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Original Research Article

Unveiling the Enduring Impact of Moodle: Extending the Discourse beyond COVID-19 Lockdown in Medical Education. A Cross Sectional Study

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Abstract:

Background: The impact of COVID-19 on medical education prompted the exploration of various online platforms, with our department opting for Moodle. This cross-sectional study seeks to understand preferences and challenges faced by MBBS students using Moodle. Thereby the study aims to establish an effective post-Covid model for Moodle as a Learning Management System(LMS), aligning with the requirements of the Competency-Based Medical Education(CBME) curriculum.

Methodology: A questionnaire in Google Forms was distributed to MBBS students regarding their experiences during ENT theory and practicals in Phases II and III. The survey included an information sheet and consent form. A total of 153 students who responded were included in the study.

Results: Moodle was deemed as an acceptable alternative during COVID-19 by a majority of students. The key appeal lies in the flexibility of timing, allowing continued studying even during illness. Some students faced challenges such as lack of concentration and self-motivation. Automated quiz grading for self-assessment received positive feedback. However, students expressed reluctance towards being monitored for attendance.

Conclusions: While the threat of COVID-19 has diminished, Moodle remains an efficient tool for CBME implementation. Its standout feature is the ability to track individual student's academic progress through assessments. The survey illuminated Moodle's strengths, weaknesses, and acceptance. Broadening LMS usage should involve more faculty through training. Policymakers and administrators should consider investing in infrastructure and manpower to ensure a successful rollout.

Keywords: Assessment, Blended Learning, Competency-Based Medical Education Curriculum, Flipped Classroom, Moodle, Learning Management System.

Introduction

During the COVID-19 lockdown, the shift to online education became imperative, leading to the widespread use of platforms like Google Classroom, Microsoft Teams, Zoom, and Google Meet. Notably, Moodle emerged as a prominent choice in universities. As a free open-source Learning Management System (LMS), Moodle addresses challenges by offering customizable learning resources in various formats.

Context of CBME: Competency-Based Medical Education(CBME) requires regular formative assessments, which can be hindered by limitations such as faculty availability and resource constraints. Moodle serves as a solution by integrating learning resources into its platform, ensuring continuous assessment possibilities.

Post Covid Applications: While the immediate threat of COVID-19 has diminished, the lessons learned from online teaching can persist in the context of CBME learning and assessment methods. Despite being underutilized, Moodle's potential can be unlocked to enhance teaching efficiency. Online learning should constitute around 20% to 30% of the curriculum, as this may serve as a constant backup in case of any catastrophes like COVID-19, ensuring that we wouldn't be caught off guard [1]

The study aims to bridge the gap in recognizing Moodle's potential by delving into the factors influencing its use from the student's perspective. Insights gained will inform teachers on designing and implementing successful models for more efficient learning [2]. Damian et al found that students preferred to use Moodle or any technology if they found it easy (Technology Acceptance Model) [3]. So the students preferences depended on their perceived usefulness [4]. The study is crucial in popularizing the use of Moodle as a pedagogic tool and optimizing the integration of

both online and offline classes through blended learning.

Study Objectives: The primary objective of the study was to examine the benefits of Moodle LMS.

Secondary Objectives Were

- Identify the drawbacks of Moodle.
- Explore the perspectives and experiences of students regarding online teaching.
- Provide recommendations for the CBME curriculum's effectiveness with Moodle.

Materials and Methods

Study Design and Setting: This was an observational cross-sectional study done in our medical college (Government T D Medical College, Alappuzha, Kerala) by recruiting MBBS students of 2017, 2018-, and 2019-year admission regarding their ENT theory and Phase II and III practical postings (February 2020 to February 2023).

Study Duration: The study was done during the month of August 2023.

Inclusion and Exclusion Criteria: The study includes MBBS students admitted in the years 2017, 2018, and 2019. It focuses on their ENT theory and Phase II and III practical postings from February 2020 to February 2023. Incomplete forms are excluded from analysis.

Sampling Technique: Convenience sampling was used.

Sample Size: The sample size was derived using OpenEpi software version 3, with a 50% probability of a response. The sample size required was 97, with a 95% confidence interval and 10% relative precision. However, 153 students were recruited.

Study Procedure: Google Forms were sent to the students through emails and mobile phone numbers registered during their online Moodle study. A participant information sheet was also included in the survey form, along with the instruction that hitting the submit button implies consent.

Data Collection and Study Variables: Demographic, and socio-economic data and preferences of their experiences with the usage of Moodle were collected. The questionnaire included various types of questions: closed and open set, multiple choice, dichotomous questions, matrix rating, and Likert's scale.

