

A Pragmatic Analysis of Mobile and MOOCs Based Learning Methods

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Abstract - With the increasing use of the Internet, education availability to large masses through online mode has become easy. The platforms for Massive Open Online Courses (MOOCs) like Udemy, Udacity, Edx, Coursera etc. and mobile learning technologies like mobile live video streaming system have evolved all over the world. Through these platforms it has become quite easier for the academicians to provide education. In several remote areas, the learners are not able to attend classroom teaching. But, with the help of emerging technologies like Electronic Learning (MOOCs) and Mobile Learning, many people can now learn things at any time from anywhere at free or very less cost. It also allows academicians to make their content and teaching skills reach everywhere. These technologies help both academicians as well as students. Various multimedia tools are also used for making out the content look attractive and interactive. Students join these courses to compete among themselves, gain knowledge and earn certificates. Almost every type of course is offered ranging from basic to specialization courses. These technologies are a boon to our learning culture. This paper makes an analysis of advantages and limitations of MOOCs based and mobile learning modes. This paper also

maps the findings with a survey on 770 students of Delhi NCR region (India). As in this era of technology we all see the future of education in MOOCs and Mobile based learning, hence the major findings of this work is to identify the gap in these modes based learning methodology. It will help the practitioners to improve the utilities from these modes of learning.

Keywords - Education; MOOCs; Mobile Learning; M-learning applications

1. Introduction

As the population is increasing rapidly, there is a need to provide education on a vast scale. But, providing face-to-face education (campus education) to everyone is not possible. So, a need to educate masses through online mode is felt. Boom in networking technology and availability of internet services can make this task easy. Also [1] states that social network sites (SNS) like Facebook, Twitter provide a common platform to share users' interests. This can group users with similar interests.

Today, the internet helps in providing education on a vast scale. It enables the instructors to provide education to a large mass efficiently and effectively. With the increasing number of MOOCs platforms and mobile technologies, the concern goes in analyzing how these can be helpful in providing education. There is a need to have an analysis of advantageous and disadvantageous features of MOOCs and mobile learning like mobile social presence of

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instructor[2]demographic differences[3] hint super posters [5], discussion forms, chat-rooms various evaluation systems learning through recorded video lectures mobile learning in rural areas learning in live video streaming various mobile built to support five themes namely:- administration, presentation, motivation, feedback and innovation of students. This analysis will help the course designers in making the course content and structure so as to have large knowledge gains of students after taking the courses.

This paper handles Section 2 giving an introduction about MOOCs and Mobile learning. Section 3 and 4 describe advantages and limitations of MOOCs and mobile learning technologies respectively. Section 5 states the future work needed to be done in some features of these technologies. Section 6 draws the conclusions that emerge from this survey study.

2. About Moocs And Mobile Learning

A. Massive Open Online Courses (MOOCs)

The platforms like Udemy, Udacity, Edx, Coursera etc. provide online courses to a large number of people where learners go through the content at their own pace. There are many free or low cost platforms that allow students to attain knowledge and take the course of their own interest. These are the platforms where students are not forced to complete their respective degrees; instead, these are very helpful platforms which offer free education to those who are not able to take classes at institutes. Students register to MOOCs and provide a list of goals that they want to achieve during their stay in the course. At the end, they verify whether they have achieved the goals set by them at the beginning of the course. Also, a student is allowed to leave or drop a course without paying for any penalty. Those who complete the course curriculum on time are provided with the certificate of completion of the course. Fig. 1 gives an overall view of MOOCs.



Fig. 1. Overall view about MOOCs

B. Mobile Learning (M-learning)

Almost everyone carries mobile equipment in today's world. M-learning is another way to provide distance education. Various applications are built on mobile which are helping to learn things. Mobile Technology can be used to make sure that knowledge is available to all at every moment of time. The whole essence of m-learning is shown in fig. 2.



Fig. 2. Overall view about M-Learning

3. Advantages and Limitations of Moocs

A. Advantages

There are several advantages of MOOCs. Some of them are discussed below.

1) How students navigate through courses

MOOCs have a lot of advantages that help the students to understand the courses and achieve their goals in a better way. They also help the instructors to better design their course content and lay out a good course structure. The first step to make better MOOCs is to understand student prior skills, their demographics, their post-course goals and how they achieve their goals. A study is made on “prior skills and goals” of students registering for the course – “Mapping with Google” in MOOCs. It addresses how their prior skills affect their success in the course as well as how their goals affect their completion and dropout rates. Based on this study mainly four categories of students were identified –

- No shows – who only register the course but never come back even to see the course.
- Observers – who register the course just to see how a course at MOOC looks like?

- Casual learners – they take the course more seriously and cover some topics based on their interests.
- Completers – they complete the course, view lectures, do all assignments and projects on time, and earn a certificate of completion at the end of the course.

