Online Teaching Learning Platforms

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***Abstract*—This Paper presents the comparison between different online teaching learning platforms. In current time, when online teaching learning is blooming in rapid way, it's always difficult to choose which platform is good from all aspects. This paper introduces Online teaching learning, discusses its types, and importance, talks about the difficulties in designing Online teaching learning platforms and compares different online teaching learning platforms based on 15 different parameters and concludes with the best possible solution for ideal teaching learning environment.**

Keywords—Online Teaching Learning, E-Learning

I. INTRODUCTION

Teaching and learning are methods of sharing or obtaining one's knowledge with the best aim of further education on the journey. Teaching Learning System is the combined process where an educator assesses learning needs, establishes specific learning objectives, develops teaching and learning strategies, implements plan of work, and evaluates the outcome of the instruction.[1]

Teaching means interacting with learners to help them to understand and apply information, concepts, and processes, while learning can state that the activity or process of acquiring knowledge or skills through study, practice, being taught, or experiencing something. In teaching learning process teacher helps students to learn new things based on the teacher's ability to teach, based on his experience in teaching and particular subject matter. Teaching can be taken as a process that enables the learner to learn on their own via direction, guidance and evaluation of things that were taught. Learning is the process where person acquires profound knowledge, skill, understanding, behavior or skill knowingly or unknowingly through mediums such as study, experience or observation. The overall process of teaching and learning can be best viewed as the interaction between teachers and learners where teacher share their knowledge and learner try to understand the concepts shared by teacher.

Technology plays a big part in many aspects of everyday life, and its importance

to education is by no means different. Online teaching learning are the new and popularized methods. Commonly known as e-Learning, Online teaching learning is blooming in the past years, and is at a peak this time due to the COVID-19 pandemic. Online teaching learning totally differs from traditional teaching learning, where teacher teaches from distant, and learners learn from their suitable place, which is why it is also called distant learning.[2] Strategic use of information technology can change teaching and learning, thus helping institutions develop higher education. The Online Teaching Learning System focuses on learner awareness, aligning learning values and activities with each other, and integrating learning technology, all intending to improve performance among students. Online teaching learning happens over the internet which is why it is becoming popular these days where synchronous learning is not possible.

Synchronous learning happens in real time with the direct interaction between teacher and learner while asynchronous learning happens in the form of recorded videos, lectures. Synchronous learning is time-bound process where teaching learning happens with the help of some interacting methods such as Video conferencing, audio conferencing and live chats. Synchronous learning has advantages and disadvantages. It attempts to mimic the traditional method of learning, i.e., learning system while being physically present, which aids learners in maintaining classroom engagement. Learners can be clear about their queries in real time with the aid of teacher in synchronous learning. But despite of all these pros, synchronous learning can be technically difficult due to the need of internet and digital medias to continue learning processes.

Asynchronous learning occurs on the learner's schedule, that also means that the teacher will give the learner a time frame within which the teacher will provide instructions and materials that the learner can use to accomplish the task given by the teacher. Asynchronous learning can happen in email, recorded video. While asynchronous learning beats the major disadvantages of synchronous learning of technical difficulty, it creates many problems about learner engagement and interests. Due to the freedom learner get, they may not even learn quite like in the synchronous mode. This can also result in feeling of isolation due to absence of real time interaction.

A. Components of OTL Sytems

Online Teaching Learning systems working synchronously or asynchronously have components without which the system won't work properly (3). These vital components in the system can be grouped to subsystems which are listed below.

1) User Management System: Online Teaching learning system has two parties one who teaches also called teacher and the one who learns who is called learner. We need some tools to manage all of their information where it will be safe and easy to maintain. That system is User Management system. It will provide a central system for managing all the details about these users. UMS (User Management System) can have authentication system which helps in logging only those learners and teachers who are associated with that particular learning institution. This can filter out fraud users. The user management system can also help in classifying the users based on their capacity and interests. Not all learners have same capacity, they may be strong in one field but weak in other. These kinds of behavior can be monitored with the help of User Management System. Also, the users can be assigned assignments, can store their grades and overall performance in the user management system.

2) Course Management System: Course Management System(CMS) is also an integral part online teaching learning system. It helps learner and teacher to manage all the courses which they are taking and are planning to take. CMS is a tool that allows teachers to develop and support online education. A good CMS is easy for both students and faculty to use, has

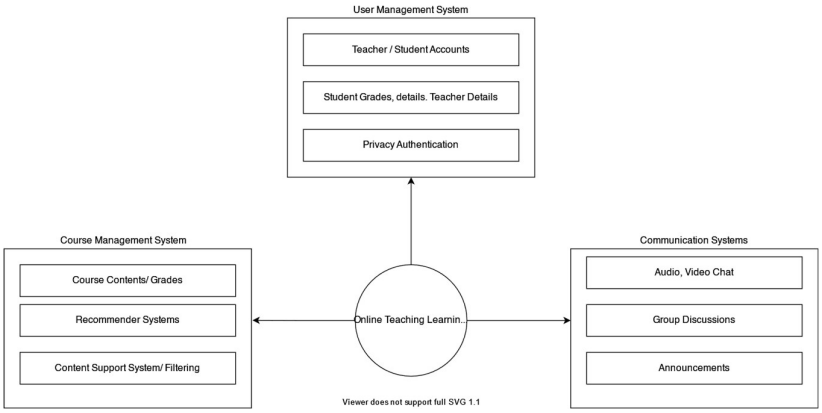


Figure 1: Components of OTL Systems

a consistent and reliable track record, and can be maintained and serviced routinely without causing students or faculty inconvenience [4-5].