Ethical Approval: Ethical principles regarding human research according to Helsinki guidelines were adhered to (revised in 2000). Approval from the IRB and IEC was obtained. Confidentiality of patient data was maintained throughout.

Statistical Analysis: Data entry and statistical analysis were done in Microsoft Excel. Analysis of categorical variables was done by using proportion or percentage and that of continuous variables by mean, median, and range depending on normality with a 95% confidence interval.

Results

153 students from 2017, 2018 and 2019 MBBS batches who had attended ENT theory and practical postings took part in the survey.

Device and Internet Usage: The most common device used was a mobile phone. Other devices used were Laptop (14%) and Tablet (14%). Apart from Wi-Fi, Mobile broadband and fixed internet connections using the traditional cable and fiber-optic connections were used.

Comfort and Satisfaction: Around 120 students (78%, CI 71%-85%) had a comfortable experience with their devices and internet connection facilities. Among those unsatisfied, 76%(61% -90%)preferred using Android Tablet.

Online Learning Tools: Google Meet and Zoom were the most common video conferencing solutions used. Google Classroom was used by a minority of faculty. The first experience with an online Learning Management System was through Moodle for 91 students(59%, CI 52%-67 %). Most participants 129(84%,CI 79%-90%) had no difficulty in accessing Moodle.

Table 1: Participant data and network details

Participant data and network details		
Participants		153
Gender	Male	70(57%)
	Female	83(46%)
Mobile Network	Jio	54(35%)
	Airtel	45(30%)
	BSNL	37(24%)
	VI	17(13%)
Type of connection	Wi-Fi	120(78%)
Quality of reception	Above average	137(90%)
Amount spent	Less than Rs 500	108(70%)
Amount spent average		Rs511[265-759]

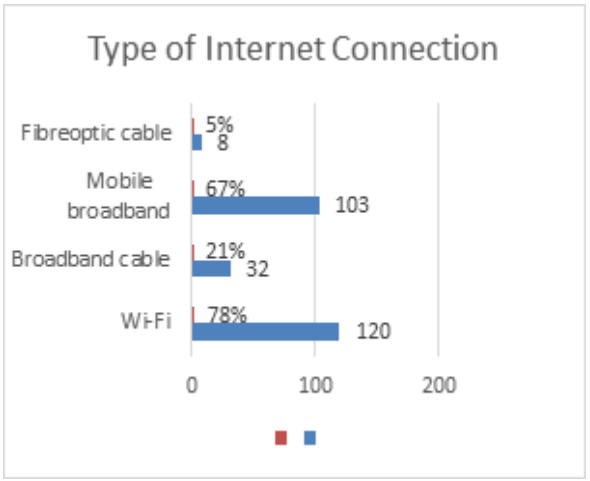

Figure 1: Type of Internet Connection

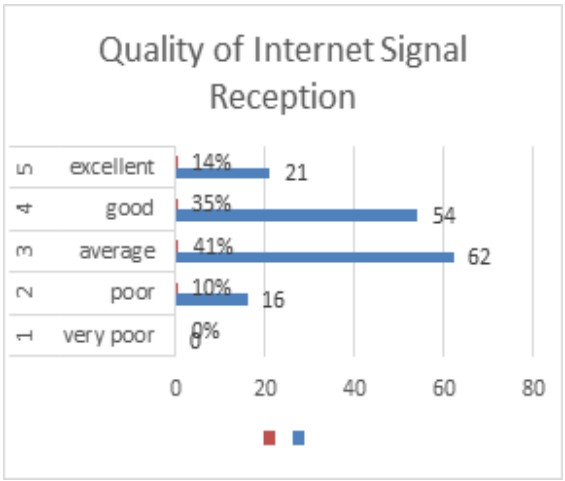

Figure 2: Quality of Internet Signal Reception

Table 2: Participant preferences

Participant Preferences		Confidence Interval
Short videos of less than 6 minutes	120(78%)	71%-85%
Concentration in online classes up to 30 minutes	104(68%)	61%-75%
Effective demonstration of clinical skills eg Tuning fork test demonstration(satisfactory experience)	124(81%)	75% -87%
How effective were conference calls in clearing your doubts?	100(65%)	58%-73%
Grading of Moodle as a Learning Management System from average to best	99(65%)	57%-72%

Student experiences and preferences

Of all the students 81%,(75%-87%) missed real classrooms and bedside clinical case discussions. Only 51% (44%-59%) of students reported being self-motivated to learn. Despite varying motivation levels, 86%,(81 % -92 %) of students were able to complete given assignments within the specified time. 35% (28 % - 43 %) of students preferred blended learning. Short videos of less than 6 minutes were preferred by 120 students(78%, CI 71 % -85 %). 104 students (68 %, 61 % -75 %) reported being able to concentrate for up to 30 minutes.