Students register to MOOCs from different age groups and different countries. Students should ensure that they are 'self-directed' and 'self-oriented' learners. But, some students are weak at taking things and defining a path by themselves. This situation makes them feel disheartened and ill-suited for taking the online courses. [29] Reveals the impact of MOOCs on the behavior and employment of self regulated learners. Describes the demographic differences among students to show how they navigate through MOOCs having these differences. The results reveal that older students follow a non-linear way (jumping back to lectures from assignments) while younger students follow a linear way (going through the course in a sequential manner). Students from countries like the USA where student-teacher ratio is low follow a non-linear way and act as “explorers” whereas students from countries like India/Kenya where student-teacher ratio is high follow a linear way and act as “observers”. Based on this mentioned point, we did a survey on 770 engineering students of Delhi NCR region (India). The results shown in Fig. 3 represent that the majority of the students want to learn new skills/want to complete their course. Many students proceeded directly to activities/exercises rather than the lectures/videos. If they were successful in those activities, then they jumped to next activities, otherwise they jumped back to videos. Students who completed activities as well as watching videos have a greater rate of completing courses than the students who did not watch videos.

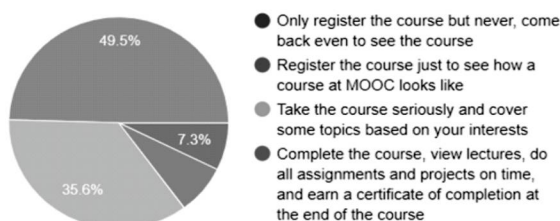


Fig. 3. Students navigation behaviour for MOOCs.

2) Video watching patterns

Contribution of videos and understanding how students learn from them is an important part while

studying features of MOOCs, but many students watch only videos and are not involved with any other activity like discussions, assignment problems. and make a study on how students interact with online videos and analyze student learning patterns through the videos. These studies have been conducted on four MOOCs of Edx namely Intro. CS & Programming (MIT), Statistics for Public Health (Harvard University), Artificial Intelligence (Berkeley University) and Solid State Chemistry (MIT).

In authors analyze video watching patterns of the students like which points of videos have dropouts and peaks. It analyzes student activities namely playing, pausing, replaying and quitting. It reports that long videos lead to higher dropout rates rather than short videos. This study highlights on five student activity patterns that explain peaks

- When a new study content is watched from beginning
- When someone misses on some content and replays that missed part
- When students learns from tutorials rather than entire lectures
- Watching and replaying a short segment again and again
- Repeating a part that is not explained through visuals.

It gives some suggestions for content developers to make shorter videos. It also gives suggestions for interface designers to provide markers to mark the peaks in videos so that the students can access interesting parts of videos in a non-sequential manner.

In a study is done to find what kind of videos help students to engage and learn more. The Student engagement is measured by engagement time which indicates the time spent by the student in watching a video. But it does not capture whether the student is giving attention or not. So, some of the findings and suggestions that arise from this study are:

- (a) Short videos, talking heads videos and videos where instructors speak at a faster rate are more engaging.
- (b) High production value might not matter i.e. the

instructors should teach by having direct eye contact.

(c) Table drawing where an instructor draws on a digital tablet is more engaging.

3) Various factors to capture students performance

There are so many resources for an online course. Now the question arises which of these resources is the most useful resource to recognize how well the students are doing in the course. [22] explores various aspects of mobile and accessible learning for MOOCs. In normal classrooms, instructors can easily identify how the students are getting engaged with their subject and other course material. It is easy as there is face-to-face interaction. But, in MOOCs it is extremely difficult for instructors to determine how learners are going with the course as there is no individual interaction. To know about the understanding of the students with the course, focuses on determining which information sources are the most valuable. Information sources being taken into account are: Grades for an assignment, Discussion forum activity and Chat logs. Data visualization is not done in MOOCs on a large scale, so in order to do so; this study has done 2 jobs: Metrics data and Survey. In Metrics data, 3 metrics tabs are used - Count of students who opened a subsection, Grade distribution per problem and Attempt distribution per problem.

In addition to metrics tab data, Survey monkey was used to conduct the survey. The survey asked the instructors which information sources they would use to know about the understanding of the users. Survey made use of the five visualization mock-ups.

Five visualization mock-ups used are: -

- Boxplot diagram of assignment grade distribution
- Stacked bar graph of grade distribution
- Line graph of forum
- Stacked bar graph of attempts distribution
- Stacked bar graph of views distribution

Metrics Tab results show that Metrics Tab was used by only 2 instructors. Both of them used an open subsection count graph to see how well the students are engaged with the course. Survey results show that the handiest activity is discussion forums and the

activity that shows very less student involvement is chat logs. The most common information sources are class surveys, forums and discussion with students and teaching assistants. Instructors found information about overall student performance relative to the class and the materials students interact with and for how long, as very useful. Visualization mock-up results show that visualization mock-up of assignment grade distribution is the most useful and understandable. Number of materials viewed by students was also useful information. Stacked bar graph of grade distribution was difficult to understand. Line graph of the forum was also not useful. Instructors felt that they could use visualization while the course was running as compared to preparing new material for a course. This concluded that assignment grades are not enough to know how well the student has done in the course; instead, discussion forum activity has proved a very useful source, whereas, chat logs are not that much useful.