With the help of a goof CMS, the learner and teachers will know about their course, contents their performance on these subjects, their strengths and weakness. This will help learners to track down each and every records based on the particular subjects which will ultimately helps to increase their performance on certain subjects.

Teachers can also benefitted from this. They can track down the record of their courses, and can adapt the best learning method based on the data they get from the system, which helps teacher to improve themselves in long run.

3) Communication Services: Communication between the teacher and the learner is essential for an effective teaching learning system. Communication can be either direct or indirect. Communication between the two parties can take various forms, such as discussion forums where a large number of students present their problem and collaborate with the teacher to solve it. Another method is direct chatting with the teacher via the platform itself or other third-party apps. Emails can also be used for the flow of information among the parties.

Without proper communication the teaching learning system will be obsolete. If learners cannot interact with teachers, then this can create big problems such as loneliness in learners, problems with subject matters. To solve the problems of learners the communication between teacher and student must happen.

Communication also helps teachers to best know their students and their capabilities, with which they can improve the way they teach to that particular student or a group of students.

B. Types of Online Teaching Learning System

1) Active Learning: Active learning is any teaching approach that requires all the students to participate in the learning process. Active learning contrasts with "traditional" teaching styles, in which the students are expert passive information recipients. Active learning can take many forms and be carried out in all disciplines. Typically, students will engage in small or wide-ranging activities based on writing, talking, problem-solving, or reflection.[6]

2) Blended Learning: Blended Learning is characterized as a structured curriculum consisting of in-person classroom time and individual online research using e-learning software.[7] It is a form of multichannel process, integrating tutor-led activities, photographs, video, digital tasks, and face-to-face conversation.

It is the mixture of synchronous and asynchronous learning systems. Synchronous learning might be conducted via traditional methods or virtual method with learners being present in the system and asynchronous learning might be conducted as per the learner's pace. [8]

3) Personalized Learning: It is an instruction in which the learning speed and the teaching method are personalized for each learner's needs. Learning goals, teaching methods, and instructional content (and their sequencing) can differ depending on learner needs. However, the learning experience is meaningful and important to learners, guided by their desires and sometimes self-initiated.[9]

4) Open Learning: Open Learning is a hands-on approach to learning that focuses on open educational resources, open-source software, and online communities.[10] Open source is intended to encourage students to be willing, autonomous, and involved in their learning. It is also oriented toward collective research and

social learning. It is a collaborative and easily accessible solution that employs open tools and educational standards.

5) Engaged Learning: Engaged Learning is a method of learning in which students actively participate. Beginning on the first day of class, students begin to participate in the decision-making process of their study course.[11] A learner who is involved in the process is similar to active learning. As a result, active learning is a subset of engaged learning. A learner engaged with the object of study is engaged in experimental learning, in which learners examine and analyze the object of study.

6) Adaptive Learning: Adaptive learning is similar to the concept of personalized learning. Similarly to personalized learning, the learning's strength, skills, and weaknesses are considered so that the difficulty and pace of learning for the current course are adapted to the user's status.

7) Colaborative Learning: Collaborative learning is a method in which students learn and accomplish their learning goals as a group. Effective learning groups are formed when each learner considers the strengths and weaknesses of their peers and works cooperatively. This helps to improve communication skills and the ability to work as part of a team.

C. Importance of Online Teaching Learning Systems

Online teaching and learning systems can give various benefits in teaching and learning. The pandemic has made people realize that you have to learn to live without any physical contact with outside world. Which is one of the reasons in OTL gaining rapid popularity and development in current scenario. Due to the portability and easiness of online teaching learning systems, they have various importance in human lives, which can be described as follows:

1) Convenience: Learners can learn at the pace of their convenience in the comfort of their location.Asynchronous learning also enables students to learn at their own pace. Online learning can be convenient for most people, and because of its flexibility, learners have the opportunity to better understand the topics.

2) Economical: OTL systems can save both time and money. When using OTL, you may save money and time on transportation. The costs physical systems will also be decreased which will inturn help in saving money.

3) Maintainance: It will be simple to maintain and manage the learning if both parties utilize user-friendly OTL technologies.

4) Online Sharing and Backup: The resources that will be utilized by students and teachers can be saved online, eliminating the possibility of tampering with them. The parties will have access to the resources, which will be simple to maintain.

5) Easy Information Sharing: Because to the availability of discussion groups and resource management, knowledge may be quickly disseminated among students.

6) More Interaction: OTL also increases interaction and conversation between teachers and students. The presence of active sessions with teachers and discussion forums allows learners to express their issues while also assisting fellow learners in solving their problems.

7) Enhanced Learning: The the variety of resources available to the learners using OTL systems can be vital for learners who want to broaden their mind with knowledge of other fields.

II. Design Issues of Online Teaching Learning System

Online Teaching-Learning Systems should be built so that it can be used by anyone without having to face any technical issues, but many systems still contain many issues in their design. Some of OTL systems' architecture issues are discussed below:

A. Heteroginity

Heterogeneity refers to being diverse in content. A heterogeneous system is one that consists of software that can be written in different languages, running on different operating systems, maybe using different communication standards. OTL systems are used by different persons with different backgrounds, different devices, different connections. So, the system must work seamlessly for all the users despite their limitation of device, internet connection. The front-end, back-end and middleware of the system must be connected in such a way that any problem in one component should not affect other i.e., the bad UI design of front -end component should not affect how the backend works, how the server handles requests.

