

Cutting-edge Tools & Technologies: Teaching Engineering Online

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Abstract

University and College instructors use a rich collection of methods of teaching in conventional classrooms to impart knowledge to students. Traditional classroom teaching includes lectures, PowerPoint presentations, class discussions, laboratory demonstrations, team projects, simulations, and games. Popular teaching methods appeal to different levels of student participation such as listening to lectures and participating in group discussions or practical work.

Teaching Engineering courses always evolve with changes and innovations from year to year with different perspectives of pedagogy. Covid-19 virus accelerated the position of colleges and universities to move towards online learning for the past year. Besides, it created a situation wherein the new online teaching methods and technologies are developing with a great frenzy. Currently, the use of the internet is increasing, and it is making a tremendous influence on the lives of people. Many of the educational institutions started offering 100 % online courses. Some of the colleges are encouraging their faculty to conduct in-person classes also. However, the decision is made by students and faculty involved. Some classes are conducted fully online, while some classes are conducted on the hybrid mode (half of the students online and the rest of them in-person class). In hybrid classes, the instructor teaches in-person while at the same time; the classroom technology will facilitate learning for the online students equally.

Online classes shall be as effective as in-person classes provided the instructor is familiar with the online technology tools and the availability of them to the instructors are possible. Besides, the way of learning among students always varies largely that it influences the instructors to adopt different ways of teaching. The diverse web technologies are in need to institute a solid set of teaching methods in an online course. The traditional “Learning Management System” is not equipped with all possible tools that can handle good communication and collaboration among students and faculties.

This paper is going to bring out the different online tools and technologies that are available for online teaching with their appropriateness for use and salient features.

Introduction

Teaching can be delivered by a 100% in-person class, a 100% online class, and a hybrid class (includes both online and in-person classes). Why teaching must be delivered through internet technology “the so-called online teaching”? Why do you need internet-based “Online” tools for teaching? To answer these questions, one has to go back a few decades past and dig into the way how the internet was evolved. Officially the internet started on January 1, 1983, in U.S.A (USG, 2021). Before this, no standard way of communication existed among the various computer networks. Around the year 1990, the World Wide Web was introduced by a British Scientist in Swiss Research labs (Couldry, 2012). After the internet was invented the World has suddenly

become a “Small World” because communication from one part of the World to the other has become easier and quicker than ever before.

In 1996, entrepreneurs Glen Jones and Bernard Luskin launched Jones International University, which became the first accredited and fully web-based university. Since the creation of these fully online programs and schools, distance learning has continued to grow in many different directions. In 2003 the Blackboard Learning System staff announced that 40,000 instructors were teaching 150,000 online courses to more than 6 million students, across 55 countries.

Since 2000, online learning has shown significant growth, as the internet and education combine to provide people with the opportunity to gain new knowledge and skills. The COVID-19 outbreak has made the situation get pushed towards online learning with a speedy swift. Most of the schools, universities, and companies resort to remote working and this increases the usage of online learning.

Today it is estimated that one out of four college students is enrolled in at least one online class. In 2009 over 4.5 million students were taking online classes, with a Master of Science in Business Administration (MBA) being the top degree offered in the United States. This trend seems to continue, currently, 83% of all U.S. institutions that offer online courses say they expect an increase in online enrollment in the coming decade. By available facts, figures, and statistics one can say that online education is here to stay. The combination of the growing interest in online learning and how it is essentially a necessity nowadays due to the Covid-19 pandemic, speaks volumes about its inevitable continuous growth. It is not difficult to visualize a stimulating future for the global online education industry as more providers, facilitators, organizations, and students realize the benefits of online learning. (Visual Academy, 2021).

Online Teaching

Online teaching can be described as teaching via the internet using the software programs such as Microsoft office tools or drawing programs for disseminating knowledge to students. Most of the time online teaching involves the teacher and students communicating with each other from distant locations via a “Learning Management System” (LMS). Sometimes the online teaching can just involve only uploading audios, videos, texts, and pictures.

Regardless of the level of technology, and regardless of our comfort level with it, even though for all that educational technology can offer through new transmission methods and the ability to reach an extensive range of audiences, it is no cure-all. A faculty or teacher must deliver pertinent material, enable students to achieve syllabus goals, and assess their hard work. Students must grasp the material, use quizzes, HomeWorks, and discussion opportunities to achieve course goals, and, eventually, produce work to be evaluated.