4) Evaluation of open-ended questions

Now, coming to the evaluation part it is seen that closed ended questions are easy to evaluate as compared to open ended questions. Closed-ended questions like MCQs, True/False, Yes/No; provide a list of choices/answers to the respondents. Students are only allowed to answer the question from those options only. Open ended questions require the question to be answered in one word or one sentence without giving any options to the student. So, this makes the student think before answering the question. It allows the respondent to give that piece of information that he thinks is the correct explanation of the corresponding question. Thus, open ended questions are better than closed ended questions for learning purposes. But, in our survey we found that 81.2% students prefer objective based questions more effective as compared to subjective questions for evaluation. So, based on the above observation, some suggestions for the designing of courses like the videos should be made more interactive by including MCQs in between the videos rather than asking questions at the end of the video.

If open-ended questions are evaluated by instructors using flat assessment, where each response is to be marked one by one, then it will become time consuming. The study in open ended questions are assessed using an interface. In this approach students' responses are grouped into clusters and sub-clusters by making use of Machine Learning and Natural

Language Processing (NLP). Then these clusters are accessed by teachers through an interface/tool named “Power grading – A 'Power Tool' for grading”, which allows them to read, grade and provide feedback to a large number of responses at once. This interface has 4 divisions - 1st division has all the clusters indicating the answer keywords on the top of each cluster. If a cluster is selected, then its sub-clusters are seen in the 2nd division. 3rd division has all the individual answers of a selected sub-cluster. 4th division has options to mark clusters/individual answers as correct, partial, and incorrect and also give feedback.

If the instructor/teaching assistant feels that the cluster is correct/incorrect/partial by watching the keyword on the top of that cluster, then he marks that cluster accordingly, which leads to the evaluation of all the answers under that cluster. Also, feedback is done only once for a significant number of students. Assessment through interface is better than flat assessment.

Another study on evaluation, “identify-verify pattern/workflow” is carried out in It combines peer assessment and automated/algorithmic grading systems for open ended/short answer questions. This is done because peer assessment takes a lot of time of students in grading, if done in isolation. If algorithmic grading is done in isolation it searches for certain keywords and grades accordingly, thus ignoring students' understanding. In this workflow, algorithmic grading estimates how many peers are needed for assessment. Using the rubric key, different meaningful answers are identified by peers.

Results reveal that peers were more lenient than staff and understand ambiguous answers in a better way, as they also look for the concepts and understandings a student has acquired. They also get benefits in return as they also learn while evaluating. Identify-verify pattern is promising as it provides accurate results. With less number of raters, accuracy is maintained because the automated system generates confidence scores and assigns fewer raters for unambiguous answers. Although it takes more time to grade, it still provides more descriptive and accurate feedback to students.

5) Discussion Forums and Interaction with students

As MOOCs are free online courses, it is normal to say that the ratio of teaching staff to enrolled students reaches 1:5000 and thus, it becomes impossible for

instructors and TAs (Teaching Assistants) to have a meaningful interaction with the students and reply to each and every question for such a large number of enrolled students. Reports that those who post most frequently on the forums, called as superposters, result in high-value contributions towards making other students understand the course in a better concept. Super-posters make quantity as well as quality posts. Quantity is measured by the number of posts that are made by a student on discussion forums. Quality is measured by the number of votes on superposters' posts. A measure of both quantity and quality is known as reputation. Many times it happens that students keep posting to forums asking their queries but the instructor may not be able to answer all the queries as they have limited time and have to handle thousands of students. Also, non-superposters reply less frequently or don't reply at all, so, in such cases, the role of super-posters is of great help to both instructors as well as students. Also in our survey as shown in fig. 4, we found that a large portion of students found the forums helpful and interactive.

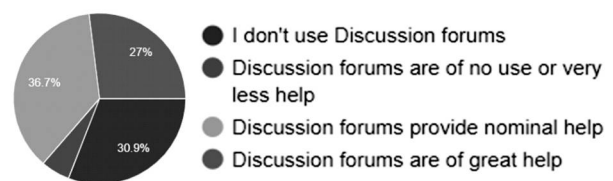


Fig. 4 : Importance of Discussion forums in learning

Participants' profiles and some social tools are delved into 2 built-in and 3 external tools were used to contribute to MOOCs. Built-in tools used are: Q&A and Forums. External tools used are Facebook, Twitter and Mentor-Mob. 339 students posted 604 posts on Q&A whereas 800 students posted 2819 posts on Forums. Among external tools, Facebook had the highest impact, Twitter had a moderate impact and Mentor-Mob has a very low impact. So, forums came out to be the best social tool to contribute to the MOOCs.

The study in works towards driving an improved quality learning process via massive online open courses. It focuses mainly on the sharp decline rate of interaction on these courses with time and facilitates easy navigation of relevant information through overloaded discussion forums. It generates an algorithm model to efficiently choose and classify threads which filter out the “noisy discussions” and thereby rank them in relevance order for appropriate course related discussion. It devises an algorithm for

discussion threads on forums which simultaneously works for effectively finding classifiers, extracting relevant topics from the discussions and ranking these in relevance order.