Another heterogeneous factor to consider is the functioning in cross-platforms. For example, the importance of the OTL system to run in various Operating Systems such as Linux, Windows or MacOS should be considered before the development of the system. In case of web-apps/websites, running of the system in various web browsers and their compatibility with them should be considered.

B. Reliability:

Reliability is the probability of failure-free program operation in each environment for a defined period of time. The OTL system developers will make the system reliable when developing the system. The system should be configured in such a way that users can depend on the method entirely. The system should not exhibit some form of serious error that could disrupt the system in the wrong direction. The system should be designed in such a way that any users can rely on it for a longer period of time. None of the users wants to lose their data, their progress and likes to change systems in a short period of time. But, if the system will not be reliable, the user will be forced to move out of the system and search for another for better reliability, which will be a bad experience for users. So, while designing OTL systems, the reliability factor must be kept in mind.

C. Security

Software security is a concept applied to protect software from malicious attacks and other hacker threats so that under these possible risks, the software can continue to work correctly. So, the primary and foremost challenge for sound OTL systems is developing a secure platform. In the OTL system, the teacher may evaluate the students by giving an assignment, quiz, project work, and maybe a personal meeting. The system contains many personal information of both teacher and learners which they never want to give to any other third parties. But if the system won't be secure, the system can be hacked by third parties which may result in third parties stealing the data for unethical purposes. So, to make system risk free, we must invest our time in improving the overall security of systems and proper management system in case the system compromises. Therefore, the OTL system must provide honesty, authentication, and availability.

D. Scalability

The OTL system should easily scale with its increased number of users. As the number of users in the system increases, the same data structures and algorithms used for recommendations, storage types used for resource storage, servers used to store data in the cloud, scheduling algorithms used for concurrency handling, security protocols, and so on, should be able to handle the increased load on the system without degrading system performance.

E. System Failure

Systems should be able to recover from unexpected failures or crashes. OTL systems are built on a variety of processes. Streaming media, downloading, and uploading of resources are among those that are prone to failure owing to simpler technological challenges. Simple rollbacks can be used to recover from unexpected errors in these processes.

F. Resource Management

Resource management is one of the issues faced by an online network. Although the device can do excellent audio-video conferencing, talking, webinars, they don't have the resources in them. Using too much of storage to store resources can result in high expense during the use of system. Using too much of the bandwidth for running the OTL system may create unnecessary slowing down of the user's system. Various compression algorithms and automation techniques can be used so that the OTL system can properly handle the resources and in some cases exit the use of excess resources for its functioning.

III. Challenges of Online Teaching Learning System

When comparing face-to-face learning systems to online learning platforms, significant flaws in the online mode exists, such as a lack of human interaction, interactive learning opportunities, teacher supervision, and, most notably, practical learning opportunities in difficult subjects like science and mathematics. Such, difficulties are listed below. [11]

A. Adaptabiity

Comparing to traditional teaching learning systems, online learning system doesn't have that feature of face-to-face interaction, note-taking, quick Q/A and so on. The environment of virtual classroom will be totally different. Some students find it difficult to concentrate since they will be just looking at some electronic devices with no friends/teachers by their side, which make them feel like let's not learn, let's play game. While in face-to-face learning students easily feel well with their friends and teacher. Some students may feel difficult to express themselves in online teaching learning. So, students with a "traditional" concept find it hard to get used to it, but with an Open mind and heart, they need to accept new learning environments. Knowing the advantages of studying online and communicating with peers will improve this cycle and make students more prepared for online classes.

B. Accessibility

All teachers and students should be able to use OTL systems. Because one of the key benefits of OTL is the ability to get education at any time and from any location, it should be available to all system users. But as online structures turn out to be more fighting to adapt, it also raises the next dimension of struggle: the place the learner, bad internet connection, as well as the instructors, can't effortlessly get entry to the system. This can be true and seen in cases where there is less development of infrastructures. That's why promising full accessibility in OTL system is not possible.

C. Computer Literacy

The Lacy of Compute Literacy is another challenge for Online Teaching Learning Systems. Although most of the students these days know how to use mobile or computer but some students who live in less developed area of any country may have not even seen these devices yet. So, they won't know how to use the system properly, how to utilize it properly. Furthermore, many students find it difficult to resolve basic computer issues because they lack experience in this area. Technological abilities, on the other hand, are required for following online courses because they allow students to manage their assignments and courseware in a planned manner rather than struggle. Essential publications in pc literacy enhance students' expertise in the field; having important information about laptop hardware would help them take part in online instructions barring interruptions and hindrances.

D. Recommendation Systems

Most of the platforms these days contain courses and materials in huge amount. Some Students feel good to explore the content and choose by themselves, but some find it as an extra burden. They can't choose what is right for them and what is not. Recommendation system plays vital role in recommending the best suitable course for any students. But, due to lack of enough data for beginner students, the system fails to best calculate the factors before recommending contents. A recommendation system must filter contents based on user input, but this will be quite a challenge for new learners since, the system doesn't contain enough data about the learner. So, A recommendation system that can recommend the perfect courses for people is not quite feasible

as the mindset of each learner is different and they desire different things from the system.

E. Content and Resource Limitation

Online Teaching Learning systems contains huge number of files for the teaching learning purposes. Managing these files and delivering contents to the users in a fast and proper way becomes a big challenge. Since, the system will be accessed by huge number of learners at a time, managing server bandwidth and resource allocation becomes another challenge. Although the contents can be delivered with the help of Content Delivery Networks (CDNs) it won't be feasible to deliver such a huge file in a single instance of time to all the users.