The online tools that are available for use in the classroom vary from free cost version to thousands of dollars’ worth of software. Online teaching tools can be classified basically under different categories such as “Video form”, “Audio form”, “Text form”, and “Picture form”. These four different forms of information are disseminated to the desirable audience through online communication tools. Online teaching can include teaching tools, communication tools,

student engaging tools, marketing tools, assessment tools, and feedback tools. This paper is going to focus on teaching, communication, and engaging tools.

Devices

Firstly, the requirement of the right equipment is highly important to conduct classes with the available online teaching tools. Suppose the device that is being used is not capable of handling high bandwidth data over the internet, then handling the Wi-Fi connection with hundreds of megabytes of the video is not going to be possible. The capable hardware ranges from the iPod Touch to super smartphones and tablet computers. Secondly, a good internet connection is needed using a good carrier, a modem, and a router.

Online Teaching Tools

Online teaching tools can be defined as the tools for the dissemination of knowledge via the internet reaching a wide audience. There are hundreds of tools available on the internet to teach online and only a handful of them are going to be discussed in this paper. The different types of online tools are listed in the Table 1.

Table 1. The different types of online tools list

List of Online Tools		
Learning Management Systems	Communication Tools	Engaging Tools
Coursera	ProofHub	Kahoot
Skillshare	Skype	Wakelet
edX & Open-edX	TinyLetter	Flipgrid
Docebo	Dropbox	Slack
LearnUpon	Flowdock	Padlet
Blackboard	HipChat	BigBlueButton
Moodle	GoToMeeting	
Schoology	Adobe Connect	
Brightspace	Campuswire	
Canvas	Discord	
Sakai	Kaltura	
WordPress	Microsoft Teams	
Linkedin Learning	Poll Everywhere	
Udemy	Shindig	
Piazza	Zoom	

Learning Management Systems (LMS)

There are a whole bunch of LMS platforms available for teaching online that are supported by educational institutions across the country. The popular ones are a handful few and they have a

wide application throughout the teaching process. The LMS handles the storage of lessons, posting of messages, news, any form of communications, emailing, video conferencing, publishing contents, uploading teaching materials, downloading contents, grading, and security issues. Some of the popular LMS platforms such as Canvas, Moodle, are described below. The details of these platforms were collected from their websites including reviews being provided by their customers. LMS will continue to play a central role in higher education for years to come. Some of them are displayed in this report.

Coursera

It partners with the top 200+ educational institutions worldwide and offers online courses globally benefitting over 20 million students. Students can receive certifications for learning from this portal by paying a nominal fee. It provides courses in specialized areas as well as offers video-lectures by demand. It also offers online discussion group forums through which students can communicate with each other. The advantages of this platform include offering a variety of learning approaches and various certificates and degrees. The mobile application is pretty smooth and students like the hassle-free entertaining classes and assessments by which they can learn new skills. It also provides some engineering courses. It also provides high-quality academic tools and instructor interactions. However, it is very limited to those partnering with educational institutions only. Another disadvantage is that their help and support are not much fast and their ID verification process page is too slow and crashes often when accessed through mobile applications. The personal experience with instructors by students is also missing.

Skillshare

Skillshare is an online learning community designed for both students and teachers of real-world skills. It provides up to 24,000 lessons benefitting over 4 million students in various study areas. This platform offers study materials including small class projects, videos, content with texts and it provides students' discussion forums for exchanging ideas and concepts among themselves. Professionals who are using the platform as instructors can teach skills by creating and publishing a class. It focuses on technology courses also. The advantage of this platform is that it provides a forum for discussion and pricing the courses equally for the students to take advantage of. But the class content is very much constrained to only four categories. No formal certification or recognition is given to students after the completion of courses. The downside is that the mobile application doesn't allow the students to see the resources. They must be on a computer to access these items. Also, on the mobile device students cannot make different lists, but it does appear as though they can create multiple lists of courses through the desktop version.

edX & Open-edX

edX allows the students to take different online courses from various top 10 Universities and the Open-edX is the other side of edX which is an open-source content management system. It provides more than 8,000 courses from more than 100 top-level Universities and businesses that are providing education in many different areas of study. They mostly specialize in engineering, computer science, and management. The advantages of this platform include interactive lessons,

free of cost, and has an application that is available on Android devices. However, the disadvantages are the outdated discussion forums and added costs for instructors' hosting and maintenance.