It first of all refines the data set by categorizing the courses as quantitative, non-quantitative, vocational, non-vocational and discussions into three types – small talk, course logistics and course specific discussions. It then studies the dynamics of small talk over time and concludes that for vocational courses it decreases steeply but for non-vocational courses like Humanity it maintains the speed throughout the course and decreases very gradually. The regression model presents a statistical analysis of different factors, for example that though the teaching staff posts increases the volume of discussion, it is not helpful in reducing the decline rate and peer graded course threads have high attention decline rate.

[25] Reports that the students who learnt with mobile applications showed a higher engagement with the lecture material and had a higher rate of completing the course. These days, universities have started including MOOCs along with their curriculum and library services. Institutes are making students get enrolled in MOOCs to earn that course credits as a part of their curriculum. [42] States that academic librarians can integrate MOOCs with their curriculum and library services.

B. Limitations

Despite many advantages of MOOCs, there are limitations as well. Some of which are discussed below.

1) Role of Instructors

As in our study shown in fig. 5 we found the role of instructors does also play an important role in making an online course understandable by the students. Open Educational Resources have the lowest level of involvement of instructors whereas Instructor-led online courses have the highest level of instructor involvement. MOOCs have involvement of instructors between Open Educational Resources and Instructor-led online courses (fig. 6. Despite a great level of involvement, MOOCs show the neutral effects of instructor interaction with the students. This is described in [2] The study in [2] makes an analysis of whether inclusion of an instructor actually has an impact on overall course completion rate, in learning

outcomes, acquisition rate and overall satisfaction of the students. For this study, they have divided the

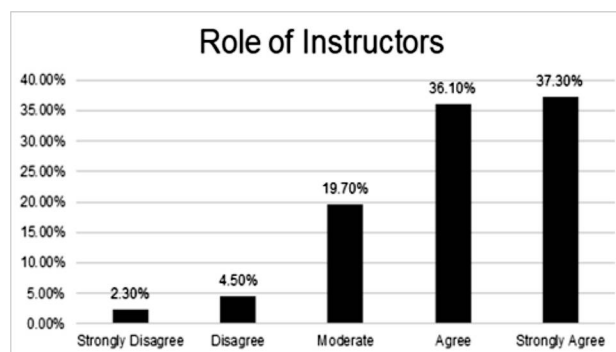


Fig. 5 : Role of instructors in MOOCs learning
students into 2 groups:-

Group A: - It is a Control group. It has no interaction with the course instructors.

Group B: - It is an Intervention group. It has the active involvement of the course instructor.

The results revealed that there was no difference between number of students participating in forums, lectures and quizzes of both the groups. Number of Quiz badge earners was approximately equal of both the groups but the number of forum and project badge recipients of Group A is less than that of Group B.

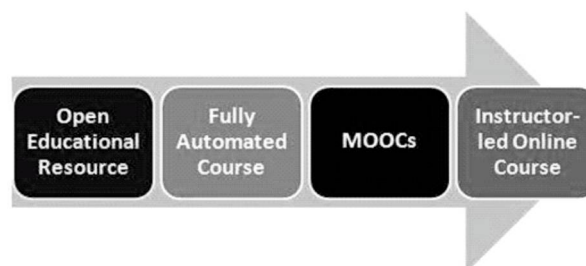


Fig. 6 : Level of instructor involvement during an online course

2) Student Engagement / Participation

[11] States that student engagement cannot be measured truly and also it can't track that if the downloaded videos are watched offline or not. In [20], it is being reported by instructors that discussion forums are the most useful information source but it is a fact that very few students registered to MOOCs are active on forums. [15] has the limitations as the decline rate factor does not consider the discussion timelines, i.e. whether the decline is continuous with time or is there some irregularity in it during

weekends, semester breaks, near semester exams, etc. It is suggested that the thread classification needs to be taken into account the teacher initiated topics and student initiated doubt-clarification topics to mark the relevance of the thread.

3) Classroom Teaching vs Online Teaching

Another study is conducted on a course on “An Introduction to Recommender Systems” [23]. This course was offered in two formats – one was the online course that was offered on Coursera and other was offered as a 3-credit graduate level course at the University of Minnesota. The university course was offered in form of a flipped classroom where students were asked to register for the same course offered on Coursera and take the lectures from there only using online materials provided and complete assignments and projects that were asked in online course. The study revealed that the university students were getting an advantage as there was the presence of instructors and teaching assistants and they were providing extra help to students facing problems in understanding some concepts and completing their assignments and projects. So, this study reveals that classroom teaching is better than MOOCs teaching and the same findings we got in our survey as shown in fig. 7.

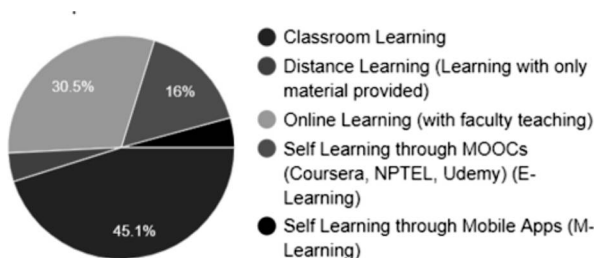


Fig. 7 : Students inference on type of education they prefer

As classroom teaching is found more effective as compared to distant learning, [26] describes the retention rate of students is low in distance learning courses i.e. only a small number of students complete their courses successfully. [18, 29] Illustrate the factors like usefulness, satisfaction, reputation and openness are responsible for low retention rate in MOOCs.

