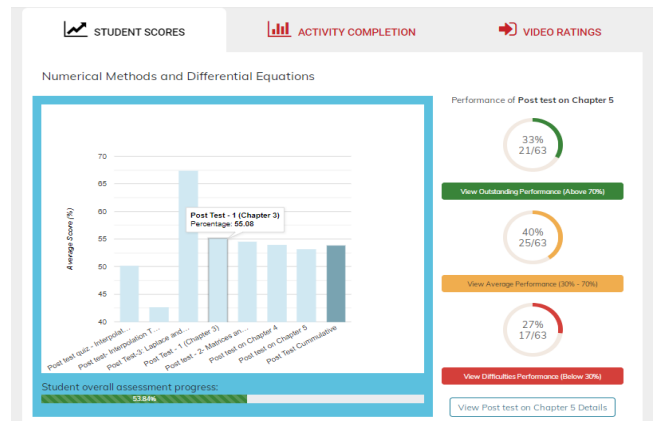


Fig 12. View of Analytics dashboard

Challenges faced during the implementation:

- Teacher spent large amount of time in planning, chunking/segmenting of topic, preparation of visual aids (PowerPoints or other videos) and storyboarding content.
- Lightboard requires high maintenance and bit complex to handle.
- The Lightboard has smaller working space as compared to traditional blackboard and cleaning the Lightboard takes some time, hence teacher needs to be very precise while writing.
- Teachers were under stress during recording of videos as they were facing camera for the first time.
- Several retakes are required to produce good quality videos.
- Software difficulties and problems during post production.
- Preparation of popup/interactive questions.

3. Student Survey

Perceptions about the application of the blended learning approach were analyzed by collecting student feedback (Ana Horvat, *et al.*,2015; Anil Shet, *et al.*,2017; Deepak Yaraguppi, *et al.*,2016; Zabin Bagewadi *et al.*,2020; Akhil Sachan *et al.*,2019)). The feedback form is designed with various questions based on Asynchronous and Synchronous delivery, Organization of the Content in LMS, duration of the video, Post-test, the satisfaction of learners, etc. Each question has 5 options viz, Strongly agree, Agree, Partially Agree, Disagree, and Strongly Disagree (Laxmikant Patil, *et al.*,2021; Shivalingsarj Desai *et al.*,2016).

A sample copy of the feedback form is shown in Table II.

Table II. Questionnaire for student Feedback

Sl. No	Questions
1	The Lecture videos in Asynchronous mode are helpful in learning the course content.
2	The organization of video content is helpful in learning the content.
3	The duration of videos is optimum.
4	Interactive/pop-up questions are helpful to self-assess learning from videos.
5	Post-tests are well designed to evaluate the learning of the course topics.
6	The synchronous mode of delivery is complementing the Asynchronous mode.
7	The content flow in the LMS was well organized.
8	The blended learning approach is a good alternative to the traditional classroom teaching/learning method.

Feedback is collected from a total 52 students in this course and the analysis of the responses is shown in Fig 13.

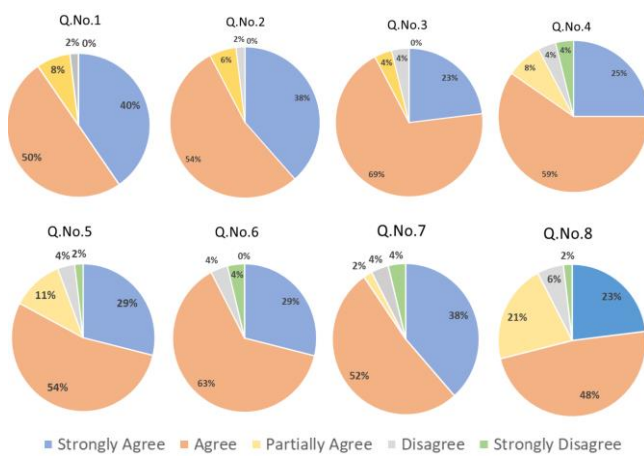


Fig 13. Students' feedback on Blended Learning

Around 90% of the students agree that the videos in asynchronous mode are helpful in learning the course content. 92% of the students expressed that video contents were well organized and the duration of the videos is optimum. This reinforces our belief that the duration of the videos should not be very long. More than 82% of the students expressed that interactive/pop questions are helpful for self-assessment of their learning and enjoyed the post-test as a good instrument to evaluate their learning of the course topics. 92% of the students are of the opinion that the synchronous mode of delivery is complementing the asynchronous mode indicating the effectiveness of blended learning. Nearly 91% of the students complimented the

content flow in the LMS. 71% of the respondents consider blended learning has the potential to replace the traditional classroom teaching/learning method.

4. Conclusion

The results of this study provide recommendations to students that through the mixing of Asynchronous and synchronous modes of learning, students will not lose the spirit of education, but instead, provide an opportunity for students to learn more flexibly and independently. The task for teachers, learning designers is critical and must work together so that a good system is built-in using Blended Learning Approach for the future. Meanwhile, educational designers can improve and design learning-friendly Blended Approaches and make it easier for students and teachers to apply them to learning.

The benefits of BLA provide an opportunity for educators and learners to stay in touch with each other in the learning process. As learners can watch videos according to their pace the engagement of the student increases automatically. Students are satisfied with this kind of learning as it is giving them time to learn anywhere, any time on their device. It also enlightens self-directed learning and participative learning. The teacher is also satisfied with this Blended mode even though it takes time for the preparation of the learning material.

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