F. Localization

Localization is a concept of adapting the contents on users' own languages. Many learners prefer to learn in their own language to understand fully.[12] The process of localization will include translation, adaptation of graphics, modification of content, change of units and formats and so on. But, translating every content to different languages itself is a difficult task. The teachers need to learn new language or need to find new teacher who is expertise in that language and subject to convert content from one language to another. And in some cases, it might not be correct. Some words are missing in some languages which creates difficulty in delivering the exact meaning of original content. Thus, the process is expensive and there might be some cases where localization is not feasible at all as the content might be offensive to the local community.

G. Time Management

Even with OTL technologies, the challenge of time management remains unsolved. Learners must still schedule time in their daily schedules to participate in the learning process. Some systems may require daily engagement, which may be difficult for students with busy schedules. This, it is yet another challenge that the OTL system faces.

IV. Online Teaching Learning Systems

Online Teaching-Learning Systems are constantly changing and have transformed the lives of teachers and students. There are many online technologies to enhance learning activities. Some of the online teaching learning systems are: Zoom, Google Meet, Google Classroom, Moodle, Cisco WebEx, Coursera, Udemy, Piazza, Udacity etc. We will discuss some of them in later parts.

The hierarchical diagram given in Figure 2 shows the major classification of the OTL systems that will be discussed. The systems can be classified in three main categories: Mode of Service, Nature of service and System Availability.

Based on Model of service, the systems can be further classified as Synchronous and Asynchronous. Briefly mention, synchronous learning means teaching and learning in real time with the help of some video conferencing tools or live chatting systems, where teacher teaches students in real time and students learns. This mode gives freedom of interaction with teacher for the student problems. Asynchronous mode basically means learning based on the contents that are present in the system, these contents can be recorded videos, lecture notes etc. In this mode, the teacher assigns some problems to the students, and they learn and submit them in their own time.

Adaptive Learning, Collaborative learning, Video Conferencing falls into Nature of services. Adaptive Learning basically means system that can adapt the behaviors of the learner. They will provide the content based on the past activities of the learners, and their interests. These types of systems are best suited for students who just don't want to explore too many courses and continuously learn similar kinds of contents. Collaborative Learning is learning in group. In this type of systems teacher assigns some tasks to the students in a group and these group submits the required tasks. Video Conferencing refers to real-time video calling while teaching and learning. This is considered as synchronous mode of learning since, teacher teaches students in real-time video calling.

Online Teaching Learning systems are blooming in the current pandemic and many platforms are using these services to earn money these days. While there are certain open-source platforms that provide these services, but most are moving towards Paid plans with better services. So, based on system availability they can be categorized as: open source and Premium services.

Some of the above-mentioned systems are classified based on their mode of learning, nature of learning and system availability in figure 3, 4 and 5 respectively.

Various OTL offers various forms of services. Each has their pros and cons. The detailed look on each of the OTL systems has been done below:

A. Google Meet

Google meet is an enterprise-grade video conferencing system that provides seamless teaching and learning. It is easily accessible with the person having a google account and can schedule and run meetings for up to 60 minutes without any cost for 100 users. It has been recently integrated with Gmail, which points out that joining meetings and staying connected has been made even easier. As it is integrated to the Google environment, meetings can be scheduled using the calendar events. Google meet doesn't offer an application for desktop but rather runs on the browser. As for mobile phones, it has support for both Android and IOS devices.

The User interface of Google meet is simple and consistent. Users will be directed to a home page when they visit google meet where they can create instant meeting or can schedule meeting for later dates. Inside the meeting the users can search other users, can chat with the everyone presents in the meeting but cannot send any attachments. The Meeting host can record the meeting, mute unmute users and even remove users from the meeting. All the users can also share their screens during meetings.

Google meet offers Premium plans based on its G-Suit packages from which the user can host unlimited meetings with unlimited participants.

Thus, Google Meet has been categorized as an OTL system with premium plans using video conferencing as the nature of service and synchronous mode of education.

The features of google meet are rather simple and easy to understand. The User interface is easily adaptable with big icons and texts. As I have already mentioned some of the features of google meet above, beside that the host can integrate google meet with his google drive for whiteboard files, video, and text recordings. Although this does not offer feature to record the exact time of entering and leaving of participants, there are many third-party applications that fulfills that criterion. Due to the service belonging to Google and Google being a reputed company that takes good care of the customer, Google Meet is promised with a good Quality