1) Effect of Hints/ Chat Rooms

In there is a study of hint systems and results show that hints negatively impact student performance.

Asynchronous mechanism of learning is combined with synchronous mechanism in by making use of chat rooms. Students in this study were divided into 3 groups: - non-chat, chat tab and embedded chat conditions. Results concluded that there were no significant differences between grades of students in chat condition and non-chat conditions and equal number of students posted to the discussion forums in these conditions and no significant difference in the result was seen. So, this study concluded that chat rooms are not useful. In our survey as shown in fig. 8, we found that many students are agreeing that hints impact their learning in other ways such as it makes them dependent on hints which makes them less confident for real problem statements.

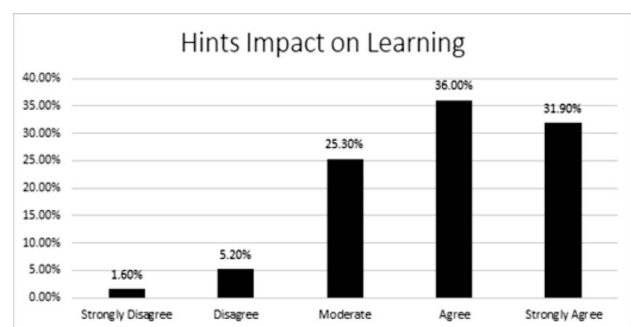


Fig. 8 : Hints impact on students confidence level in learning

At the end we are summing up this section by providing a summary in table 1 of advantages and limitations of MOOCs based learning.

Table 1 : Summary of Advantages and Limitations Of E-learning

Advantages	Limitations
Students can discuss everything with anyone at any time.	Students can drop the courses if they don't acquire the prerequisite skills.
They help weak students (backward sections) to learn things at their own pace.	Passive mode presence of an instructor doesn't create an effective communication channel between educator and learner.
Most MOOCs are free.	It is the sole responsibility of students to carry the course successfully.
Their interface is user friendly and interactive.	Sometimes, communication becomes a problem.

4. Advantages and Limitations of M-learning

A. Advantages

There are several advantages of M-Learning. Some of them are discussed below.

1) Effect in Rural Areas

Mobile learning techniques make education more accessible in rural areas of developing countries. The objective of [12], [13] and [14] is to explore the scope of mobile learning in developing regions of the world, like India. The authors of [13] have designed learning games using a format of receptive-activation cycles. In receptive phase, a set of words were introduced by playing their audio pronunciations and showing graphics of their meanings on the screen, followed by a practice phase where learners spent their time in practicing with items as long as they want, followed by an activation phase where a randomly selected word from the set of introduced words is displayed or read aloud and the player has to guess its corresponding meaning. [14] Presents the PACE framework (Pattern-Activity- Curriculum-Exercise) that helps to teach English language to rural India. The results show that use of mobile phones to teach rural children was a great success as some degree of academic learning occurred and also PACE framework yielded positive learning outcomes.

2) Live Video Streaming

As the population is gradually increasing, there is a need to educate more people and establishment of new institutes is not feasible to give admissions to everyone. So, a need to provide distance education to a large population is felt. The research of [16] was conducted on two large classes containing about 1000 students each of Computer Science and English courses. Mobile Live Video Streaming System (MLVSS) is developed in [16] that streams live video lectures to mobile phones of users. Three views of lectures were delivered - (a) slide view (b) slide and teacher view (c) teacher view.

There are three users of MLVSS –

1) Teachers who deliver slides and hand written information in high quality, receive feedback from students and are able to see students screen watching lectures at that time.

2) Students who can see lecture timetable i.e. lectures currently available and select one of them, zoom in and zoom out the lecture content, give feedback to teachers regarding their teaching speed, handwriting, transmission quality etc., ask questions and get answers to most questions immediately.

3) Administrators who maintain and take care of proper transmission of content.

The architecture has two subsystems: Mobile Phone Broadcasting System, which broadcasts content to mobile phones and the other, is Classroom Management System, which is responsible for students' interactions with lectures. Mobile Phone Broadcasting System is composed of three components- Classroom Recorders which encode data; Broadcasting servers which transmits data to mobile phones and Client Viewer which enables students' to view videos. Classroom Management System is composed of four components which are defined as follows-

1) Curriculum Schedule Management System- It displays currently available lectures to students and allows them to select one. It also helps to avoid downloading of duplicate lectures.

2) Client Screen Monitoring System – Every 30 seconds, students' screen is captured and shown to the teacher so that teacher can have control over his students. Students can enable/disable this feature because of privacy reasons.

3) Polling System – Students can give feedback to teachers regarding teaching speed, handwriting and voice.

4) SMS Interaction System – Students ask questions using SMS service (text messaging) and important questions get answered immediately.

This work evaluates that in both the courses students are highly satisfied with the system.