Docebo

This platform is good for large-sized organizations to use as a learning platform for many reasons. The most important ones are that it is learner-centric and engaging gamification. It also has instructor-led training features plus it supports more than 30 languages. However, it doesn't offer customizable or advanced reporting capabilities and it has limited functionality on certain objects of the LMS. Also, it cannot suit small and medium-sized businesses. Large corporations such as Bloomberg and Sharp endorse this platform of learning and training. One of the disadvantages with Docebo is that the functionality of reporting, surveys, rating/commenting on courses needs more work. Docebo only offers email/ticket management and online chat support. There is currently no phone support and many times issues could be solved if students were just able to talk to someone. Customer support is terrible.

LearnUpon

It is a great cloud-based software for corporate, customer, and partner training. Its advantages are a user-friendly interface, segmenting different teams, and the multilingual support it offers. It may be ideal for educational institutions and businesses of all types and sizes. Popular users are TripAdvisor and Booking.com. However, it does not support HTML5 based courses and it is also very expensive. Learning paths in LearnUpon are a bit cumbersome.

Blackboard

It gives the students an LMS that will provide a flexible learning environment that is suitable for both academic institutions and businesses. Throughout the courses, it engages the students with a range of social and combined learning features. It has the advantages of use with a mobile application such as iOS and Android and it integrates with social channels and video conferencing tools easily. However, it has the disadvantages of having limited reporting features and gamification choices. It also does not have proper security attributes.

Moodle

It is a free, open-source learning management platform. It empowers most of the learning environments worldwide and is practiced in over 95 languages. It has desktop as well as mobile applications such as iOS and Android. It has integrating plugins and add-ons that extend the capabilities of the learning platform. It is suitable for educators, freelancers, businesses, and public administrations. There are currently over 1,300 plugins available to extend the functionality of the LMS. If the students do not want to go alone, Moodle has a worldwide network of partners who are ready to help. However, the disadvantages of this software are that it does not have good customer support and it has very limited gamification choices. Its setup is tricky, time-consuming, and also, its consultation services may have a heavy price tag. Customer support is very poor. If the students do not have some IT knowledge, it is very hard to set up and

configure Moodle. The learning curve is a bit higher for administration and building Moodle courses for First-time users.

Schoology

It is a full-featured LMS that has a lot of built-in integrations such as YouTube, Google Drive, and Dropbox which students can use directly within the system. To connect faculty and students for improving communication within their institutions and outside, this software is very helpful. Its disadvantages are the lack of proper interface and old mobile applications if updated could make it more user-friendly and easy to navigate.

Brightspace

It helps create inspired and engaging learning for all types of students and it is used by Universities, Colleges, High Schools, Kindergarten, and global corporations. It offers a highly personalized digital experience to every learner that uses it. It may have a harder learning curve, however, it is just functional. It has a particular feature called “Release Conditions” which can be used by a faculty to manage students’ assignment submissions with certain conditions. One of the disadvantages is that the course files are stored on a remote server that manages Brightspace. Some of the grade book issues range from students not being able to view grades, even after the instructor make them visible to them, and the site showing a percentage or point instead of a letter grade.

Canvas

Canvas is offered to K-12 educational institutions, Colleges and Universities, and industries. It supports custom integration with students’ favorite education applications on iOS and Android-based devices. Boasting an easy-to-use interface, Canvas has recently been gaining attraction with higher education institutions. This platform can be used free of cost if the instructor’s institution does not have one. Through open, usable, cloud-based technologies, Canvas enables easy integration of the content, tools, and services that teachers and students need. One of the disadvantages of this platform is when assessing students’ work, the name list is not synchronized with the University roll call. It is a painful effort one has to go through for a large class to scroll through names and check for students’ grades. Quizzes are great but cannot create duplicate questions, sometime academicians need this feature.