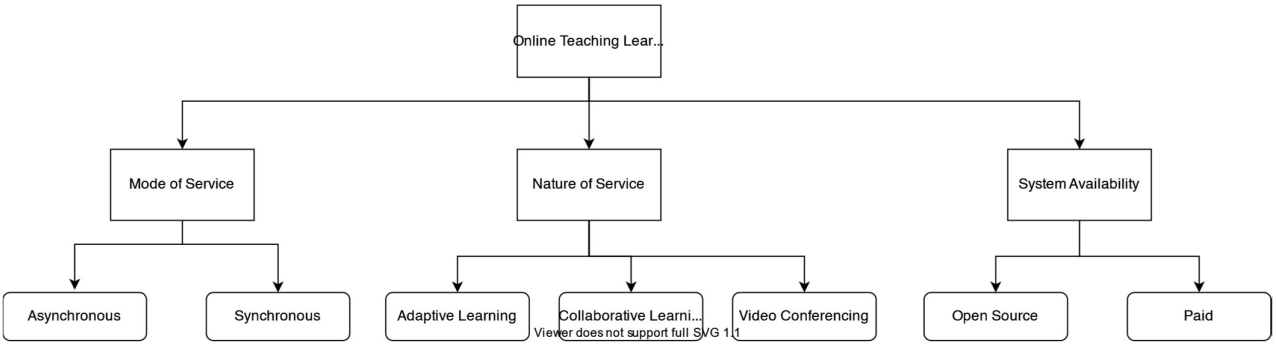


Figure 2: Hierarchical Block Diagram of Online Teaching Learning Systems

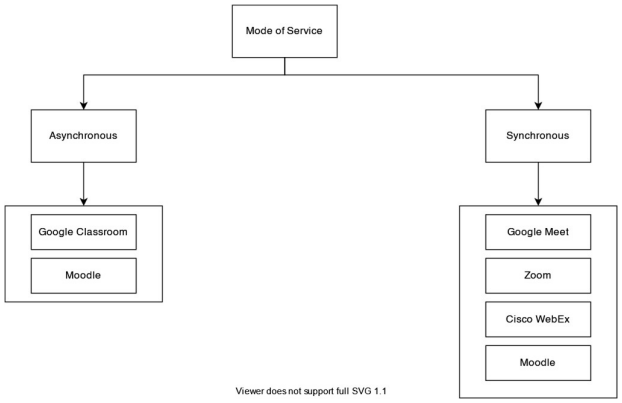


Figure 3: Classification of OTL Platforms based on Mode of service

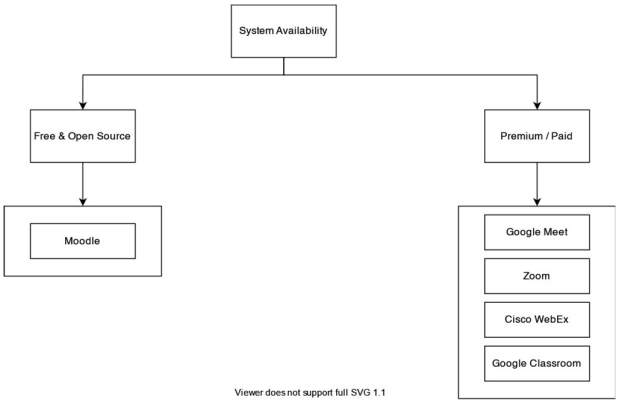
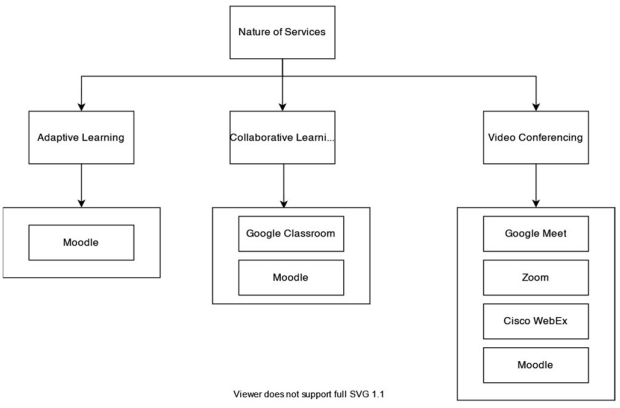


Figure 4: Classification of OTL Platforms based on Nature of service

Figure 5: Classification of OTL Platforms based on System Availability

of Service as it has good reporting and feedback systems in place.

The major components in Google Meet have been described below with its component diagram in figure 6.



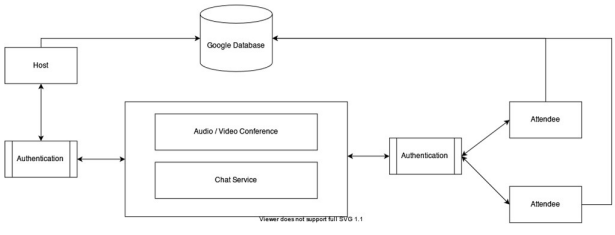


Figure 6. Block Diagram of Google Meet

B. Google Classroom

Google Classroom is free assistance for instructive establishments, including schools and colleges.[13] It is a free system offered by google for better learning and teaching experience. Since, it is integrated with google services, any user having google account can use this feature. It is web-based system which offers Android and IOS apps for seamless use.

Any, user can create classroom, invite students and can assign different tasks to the students. The students can see the tasks, submit their assignments and ask questions. Google classroom helps teacher to share different contents through this platform. Teacher can share any type of contents such as PDFs, Video files. Teacher can even schedule google meetings from the classroom page itself which can be very useful for repeating classes. Since all the Storage is based on google drive any user can get up to 15GB space for content sharing. Google Classroom also allows private chat between the teacher and students. It can be taken as virtual classroom itself. But due to the pay wall some of its features are not available to the free users.

Google Classroom closely resembles the environment of the classroom, so calling it an asynchronous virtual classroom would not hurt. It is highly portable and can be used in any sort of devices with internet connection.

The major components in Google Meet have been described below with its component diagram in figure 7.

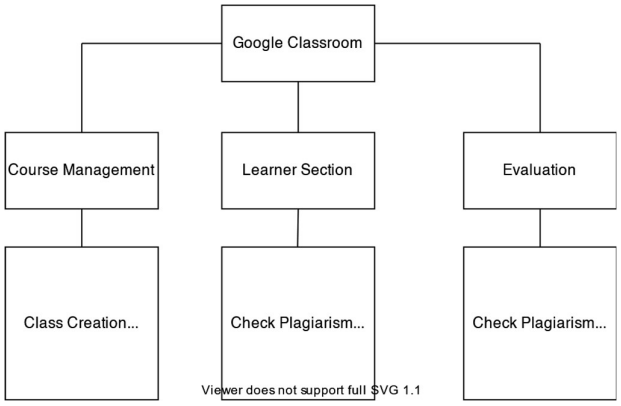


Figure 7: Block diagram of Google Classroom

C. Zoom

Zoom is a cloud-based video conferencing service that lets users meet virtually with others - either by video or audio or chat or a mix of all. It is suitable for all sizes of groups. Zoom offers synchronization with wide range of platforms such as Google (Calendar, Drive, Chrome), Microsoft (Outlook), Dropbox and so on. Users can use Zoom in desktop app and is also available as Android and IOS app.