3) Role of Social Network Sites

As per our survey on mobile device usage shown in fig. 9, we found that people use it mostly for surfing social networking sites. Hence social network sites (SNS) can play a major role as a learning medium in mobile learning communities. [1] Aims to find out the social interactions' impact on the mobile learning

community, which is integrated by mobile equipment. This study reveals that there is a great impact of social interactions on the mobile learning community. Another study [43] has used a social network platform named Facebook for learning and teaching purposes. The results were highly satisfactory.

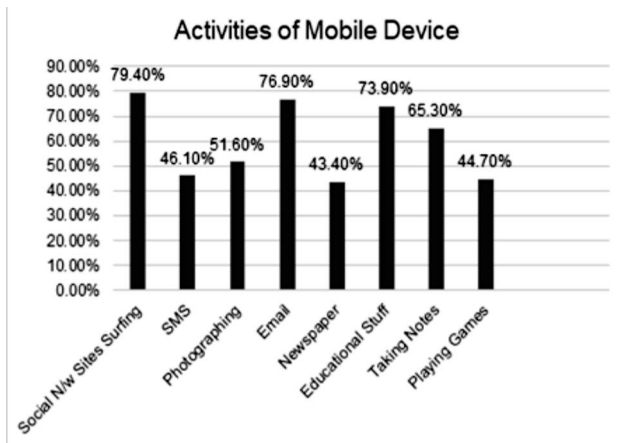


Fig. 9: Students interest on mobile device usage

4) Interaction, Team Formation and Training

In Mobile learning, users share their experiences and exchange their ideas while working on assignments together. Due to the constraints, face to face conversations are difficult among team members and so are their understandings. Team formations become crucial in such a scenario based on each learner's strengths and weaknesses. The major task is to mark each learner properly based on their individual contributions. Suggests a method to provide Teamwork as a Service (TaaS) with the facility to provide a platform that can be shared between students and teachers. Kolb Learning Style has been used in this model by basically mapping the 4 styles of learning i.e. accommodating, assimilating, converging and diverging to their respective roles.

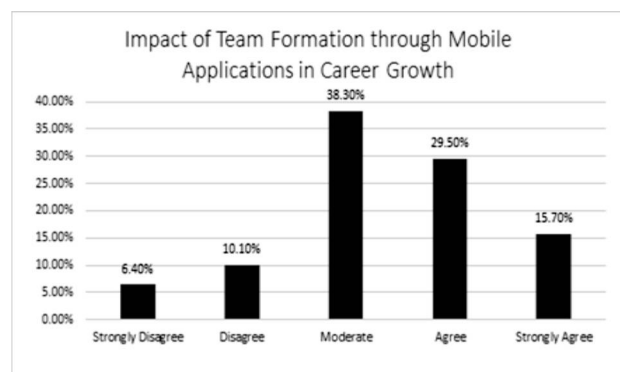


Fig. 9: Students interest on mobile device usage

This facility of TAAS helps in building team relations and thus it leads to team work in assignments and projects. In our survey as shown in fig. 10, many respondents also agreed that this team formation also helps them in their career growth.

In [28], three types of learning systems are compared - Mobile learning, Map based learning and Game based learning. Game based system was more difficult to use than the other two systems as it did not allow the participants to physically visit the rooms and interact with the real building environment. The map based system did not support the way to find a room and also did not include interactive features, whereas these features were supported by mobile based systems. This study results that participants with mobile based systems performed better than other two systems. A recent study described in [41], reveals that Mobile Instant Messaging (MIM) which is a massive communication phenomenon is an extension to mobile learning platforms.

Another study [30] reveals that mobile learning in teacher training is a great success. In this study, trainees and the supervisors discuss and share their ideas on teaching methodologies through SMS and digital pictures, which turn out to be great success. [38, 39, 40] reveal that mobile learning platforms are quite useful for higher educational universities or institutions to support teaching and learning.

5) Flow Experience

[28] Aims to analyze the concept of flow experience to the process of mobile learning. Flow experience can be defined as:-

Whether the user is engaged or focused on material.

- Whether the user is curious about the material.
- Whether the user is getting distracted away from material.

Fig. 11 explains that if a person is having a higher skill level and the activities assigned to him are not challenging, then the person feels boredom while doing that activity and thus may disengage from that activity. Also, if the person is assigned an activity/task which has higher challenges than his skills, this may also lead to disengagement from that activity.

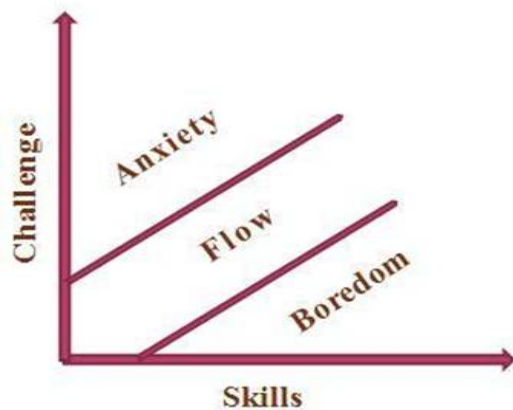


Fig. 11: Flow experience

B. Applications

Based on our survey as shown in fig. 12, we analyzed that learners feel a lot of benefits of mobile applications based learning. The major benefits came in terms of cost and time effectiveness and enhanced learning experience.