Sakai

Another open-source LMS, [Sakai](#) is a popular choice among higher educational institutions. Bundled with some APIs and community features, you’ll find many of the features found in the premium options. Sakai provides a wealth of powerful, flexible tools that enable great teaching, compelling learning, and dynamic collaboration. One of the disadvantages is the Gradebook tool and its interface which is cumbersome and does not translate well into Excel.

WordPress

WordPress is one of the best content management systems with a smooth learning curve and can be used with minimal training. No knowledge of coding is required, and the process is extremely straightforward. It offers unlimited flexibility in designing and managing the website. Most of the WordPress-based LMSs have only the course (and related elements) creation functionality as the basic feature. However, for all other functionalities, separate plugins need to be installed, which increases the size of the website over a period. An excellent User Interface and straightforward navigation are some advantages of a WordPress-based website.

There were over 51,000 plugins for WordPress at last count, and the number keeps growing every day. Though the number is inclusive of all sorts of plugins for eCommerce, eLearning, and other myriad applications of WordPress, it is significantly higher than the extensions available for the other learning management systems. The disadvantages are the WordPress LMS plugins are, as of now, equipped to deal with thousands of students accessing courses simultaneously on the website. Add to that the other extensions integrated into the core website, and the site becomes heavier and buggier than ever. It could slow down the speed of the internet.

LinkedIn Learning

Formerly it was called Lynda.com, is an educational platform that provides students with technology courses, and business management in the form of video lessons. The platform serves as a premium portal for its users and it offers more than 16,000 courses in 7 languages. Its advantages are that it offers personalized course recommendations for users and it has offline learning access to learn on the go. It also gives certificates upon course completion. It is mostly suited for professionals and businesses looking to train their employees. The quality of courses is always questionable and at the individual's discretion, it should be chosen for the study. It is very challenging to join as an instructor. There is no accreditation for the courses and no variety in content delivery methods. Difficulty levels are not always accurate.

Udemy

It has more than 40 million students and 50,000 instructors that are involved in the education scenario. They produce online learning materials via pdf documents, text, PowerPoint presentations, and videos.

It allows the instructors to join Udemy and start teaching online, but it has control over pricing and discounting the courses. Advantages are that there is no setup cost and there is no need for high technical knowledge. There is an Udemy application available for iOS and Android-driven devices. It's great for teachers, instructors, educators, and freelancers who are just starting. Some of the disadvantages are that it offers limited interaction among students and instructors and there is no data ownership or control over branding. Quality is not always consistent. Also, the platform promotes only the already popular courses.

Piazza

It is a free platform with a wiki-style question and answers feature for better collaboration and dissemination of knowledge among students. When posting information or a question, students may choose whether to ask for their needs publicly or anonymously. Any enrolled student in the class then contributes to the response by editing the section, allowing a sense of community and communication among peers. While Piazza's discussion board is innovative, the platform does not offer the remote lecturing or video conferencing features that are provided by other platforms. The phone application version has limited functionality. The user interface could be more updated and it has limited, by invitation closed group access only.

Communication Tools

Online education relies on communication tools as they provide the necessary interactions between students and instructors. Communication can happen on a "one to one" basis, or on a "one to many" basis, or on a "many to many bases". The whole process requires a team of people with different roles. Sometimes, due to a communication breakdown, online education suffers, and it affects the people involved. It is important while designing an online course to carefully consider which communication tools align with the goals of the learning process. In an online class setting the communication is mostly a one-way street. The instructor pulls the heavyweight, and the students can participate in the discussions, debates, question and answer sessions. There are hundreds of communication tools available in the market for online education today. Some of the important communication tools are going to be discussed in this report.

ProofHub

It is a collaboration tool that gives full control over student's tasks and enhances an organization in learning projects. It offers a platform for discussion, proofing, and chat that will improve communication among teams that are involved in online learning. The teams can use it for quick chats and discuss the topics of interest with zeal and enthusiasm. The disadvantage with this software is its training modules that are basic and not easy to follow. Customer care is nil.

Skype

It is another popular communication tool that has been in use for a long time and it is also free of cost. It offers instant messaging, group video calls, Skype to Skype calls, and screen sharing to stay in touch with teams always. Customer support is not good. It is getting outdated and a lot of other similar tool types are taking their place in the market.