Table 3: Covid-related factors affecting studies.

COVID- related factors affecting studies		Confidence Interval
Had COVID	66(43%)	35%-51%
Family members had COVID	45(29%)	22%-37%
Had financial difficulty due to COVID	29(19%)	13%-25%
Faced social isolation either due to COVID or due to Lock-down	45(29%)	22%-37%
One or all of the above affected my studies	29(19%)	13%-25%

Covid-19 Impact

Around 111(72%, CI 65%- 79 %) of students or their family members had been affected by COVID-19**.** Despite the impact of COVID-19, only 37 students (24%, CI 17%-31%) reported feeling either anxious or depressed.

Other Health Complaints

The most common physical complaint was eye strain, reported by 128 students(84%, CI 78 %-89%). Neck pain was the second most common complaint, reported by 43 %(CI 35%-51 %) of students.

Educational Effectiveness

Effective demonstration of clinical skills eg Tuning fork test was reported by 124 students (81% CI75% - 87%) 65 % (58 %- 73%) of students reported that video conference calls were effective for clearing their doubts.

Table 4: Advantages of Online Moodle Learning

Advantages of online Moodle Learning		Confidence Interval
Being with family	95(62%)	54%-69%
Saving Hostel and Mess fee	62(41%)	33%-48%
Repeatability of classes	79(52%)	44%-59%
The flexibility of viewing the classes at a suitable time	95(62%)	54%-70%
Better demonstration of X-rays and instruments when compared to regular classrooms.	118(77%)	70%-84%
Automated self -evaluation of Quiz assignments	37(24%)	17%-31%

Table 5: Disadvantages of Online Classes

Disadvantages of Online Classes		Confidence Interval
Disturbances at home, attending doorbells, visitors, cooking, etc	54(35%)	28%-43%
Time management-procrastination and being lazy	58(38%)	30%-46%
Lack of concentration	66(43%)	35%-51%
Lack of motivation to self -study	70(46%)	38%-54%
Lack of clinical experience.	116(76%)	69%-83%
Inadequate Disk space in the device to watch and store relevant data.	25(16%)	10%-22%

Disturbances at home due to household activities affected the focus and concentration of students. Challenges related to time management, including procrastination and a tendency to be lazy impacted the effectiveness of studying and completing assignments. Difficulty in maintaining concentration during online classes was due to external distractions and the absence of a structured classroom environment. Reduced motivation for self-study, as the absence of face-to-face interaction and a physical learning environment led to a sense of isolation or disengagement. The inability to gain hands-on clinical experience, which is crucial for medical education was another problem faced by students.

Table 6: Details of ENT Course through Moodle

History taking and examination	Proforma	Word doc
	Video demonstration	Embedded video
	Video demonstration by students	Embedded video
	Using Head mirror	Embedded video
	Tuning fork test demonstration	Embedded video
Case discussion	Ear, Nose, and Throat	Video conferencing and link to Youtube
Case presentation	Given as Assignment	Word doc, pdf
	Otitis media demonstration using Oto endoscopy,	Embedded video
	Nasal polyps, sinusitis, and adenoids demonstration with Nasal endoscopy	Embedded video
	Vocal cord lesions with 70 deg scope	Embedded video
X Rays	Mastoid, nasal bones, PNS, Soft tissue nasopharynx, neck	Annotated videos
Audiogram	Normal, various types of hearing loss	Video
Temporal bone	Normal Landmarks and types of mastoidectomy	Embedded video
Instruments	Identifications, indications, etc	Video and ppt
Procedures	Anterior nasal packing, Direct laryngoscopy,	Embedded video
Surgeries	Myringoplasty via Post aural incision	Embedded video
	Endaural incision	Embedded video

	Laser stapedectomy with endo-meatal incision	Embedded video
	Mastoidectomy	Embedded video
	Tracheostomy	Embedded video
Assessment	Quiz	Automated valuation
Case presentation	Written by students in word doc or PDF format and submitted	Evaluated by teacher
Wiki	A collaborative work by students	Queries to be asked in history taking, Steps in the examination of patients, investigations, and various treatment methods
Forum	A teacher posts a question	Students can see the replies of their colleagues only after they post a reply.
Database	The teacher wants the students to know the causes of epistaxis	Students can post pictures of various conditions or diseases causing epistaxis.
Workshop	The scoring guide given by the teacher.	Evaluation of students by their colleagues