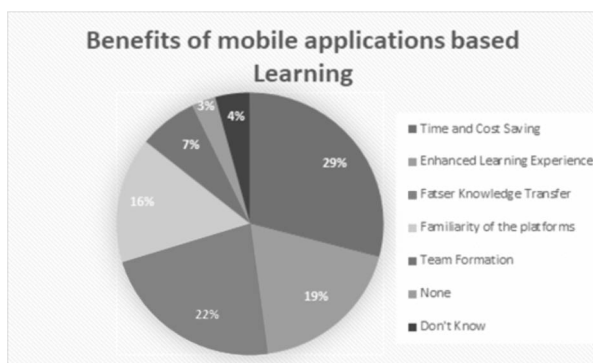


Fig. 12 :Benefits of mobile applications based learning

There are several applications of M-Learning. Some of them are discussed below.

1) Adapted Learning Content

An Adaptive neuro-fuzzy inference system (ANFIS) is proposed in [31] that provides adapted learning content to mobile learners. A mobile learning reasoning engine is presented, which provides a suitable learning content format for a mobile learning application using ANFIS system.

Mobile2Learn framework is presented in [32], which helps to access and reuse Mobile Assisted Language Learning (MALL) resources. The participants of this framework are English language teachers who search and reuse these resources for teaching and also share them with foreign language

teachers. Two of the most important tools of this framework are Mobile2Learn Web Repository and Mobile2Learn MALL Courses Delivery tool which provide the knowledge to mobile learners.

2) Clickers

Clickers also serve a purpose of m-learning. Clickers are handheld electronic devices which provide voting functionality for multiple choice type questions. Popularly, they are being used in quiz shows for audience polling. They are also used in classrooms for quizzes and feedback. [33], [34], [35], [36], [37] explore various modifications to these traditional devices and are similar in their end result of replacing the clickers but differ widely in the way that is achieved.

3) Mbelick

Mbelick [33] is designed for presenting in-class quizzes. Responses are sent either by using the phone's built-in web browser, or by using a dedicated smartphone application, or by SMS text message, and subsequent personalized feedback is sent on the students' phone itself. Instructors provide lecture based questions and feedback is textual. Smartphone users have to login to the relevant numbered session or send SMS.

4) Votapedia

[34] Talks about a mobile phone based Audience Response system, called Votapedia. It allows users to vote through web, SMS or vote by dialing, which despite 'engaged tune' flaw is a novel concept. Each survey type has multiple options, a maximum survey time, number of allowed responses per voter, whether web based voting is allowed and how many responses per voter are allowed.

5) Classroom Response System

[35] Makes use of multi-functionality smartphones to extrapolate the benefits of Clickers in traditional multiple choice questions to illustrative and short answer type questions. The rich Classroom Response System (CRS) has two stages: student response and instructor feedback. Two tests are used- Clicker Test and Concept Retention Test in rich versus traditional setting, where the former shows better results for rich type questions but is ambiguous due to small sample size for the latter case. Since the testing had not yet

been completed for instructor feedback, it is early to comment on the usefulness of that feature. However, server data can be analyzed and automatic feedback to individual students can be designed using the graphic feature of the smartphones.

6) Quizit

[36] Presents the development of Android mobile devices named QuizIt. Native app is used over HTML5 as it is easier to use, is user friendly and has faster responses. The lecture application or the web environment are used to insert questions, delete existing questions, activate existing questions and see and delete the results. The student application is used to play the question with the choices one after the other. It does away with the need of displaying the questions and choices on a projector and instead displays them on the app itself.

7) Pencast

Pencast [37] is a technological development which is used as an audio visual tool where a handwritten note is recorded in real time along with the instructor’s vocal explanations. It is basically a digital pen with microphone and camera, and the written file is saved as a PDF. Viewed along with the audio, it serves as pre-read before and after the class and is meant to enhance concept retention. It can be used in sync with clickers or mobile clickers to improve the understanding and retention of students.

C. Limitations

Besides these advantages and great applications, there are some limitations of Mobile Learning. In our survey as shown in fig. 13, we found that in mobile learning the major barrier is to face the distractions available in devices for users in the form of applications. Other challenges include internet service availability, and hardware restrictions.

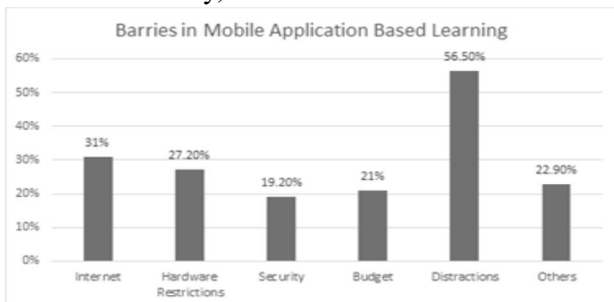


Fig. 13: Barriers in Mobile Application based learning

Table 2 : Summary of Advantages and Limitations of Mobile Learning

Advantages	Limitations
It costs less to students.	Students who cannot afford their own devices are left out of the courses.
It involves less risk for the institution.	Students can make misuse of mobile devices instead of learning.
Students have a familiar device which is a Smartphone.	Incompatibility problems like network issues may occur.
Students can study well on their own devices rather than on institutions’ devices.	Software compatibility issues like not upgrading to a new version, regular system crashes, etc. may occur.