Zoom supports 100 users for 40 minutes for free for host meetings but unlimited one-one conversations. If the host wants to connect the class for more than 40 minutes again, all have to rejoin; otherwise, they have to pay for the uninterrupted course after 40 minutes.

The feature of Zoom includes end-to-end encrypted video calling, chatting feature with one or many of the attendees in the meeting, screen sharing and so on. The host can lock the room, can create different break-out rooms for group conversations, can add, remove participants.

The User Interface of Zoom is okay-ish. It has very small letters which may be difficult for some users to read. Similarly, the buttons are also small.

Zoom shows the details of CPU usage, bandwidth usage and other statistics about machine in the app itself from which users can get idea about their machine and network status. Users can also enable or disable noise cancellation features in settings and other several audio and video manipulations.

Zoom promises 100 participants in its free accounts with unlimited storage option. Zoom also has a chat feature where active participants can chat publicly with the group or have private chats with other participants. The chat system supports up to 512MB of file sharing. Host can also change the server to change the connectivity status of the meeting.

Zoom, for personal to small group use is highly effective with its free plan but for larger groups at industrial scale, paid plans can be used to improve its use. Paid plans include additional features such as increased number of participants up to 1000. Paid plan also give access to administration dashboard and support, auto-generated transcripts of the recordings, user management, reporting features, dedicated phone support and so on.

The components of Zoom have been described with the block diagram shown in figure 8.

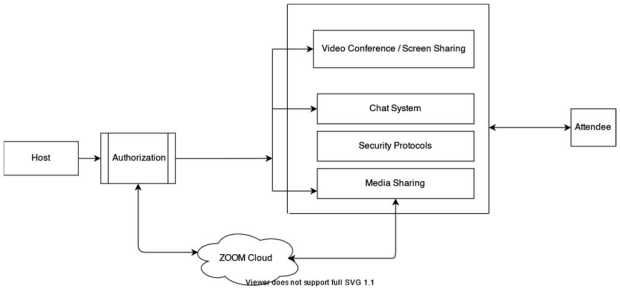


Figure 8: Block Diagram of Zoom

D. Moodle

A modular object-oriented dynamic learning environment (Moodle) is an open-source software and learning stage intended to give instructors, overseers, and students a solitary powerful, secure, and incorporated framework to make customized learning situations.[14]

Moodle's highlights incorporate the capacity to create courses, enlist 10 students, oversee assignments, and give tests, reviewing, wiki and conversation gatherings for many virtual understudies one after another.

Moodle provides private domains to various learning classes that teachers teach. Various contributors have implemented Moodle with over 100,000 registered implementations across the globe. Various plugins and extensions allow Moodle to convert itself to any sort of learning environment the teacher wants it to become. It can be the source of synchronous education where the teacher and learners learn with real time interaction which can be achieved via freely available plugins such as EJSApp. Else by default it can act as an asynchronous learning environment.

The User interface of Moodle is a bit confusing since it contains many features which are all grouped in a single home page. For beginners this will be exhaustive to find a feature that is perfect for them. The texts are too small, there are not perfect feedback systems for file uploading, and course completion. Sometimes it becomes harder to find the required courses.

If used default, the Moodle can be very confusing but if we change the user interface and group features based on their requirements and priority, this can be a very useful tool for online teaching and learning.

In an administrative point of view, Moodle has implemented secure authentication and mass enrollment system where over 50 authentication and enrolment options are provided to add and enroll leaners to the course. Moodle has support for open standards and the administrator or teacher in most cases have the ability to manage user roles and permissions within in the course they are in charge of.

The various components of the Moodle system have been compiled into the component diagram in figure 10.

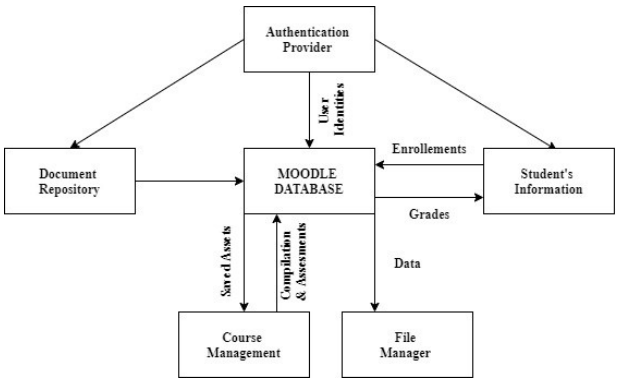


Figure 10: Block Diagram of Moodle

E. Cisco WebEx

Cisco WebEx is a cloud-based suite that provides video conferencing service that connects globally and virtual teams to interact using smart devices that support video systems in real-time. It includes features such as screen sharing, meeting recording, customizable layouts, and meeting broadcasting. [15]

WebEx is targeted mostly for large business platform requiring comprehensive video conferencing solution. Thus, the pricing of the system is relatively high. Free usage is also available with up to 100 participants. It is built with end-to-end encryption making the whole system even more secure and comes with the usual in video options such as screen sharing, call scheduling, and calendar integration.