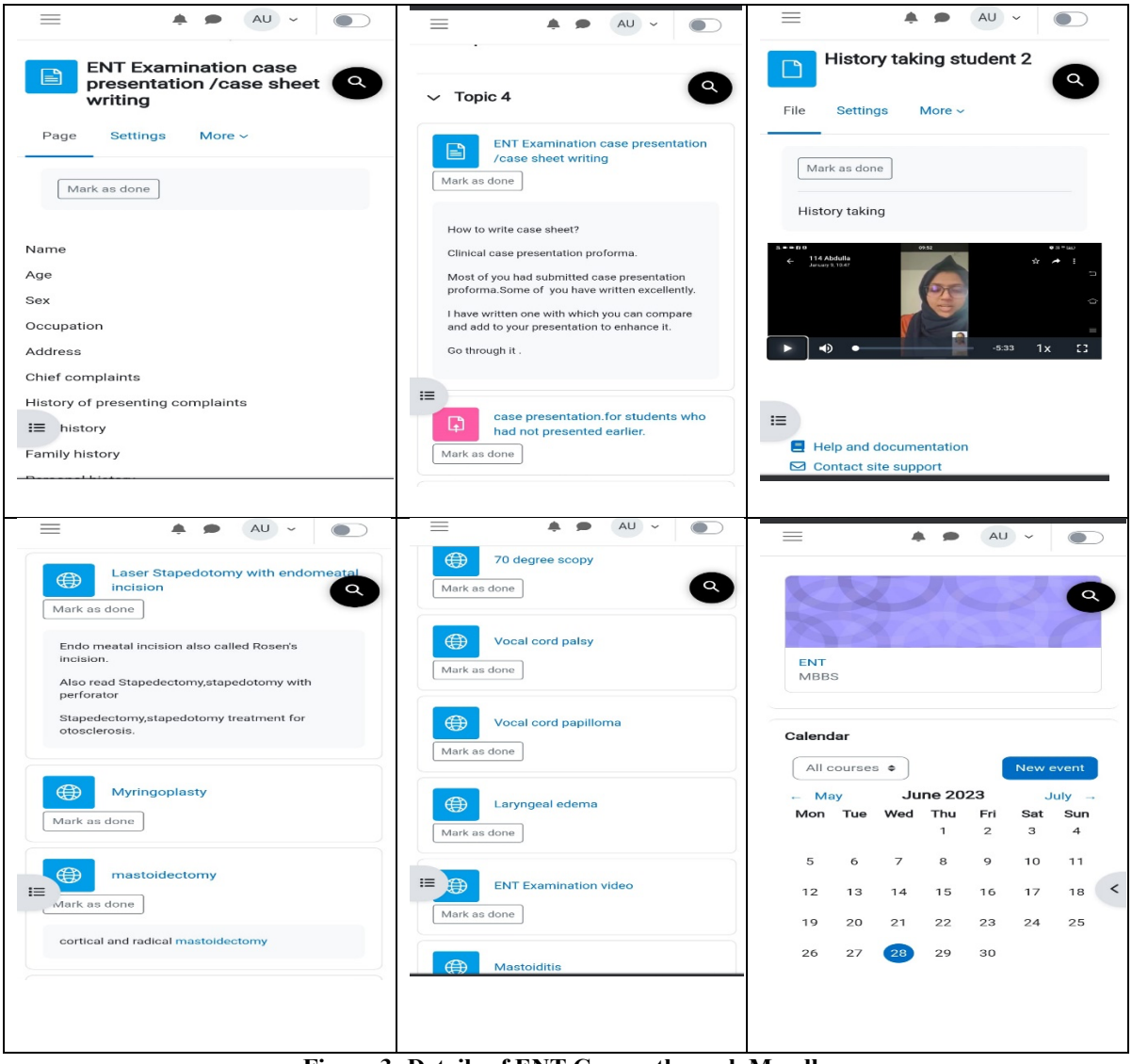

Figure 3: Details of ENT Course through Moodle

Discussion

Amid the challenges posed by the COVID-19 pandemic, various remote learning options were explored, including Zoom and Google Meet. However, limitations such as participant capacity and time constraints led to the adoption of Moodle(Modular Object-Oriented Dynamic Learning Environment). Developed by Martin Dougiamas, Moodle is an open–source Learning Management System(LMS) with over 300 Million users(5). Its flexibility, being free, and ease of customization made it a preferable choice for educational institutions.