TinyLetter

It is a free way to share content by email. One can communicate with others and show them what they are reading, watching, and listening to. It has more than 100,000 users and more than 9 million subscribers and its news feed reaches more than nine million audiences. One can create a personal newsletter very easily and conveniently with TinyLetter. Instructors can use TinyLetter for sending emails to keep learners updated on courses that they have created. The disadvantages

of TinyLetter are that it is not capable of setting up a multi-user account and it is lacking certain advanced features that may become necessary if the audiences get much bigger.

Dropbox

It is another simpler way for online learners to work together. It helps in sharing, creating, and collaborating among online learners' teams. For example, a lesson plan can be written by an instructor and can be shared among the students using Dropbox. One can also create a folder for the online learning community and share it to make information available to everyone in the team. Also, it offers the facility to work with other devices that operate iOS and Android. It is available free of cost with a small size of memory; however, one has to pay for more memory use.

Flowdock

The chat option in the Flowdock makes possible the flow of communication among the collaborators. It is one of the primary communication tools among the online learners where the daily conversations will be live and people can discuss, notify and share files on the desktop and the go. Sometimes, the iOS application crashes, and it is not reliable at all. Also, each click may open a new window and it becomes unmanageable easily.

HipChat

It is a privately hosted chat service that is very successful in serving all e-Learners. One can easily set a group chat among a team and avoid any miscommunication and redundancies. When there is no possibility of virtual meetings, one can save the conversation that includes important documents and collaborations with them and use them at their convenience. You can also converse with your team through video chat on any device. It also has custom emojis for use. Media and file sharing and video chat can be done directly or in a group. The disadvantages are that it has dull and uninspiring colors and temporary rooms are not possible for video chats. It is also very expensive if the team size grows and it goes up exponentially.

GoToMeeting

To collaborate in real-time for clarity in communication with online learners, GoToMeeting is an excellent platform one can choose. It can keep people connected anywhere with anyone and schedule meetings and build business relationships. It could be used for sales demonstrations, external presentations, or collaborative meetings and training. Sometimes, the audio does not work perfectly and the only way it can be corrected is to restart the device. One cannot attend two meetings at the same time and which necessitates downloading the software every time.

Adobe Connect

It is a virtual classroom that provides solutions for quick training and is accessible anywhere, anytime on any device including iOS and Android platforms devices. It delivers an immersive online classroom experience with a lot of possibilities for interaction with instructors. It is a

tailor-made video conferencing tool that highlights the user experience by letting the hosts design their virtual classroom by manipulating the pods (platform's presentation screens). *Faculty* can use this feature to set up an assortment of video, lecture, and webcam pods to be easily accessed during the lecture. It also includes private and group chatrooms strictly with password protection controls. Even though the flexible pods indicate that Adobe cares about user experience, users have reported a steep learning curve in adapting to the tool. The disadvantages are that it is not user-friendly software, and the price is also more expensive.

Campuswire

University faculty looking to move their course online can set up a designated class page containing a collaborative discussion board with anonymity, participation tracking, and answer up-voting. And also, it can have unlimited topic-based chatrooms, polls, live lecture-hosting with built-in student response questions, and a soon-to-be-released video conferencing tool. Campuswire is now used at more than 300 universities among 200,000 students. One of the disadvantages of this software is that it does not offer students or educators the benefits of peer review.

Discord

It was originally designed as a video and voice chatting platform for gamers. As the platform's user base has grown, some faculty from Universities started looking at it as the site for installing their teaching lessons. Multiple texts, voice, and video channels within a community's feed allow professors to easily organize their course materials for students' access. Discord also allows users to run the application in a browser, rather than downloading an application to their computer, which allows students who may not have strong Wi-Fi connections or who have limited space on their computers to participate in class discussion. It is good for gamers. It is available free of cost. It is not fully developed for teaching purposes. Customer support is horrible.

Kaltura

This online platform is used as a leading video platform, video player, and wide array of video solutions for the dissemination of knowledge by instructors to students worldwide. It is also used by thousands of enterprises, media companies, and service providers using videos to teach, train, learn, communicate, collaborate, and entertain. Professors can choose whether to share pre-recorded videos in their video library or host a live class session, complete with screen-sharing, lecture hosting, and a virtual white-board for working through difficult equations on-screen. Kaltura offers both a chat feature and the ability to record and send a video message to another user. It does not currently offer a discussion board nor polling. Kaltura is best suited for educators looking to improve upon their current LMS with a video-conferencing tool built specifically for education.