Cisco WebEx is the top video conferencing with the HD video, screen sharing, and meeting recording. Likewise, it's the interface is simple to use and easy to host meetings.

WebEx also lets us have online classes having features of surveying, Q&As, and content visit and permitting us to make the most out of each meeting. The online class devices incorporate whiteboarding, content sharing, and the capacity to share screens to keep everybody on the same wavelength.

The components of the system can be seen in the component diagram in figure 11.

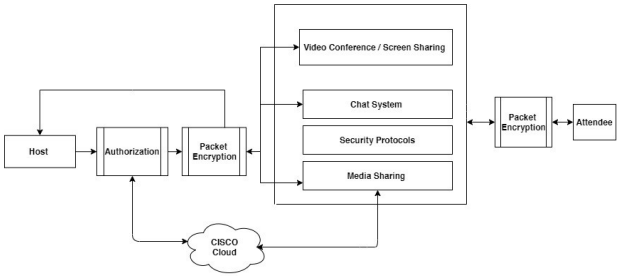


Figure 11: Block Diagram of Cisco WebEx

V. Comparative Analysis of Online Teaching Learning Systems

The various forms of OTL have their features and their shortcomings as well and all of them can be compared to one another. Listed below is the list of parameters that have been used to compare the most popular OTL systems explained in the previous section.

A. Usability

Usability of any software is measure of how usable it is. In case of OTL systems, the features and functionalities it provides can be said as a factor of usability. The system is said to be usable if it can be used by all the users without any problems.

On comparing above mentioned learning platforms, I found Google Meet and Google Classroom easy to use. They have very simple interface; fonts are big enough to read. Zoom gave the problem of small font and have a bit more features which makes users confusing. In case of Moodle, it has very complex user interface. WebEx is usable but it was primarily made for complex tasks.

B. Reliability

Reliability is defined as the quality of performing consistently. In the case of digital systems, reliability of system is inversely proportional to the number of crashes or severe problems face by the user during the use of the system.

All the platforms are equally reliable. They give secure features and better security but, WebEx is more secure and reliable compared to others while since Moodle should be used with hosting in our own server, it can be a bit unreliable in time. Zoom, Google Classroom and Meet are all from big companies and they fix any issues within no time. That's why they can be considered reliable systems.

C. Security

Security is protection of the system from Malicious attacks and malwares. The system should be safe and secure in order to use them. Most of the systems collect user data while registering to the system, and if the system is not secure then all the user data will be in stake. That's the main reason OTL systems should be secure.

WebEx has most secure measures, while zoom, Google Classroom and Google Meet follows that. Zoom and Google Meet has end-to-end encryption in premium modes only, so, their free plan may not be as secure as premium plan. And talking about Moodle, the security measure mainly depends on us, since we have to host it in server, which sometimes becomes less secure than all others.

D. Understandability

The capacity to be understood is referred to as understandability. The system may give its users with a wide range of functions. The users must have a nice experience, knowledge about how to use the features and when to use them. Users will be more likely to utilize these features if they understand how they function.

All the above-mentioned systems are easy to understand. Among them Google Meet and Google Classroom comes first followed by Zoom, and WebEx. Moodle has many features which makes it a bit hard to understand and use. But if we just take its basic features then it is also easy to understand.

E. Scalability

Online teaching learning platforms available have multiple tools and most of them are scalable. They support multiple features and can be used on different devices like cell phones, computers, etc.

Out of all above-described platforms Zoom can be more scalable than others. It has more features that can be scaled. It can hold up to thousands of peoples in a meeting which comes handy in come cases. All other platforms follow Zoom in case of scalability.

F. Heterogenity

Heterogeneity is the property of having a wide range of characters or substance. Many individuals speak their own language across the world, yet English is the most widely spoken international language. Many platforms offer their application in various languages.

Out of above-mentioned platforms Moodle can be more heterogenous since it can easily be translated into another language. Zoom, Meet and Classroom need to be translated by their own companies.

G. Testability

Testability refers to the power of testing the system. If users can test and experiment the features of systems, then they know how they function and can adjust according to their needs.

All platforms provide basic functionality of testing. Zoom, WebEx provides Audio and video testing in advanced form. Google meet also provides some basic functionalities about audio and video testing. Moodle is itself a testable platform which can be used and tested as much as user want. Last comes the Google Classroom, which is itself is a black box since not all the features are shown to the users.

H. Adaptability

The capacity of a system to adjust to changes is referred to as adaptability. For OTL systems, these might involve OS or browser upgrades. Some OS services used by the OTL may be updated, and the same system may no longer be compatible with the OS. This is one of the adaptability issues. Other issue would be for video conferencing systems where the video streamed to viewer need to be adapted to changing network conditions.

All the platforms have capacity to adapt themselves in case of any changes. WebEx provides HD quality video transfer service. Zoom and Google Meet are following it. Google Classroom and Moodle are also capable to adapt to the changes.

I. Personalization

Personalization refers to the capability of system to be personalized according to the needs of user. User should be able to personalize their account according to their needs and usages. Some users prefer one setting, some prefer other. Just Consider one example of theming, some users prefer dark theme, while some prefer white. The system must have some settings to personalize that according to their preferences.

All the platforms have different personalization methods. All system provides some sort of features that can be personalized according to their needs. For example. Google Meet, Zoom and WebEx provide feature of Changing the background of video to some certain wallpapers. Which will be applied to all their video calls that onwards.

J. Privacy

Privacy is the ability of system to keep the secrecy of any user. All the systems collect some data while registering in their platforms. If the systems openly share that data to any third-party applications, that will be violation of privacy. In case of OTL systems, not all students feel comfortable in sharing their grades with others. So, there must be some setting to give grades privately.