V. Discussion

We can see that MOOCs and mobile learning; both are the face of future education system. In such systems, instructors play a very important role as mentors. This can be analyzed by applying various machine learning algorithms such as Decision Tree, Naïve Bayes, Logistic Regression and Multi-Layer Perceptron (MLP) on the pilot data. The results of each algorithm are described in Table III.

Table 3 : Results of various machine learning Algorithms applied on our dataset for the role of instructors

Method	Accuracy (%age)	Precision	Recall	F Measure	MAE
MLP	69.13	0.800	0.818	0.809	0.215
Naïve Bayes	72.37	0.796	0.901	0.845	0.234
Logistic Regression	72.89	0.781	0.931	0.849	0.235
Decision Tree	73.80	0.764	0.951	0.847	0.252

Decision Trees perform the best among all having an accuracy of 73.8003% and Mean Absolute Error (MAE) of 0.2523.

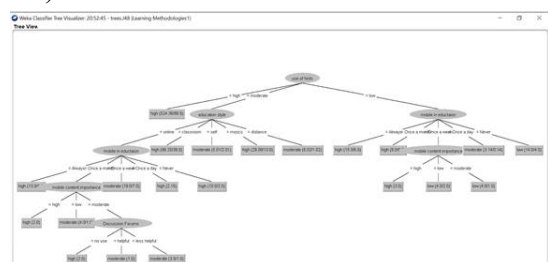


Fig. 14 : Decision tree for the role of instructors

Fig. 14 shows the decision tree taking leaf nodes as role of instructors. Role of instructors is classified as high, moderate and low. High role of instructors indicates that there will be high use of hints and no use of discussion forums.

6. Future Work

A. MOOCs

The study in [15] focuses mainly on the sharp decline rate of interaction on most of the MOOCs with time and facilitates easy navigation of relevant information through overloaded discussion forums. This work can be applied to find the most read topic by an Ebook/kindle reader and revert them back with suitable further reading suggestions. It can also be used by users to find relevant feedback in e-commerce websites and by the company to find the gist of the feedback, classify and rank them accordingly. The work in [4] does not make progress to understand why the hint systems negatively impacted student performance. Future work needs to be done to improve the utility of feedback and discussion forums to learners. Hence more work needs to be done to suggest relevant individual topics and threads to the learners so that their activities get increased on discussion forums and they can utilize the benefit of the discussions to the maximum.

B. Mobile learning

M-learning can be used to provide immediate knowledge to help individuals. It can be seen as the next wave in the education domain. As the speed of business and information overload is increasing, everyone requires information and knowledge just when they need it in their desired format and in the mobile platform of their choice. It can be applied to everything from product training to IT and organizational training. It is suggested that the Mobile Live Video Learning System (MLVSS) can be used to conduct live quiz contests among the learners so that they remain active throughout the session. The study in [12], [13] and [14] is carried only for rural people but it can be extended to reach the entire rural community. M-Learning can be used to provide practice questions, make connections with peers and instructors, and access knowledge [24].

Further suggestions come to Mobile learning applications like mbclick [33] can be used to conduct quick audience surveys. Further applications of

mbclick include deployment in sport grounds for the audience to answer polling questions such as which team is likely to win or who would be Man-of-the-match. Votapedia [34] can be used for rural settings where language options can be embedded in vote by dialing and combined with web voting for web sessions. In QuizIt [36] more features such as graphical questions and ratings could be used to make full use of android OS. Pencasts [37] can be proved as a replacement of chalks and markers used by academicians and the instant generated notes can be used as supplementary reads.

7. Conclusions

E-learning (MOOCs) and m-learning both are growing steadily as a means to provide distance education to people who cannot attend classes. Both MOOCs and m-learning technologies have various advantages and limitations which have been discussed thoroughly in the paper.

Some of the advantages of MOOCs include the contribution made by videos feature in making MOOCs a huge success as the learner can learn from the videos at his own pace. Other important features include automated evaluation by the system as well as combination of peer and automatic system, superposters who help in by posting detailed answers to questions and by asking good questions. Forums are the best social tool preferred for discussions. Some of the limitations of MOOCs are that instructors do not play an important role in the course. Chat Rooms and hint systems are not of much use. Age, gender, highest degree qualification, programming confidence, status as a professional, graduate or undergraduate student and English proficiency all had no impact on completion rate of the course.

Mobile learning has some advantages such as that it can be used for teaching rural people along with urban people. Mobile Live Video Learning System (MLVSS) provides live streamed video lectures to mobile phones of users, social network sites (SNS) can be maintained on mobile phones that help in learning. Learning Management Systems (LMS) provide a virtual platform to work together in assignments, ANFIS system delivers adapted learning content to mobile learners, Mobile2Learn framework helps to access and reuse Mobile Assisted Language Learning (MALL) resources. Clickers are also helpful for m-learning purposes.

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