Implementation: To overcome the limitations of other platforms, our department opted for Gnomio, a Moodle hosting site with unlimited student capacity. This proved instrumental in navigating the challenges presented by the pandemic, and the insights gained were extended to the implementation of Moodle in the MBBS curriculum.

Curriculum content: Utilizing Moodle, the ENT course was structured to include history taking, examinations, video demonstrations, case discussions, presentations, X-rays, audiograms, and case presentations. The platform's structure consists of a header, dashboard, navigation bar, main content area, and footer.

User Roles and Enrollment: Moodle operates with three user roles, administrator, teacher, and student. Teachers can have editing or non-editing capabilities. Administrators can enroll students using various setting options.

Learning Resources and Assessment: Courses in Moodle are organized spaces where teachers add learning resources, presented in either topic or weekly formats. Resources include pages, books, MS Word documents, PDFs, PPTs, and links (7,8). Short videos are embedded for clinical case scenario depictions, case presentations, and skill development. Activity methods include quizzes, discussions through forums and chats, databases, glossaries, and wikis for collaborative work. Administration tools include enrolments, attendance, grades, and calendars.

Advantages: Moodle offers a centralized location for learning resources, allowing repeated access for slow learners. Visual learners benefit from videos, and clinical skills can be practiced at home, saving time for case discussions (9). A study conducted by Lei Li on Chinese students demonstrated that Moodle was effective in the better identification of herbal plants (6). Shehzadi Rimsha et al found in a study on Surgical Post Graduates that blended learning was found to be beneficial in their training (10). Flipped learning where video content is viewed by learners first and later the procedures are practiced or revisited was found to be useful in improving learning (11). Moodle also offers improved visual demonstrations of X-rays and instruments compared to traditional classrooms, potentially enhancing the learning experience in specific subjects (12) (13). Cheng Maw Hoa et al found that the high engagement viewing pattern of online videos by students increased their interest in learning core concepts (14). Another advantage was that Moodle was accessible through mobile phones (6). Flexibility in study time accommodates different schedules. During Covid when students fell ill, they could continue learning from the comfort of their homes. Assessment tools such as quizzes, offer multiple attempts, promoting learning from mistakes and avoiding offline embarrassment (15). This employs a hypermedia smart tutoring system and enhances Self Regulated Learning (16). Implementing workshop activities where students assess their peers' assignments based on faculty-provided scoring guides not only eases the burden on teachers but also fosters a collaborative learning environment among students. Marcou et al reported about a software tool that enables automated grading of chemical structures using free and open plugins similar to Moodle (17). Formative assessments can be conducted by assigning credit for punctual assignment submissions and active participation in discussions (18). A due date criterion is applied for timely submissions, distinguishing it from a cut-off date where submissions become impossible. Minimum pass grades for assignments can be specified. Grade books facilitate downloading and storage of marks and grades, enabling effective tracking of students' progress (19)

Disadvantages: While Moodle's interface may seem complex, training can overcome this hurdle. Technical expertise is required for server installation, which can be addressed by using Moodle Cloud, a paid version with managed services. Some students may resist time-bound assignment monitoring, and a learning curve may be needed for extensive features.

Applications: Beyond the pandemic, Moodle serves as a reliable backup for uninterrupted learning during emergencies. Blended learning is recommended, ensuring a continuous learning approach (9) In Competency Medical education (CBME), flipped classroom techniques enhance skill acquisition (14). Short-duration videos cater to student preferences, while infrastructure improvements support remote learning. Faculty training in LMS management is crucial for effective implementation. Moodle can serve as an e-logbook for recording competencies, and tracking achieved grades. Maria Dorinela Dascalua et al conducted a cohesion network analysis of students' online participation in Moodle courses to predict

student grades (20). So there are possibilities of using such applications to know preferences, thus improving the quality of delivery content that makes it engaging to the learners.

Limitations

Faculty awareness and preferences were not surveyed. The study focussed on ENT clinical and theory exposure, and time constraints prevented a qualitative study. Convenience sampling was used.

Conclusions

Moodle, initially underexplored, holds the potential for enhancing MBBS teaching efficiency, especially in the context of the CBME curriculum. With initial technical support, its versatility and user-friendly features can contribute significantly to Medical Education.It is important that faculty be trained in Moodle, which is available as a MOOC (Massive Open Online Course) at https://moodle. academy.

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