Microsoft Teams

It is a web-conferencing tool, allows the instructors to stream presentations or collaborates with students in the class remotely. While this two-way audio and video feature allows students to speak up, it is worth noting that there is no electronic 'hand-raising' feature meaning that professors cannot approve nor deny a student's request to join the video call. One of the disadvantages of this software is that it is not consistent in performance across the various devices. Also, it is not that user-friendly. The notifications are sometimes not reliable. Files collaboration has lots of problems and is not reliable also. Chat window organization does not serve all needs.

Poll Everywhere

It is a platform used for improving student engagement by introducing live presentations with student response questions. It also offers live results tracking and in-depth analytics of student's performance at the end of each presentation. This web-based audience response system lets you embed interactive activities directly into your presentation. The audience responds on the web or via SMS texting on their phones. Its capabilities as a teaching platform are not that good while it is recognized as an excellent communication tool.

Shindig

It is used primarily for video conferencing to cater to the need of thousands of audiences at a time while comparing to the other software available in the market. This makes Shindig being used for remote conferences and media interviews. Shindig allows for one or more meeting hosts to lecture before a remote audience, then take questions from audience members. Audience questions are filtered through a question management tool, allowing presenters to prioritize which questions they'll address during the presentation. Attendees can begin their private video chats with groups of other participants — a feature designed to emulate the "breakout sessions" that are commonplace at conferences— allowing for networking despite the remote nature of video conferencing. For educational purposes, Shindig can be used widely in educational institutions.

Zoom

Zoom helps universities and schools improve student outcomes with secure video communication services for hybrid classrooms, office hours, administrative meetings, and more. Zoom has become almost synonymous with life under quarantine. One of the most powerful groups video-conferencing tools available, Zoom allows multiple users to engage in live meetings using their webcam and microphone devices, present using screen share, and provides a chat for side conversations or questions while within a call. The platform has been praised for its intuitive design, efficiency, and customizable backgrounds. But as Zoom's user base has exploded, the company has come under fire for issues with its security.

Despite their security issues, Zoom has experienced an unrivaled level of growth over 2020's first financial quarter: their user base exploded from 10 million to 200 million active users. But while

they may set the bar for video and audio streaming quality, the platform lacks a discussion board or virtual classroom space that other communication companies offer features that may be necessary for the class.

Engaging Tools

Engaging students online is nothing like engaging students in physical classrooms. It can be challenging, especially in times of crisis as students have to deal with more stress and anxiety. For many learners, online learning is a new experience. And even when they have the best intentions, they can easily get distracted and lose interest. This can cause a higher number of students to drop out of school or classes. Also, students with special needs and learning disorders are more likely to feel lost and disengaged. Even though a lot of software for engaging students online is in existence, this report is going to deal with few important ones.

Kahoot

The most famous interactive quiz platform is [Kahoot](#), a free student-response that uses many gamification techniques to engage students' participation and enhance learning. With Kahoot, you can both host live quizzes and self-paced challenges for out-of-class review. You can play Kahoot games in single mode or team mode and offer plenty of fun features to stimulate students to play and learn. Kahoot offers a basic free plan where you can invite up to 50 players, host online games, play, and create as many Kahoots as you want and have assessments of reports ready to download. Regrettably, multiple questionnaire types cannot be implemented in a presentation. Fast and stable Internet connection is also necessary, since any progress is eliminated in the event of an interruption because there is no automatic save option.

Wakelet

A free platform that allows instructors to curate and organize content from different platforms to save and share with students, colleagues, and friends. You need to create a collection of something like hashtags topics and students can contribute to adding text, pdf, videos, URLs, images, and notes. These are brilliant ways for students to express their learning. Apart from this, the teacher can encourage creativity among the learners by inviting students to approach the assessment the way they want to. The idea behind Wakelet is to curate content like you will do for blogs (like Medium) or magazines. You can synthesize a bunch of different content, filter out the noise, and keep what is valuable in one sole collection to better communicate about a specific concept or topic. Wakelet is completely free, and its potential is amazing. The linear layout lacks excitement, and kids are bound to come across inappropriate content in the public collections.