All the discussed platforms respect privacy, but among all Moodle can be made as strict as possible since we can customize it according to our needs. In case of other systems, they all have different privacy policies about their platforms which is good.

K. Affordability

Affordability means how affordable are they, how are their cost. The software must be affordable to all users for them to be able to use. If the system is expensive in costs, then average users cannot use the system due to their limitation in costs.

Moodle is an open-source platform, so the most affordable will be Moodle. Google Classroom, Zoom, and Google Meet also provides basic features in their free plan. So, they are also affordable. But WebEx can be costly for some user and companies.

L. Quality of Service (QoS)

It is the measurement of performance of components, may be video quality, clarity of sound, loss of image resolution when using an OTL platform.

All the platforms are equally good. The video and Audio in WebEx are better than Zoom and Google Meet. File quality in Moodle is based on hosting servers while Google only provides maximum of 15GB per users. Users can upload any sort of files in both platforms. So, all in all they are all good quality.

M. Learnability

Learnability is the measure of easiness to learn and use the system. Learning anything has a learning curve. If the learning curve is steep, then learners have difficult time learning but once they have learnt then they can be claimed an expert in the system use.

Some platforms like Moodle offers the introduction of system and tutorial in the beginning of enrolling into class which is good for users having no knowledge about the system.

TABLE 1
COMPARATIVE ANALYSIS OF OTL PLATFORMS

	Google Meet	Google Classroom	Zoom	Cisco WebEx	Moodle
Usability	High	High	Moderate	Low	Moderate
Reliability	High	High	High	High	Moderate
Security	High	High	High	High	Moderate
Understandability	High	Moderate	Moderate	Low	Moderate
Scalability	Moderate	Moderate	High	High	High
Heterogeneity	Moderate	Moderate	Moderate	Low	High
Testability	Moderate	Low	High	High	High
Adaptability	Moderate	Low	High	Moderate	High
Personalization	Moderate	Moderate	High	Moderate	High
Privacy	Moderate	Moderate	Moderate	Moderate	High
Affordability	Moderate	Moderate	Moderate	Low	High
Quality of Service	Moderate	High	High	Moderate	High
Learnability	High	High	High	Moderate	High
Portability	High	High	High	Moderate	High
Efficiency	Moderate	Moderate	High	Low	Moderate

N. Portability

Portability is the property of that defines the system to be able to work in different environments. The hardware specifications and OS specifications sometimes limit the functioning of OTL systems.

All the platforms are available in both web and mobile versions. So, they all are highly portable.

O. Efficiency

Efficiency is the degree of use of available resources. For OTL systems, the resources might be taken as CPU, RAM and network bandwidth. If more resources are used while performing minimal amount of work, both the user and system is affected.

Zoom is highly efficient since it uses much less CPU and RAM. Google Meet, Google Classroom and Moodle all are based on web system, so they are not much Efficient since they need to run inside a browser which is almost inefficient. And talking about WebEx, there are complaints about the high usage of resources by WebEx. So, we can consider it as inefficient.

VI. Discussion and Way Forward

Every system has some pros and cons. In some cases, a feature that is optional in one system may be required in another. Users can take use of a variety of services provided by OTL systems. The major objective of the system is to facilitate the teaching learning environment, depending on the mode of service and kind of service. Considering a system that satisfies all the services packaged into one single system, can be called an ideal OTL system.

Online Teaching Learning platforms are helping students learn in many ways. But not a single system is perfect. Some has security issue; some has quality and so on. The system must provide all the requirements that any teacher and student want to be a perfect system.

The system must be secure and has strong privacy features to be perfect. If the system cannot even survive small attack, then it's not going to work in long run. And if the

system data can be easily seen by other users, then also, it's not going to help learners.

The User Interface of the system is also one of the important aspects while considering the perfect system. UI is the first thing that any user sees. If it is not simple and attractive, user does not even go for other features. The user interface determines how usable the system is and how good simple and learnable it is.

Not all users will be rich. And Every user wants to use open-source systems because they will be secure and affordable. In case of any bug or attacks, the community will fix that in no time. Which makes system reliable and secure and affordable.

Personalization is also one of the most important features that every learning platform should include. In current world everyone wants the system to be in their own way. They want to make the system as good as possible in their own ways. So, one of the key features that should be included in OTL systems is personalization.

Gamification is blooming in OTL systems these days. Students feels motivated when they find themselves in leaderboard. And they try to be on top every single time. Which helps them to study even more. So, the concept of gamification can also be considered as one of the important features in considering ideal systems.

There are a lot of other features that must be included in the systems for them to be perfect. On comparison with 5 most popular OTL systems, Moodle stood on top with others following it. But Moodle itself has some bad features like Bad User interface, bad feedback etc. If improved that can be considered as a perfect OTL systems. Talking about new features, if we can add live-meeting service, Moodle will be a wholesome perfect place for teachers and students where they can meet, they can work and learn together.

VII. Conclusion

The Use of technology is blooming in current market. And due to the current pandemic, Online Teaching Learning systems are in a rise in exponential factor. But still, we can feel something missing in these systems. These systems feel good at first but boring after using it for some time. Not all systems feel perfect. All the platforms are focusing on learning with old traditional way, but none are thinking about how to improve the way any system works so that student feel entertained while learning. Introduction of Gamification, other interesting features will surely be going to help students in studying better. As I have already mentioned in above section about the important of gamification, this could change the current way of thing game as only entertainment medium.

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