Flipgrid

Flipgrid is a free social learning application to create and share short and exceptional videos. As an educator, one has free access to the app and you can create different grids classrooms and topics of discussion. Each grid has a unique code that you can share with your students so they can access the topics and the videos being posted by the professors and classmates. It is a magnificent tool for reflective learning and for building solid learning communities within your

classes. As an educator one can post discussion prompts and students may respond with short videos, whether they are learning in class or at home. Flipgrid is completely free. Teachers can grade using embedded rubrics, but they are very basic. Teachers must upgrade if they want detailed rubrics.

Slack

Initially conceived for business team communication and project management, slack can also be an outstanding tool for education. From planning and teaching curriculum to managing student services, slack offers amazing functionalities for both students and educators. One can create one workspace for each course, each with a set of channels for classroom work, discussion, group projects, and office hours. Students can use channels to post clarifying questions and comments throughout the lesson, and their classmates can use emoji reactions to second questions or show support for comments. Slack is compatible with Zoom, so when running a virtual classroom on Zoom you can directly access slack channels and questions. You can use threads to organize smaller group discussions around specific topics during the class. Slack is free, but for a better experience and more control over one's interactions, and data premium plan is a better option. Slack offers an 85% discount on the premium plan to education institutions. Slack is built primarily for synchronous communication, meaning that the entire class should be online concurrently to fully make use of its instant messaging tool.

Padlet

Padlet is a productivity software and it's essentially an online bulletin board, something like a notice board. It is an outstanding tool for making classes more interactive as it has a wide range of features such as sharing and collaborating documents, videos, posts. Inappropriate content may be created by other users on the site. Browsing walls can turn up material that is not suitable for children.

BigBlueButton (BBB)

An alternative open-source web conferencing system for online learning. The goal of the project is to provide remote students with a high-quality online learning experience. BigBlueButton is amazing because one can have the same Zoom pro functionalities for free. The software is user-friendly. BBB has a whiteboard that you can share with one's participants, the instructor can breakout rooms for team collaboration and create polls during the virtual lecture. Overall customization of different parts is not so easy and there is very limited resources available for helping in this. Something like greenlight installation is not easy and support on web is almost nowhere about this.

There are lots of advantages and disadvantages that are listed in the Tables 2, 3 and 4 for all the different types of online tools that have been described in this paper.

Table 2. Comparison of Learning Management Systems with respect to advantages and disadvantages

Learning Management Systems	Advantages	Disadvantages
Coursera	A variety of learning approaches and various certificates and degrees. The mobile application is pretty smooth.	Limited to those partnering with educational institutions only. personal experience with instructors by students is also missing
Skillshare	Provides a forum for discussion and pricing the courses equally	Class content is very much constrained to only four categories
edX & Open-edX	Include interactive lessons, free of cost, and has an application that is available on Android devices	Outdated discussion forums and added costs for instructors' hosting and maintenance.
Docebo	Good for large-sized organizations	It has limited functionality on certain objects of the LMS. Also, it cannot suit small and medium-sized businesses
LearnUpon	A user-friendly interface, segmenting different teams, and the multilingual support	Does not support HTML5 based courses and it is also very expensive. Learning paths in LearnUpon are a bit cumbersome.
Blackboard	It has the advantages of use with a mobile application such as iOS and Android and it integrates with social channels and video conferencing tools easily.	Has limited reporting features and gamification choices. It also does not have proper security attributes
Moodle	Practiced in over 95 languages. It has desktop as well as mobile applications such as iOS and Android.	If the students do not have some IT knowledge, it is very hard to set up and configure Moodle. The learning curve is a bit higher for administration and building Moodle courses for First-time users.
Schoology	It is a full-featured LMS that has a lot of built-in integrations such as YouTube, Google Drive, and Dropbox which students can use directly within the system.	The lack of proper interface and old mobile applications if updated could make it more user-friendly and easy to navigate.
Brightspace	It offers a highly personalized digital experience to every learner that uses it.	Has a harder learning curve and course files are stored on a remote server that manages Brightspace

Table 2 (Continued...). Comparison of Learning Management Systems with respect to advantages and disadvantages

Learning Management Systems	Advantages	Disadvantages
Canvas	Through open, usable, cloud-based technologies, Canvas enables easy integration of the content, tools, and services that teachers and students need	Quizzes are great but cannot create duplicate questions, sometime academicians need this feature.
Sakai	Flexible tools that enable great teaching, compelling learning, and dynamic collaboration.	Gradebook tool and its interface which is cumbersome and does not translate well into Excel.
WordPress	Lots of plugins play important role in catering to the needs of varied levels of clients.	The site becomes heavier and buggier than ever. It could slow down the speed of the internet.
Linkedin Learning	It offers personalized course recommendations for users and it has offline learning access to learn on the go. It also gives certificates upon course completion.	There is no accreditation for the courses and no variety in content delivery methods. Difficulty levels are not always accurate.
Udemy	Advantages are that there is no setup cost and there is no need for high technical knowledge. There is an Udemy application available for iOS and Android-driven devices.	It offers limited interaction among students and instructors and there is no data ownership or control over branding. Quality is not always consistent. Also, the platform promotes only the already popular courses.
Piazza	It is a free platform with a wiki-style question and answers feature for better collaboration and dissemination of knowledge among students.	While Piazza's discussion board is innovative, the platform does not offer the remote lecturing or video conferencing features that are provided by other platforms. The phone application version has limited functionality.

Table 3. Comparison of Communication Tools with respect to advantages and disadvantages

Communication Tools	Advantages	Disadvantages
ProofHub	It offers a platform for discussion, proofing, and chat that will improve communication among teams that are involved in online learning. The teams can use it for quick chats and discuss the topics of interest with zeal and enthusiasm	Its training modules that are basic and not easy to follow. Customer care is nil.
Skype	It is another popular communication tool that has been in use for a long time, and it is also free of cost.	Customer support is not good. It is getting outdated, and a lot of other similar tool types are taking their place in the market.
TinyLetter	One can create a personal newsletter very easily and conveniently with TinyLetter. Instructors can use TinyLetter for sending emails to keep learners updated on courses that they have created	It is not capable of setting up a multi-user account and it is lacking certain advanced features that may become necessary if the audiences get much bigger.
DropBox	It helps in sharing, creating, and collaborating among online learners' teams. For example, a lesson plan can be written by an instructor and can be shared among the students using Dropbox	However, it is for casual files and not very sensitive ones.
FlowDock	It is one of the primary communication tools among the online learners where the daily conversations will be live and people can discuss, notify and share files on the desktop and the go.	Sometimes, the iOS application crashes, and it is not reliable at all. Also, each click may open a new window and it becomes unmanageable easily.
HipChat	One can easily set a group chat among a team and avoid any miscommunication and redundancies. When there is no possibility of virtual meetings, one can save the conversation that includes important documents and collaborations with them and use them at their convenience.	It has dull and uninspiring colors and temporary rooms are not possible for video chats. It is also very expensive if the team size grows and it goes up exponentially
GoToMeeting	It can keep people connected anywhere with anyone and schedule meetings and build business relationships. It could be used for sales demonstrations, external presentations, or collaborative meetings and training	One cannot attend two meetings at the same time and which necessitates downloading the software every time.
Adobe Connect	Faculty can use this feature to set up an assortment of video, lecture, and webcam pods to be easily accessed during the lecture. It also includes private and group chatrooms strictly with password protection controls.	It is not user-friendly software, and the price is also more expensive.
Campuswire	It can have unlimited topic-based chatrooms, polls, live lecture-hosting with built-in student response questions, and a soon-to-be-released video conferencing tool.	It does not offer students or educators the benefits of peer review.

Table 3 (Continued...). Comparison of Communication Tools with respect to advantages and disadvantages

Communication Tools	Advantages	Disadvantages
Dicord	Multiple texts, voice, and video channels within a community's feed allow professors to easily organize their course materials for students' access.	It is not fully developed for teaching purposes. Customer support is horrible.
Kaltura	Professors can choose whether to share pre-recorded videos in their video library or host a live class session, complete with screen-sharing, lecture hosting, and a virtual white-board for working through difficult equations on-screen. Kaltura offers both a chat feature and the ability to record and send a video message to another user.	It does not currently offer a discussion board nor polling. Kaltura is best suited for educators looking to improve upon their current LMS with a video-conferencing tool built specifically for education.
Microsoft Teams	It is a web-conferencing tool, allows the instructors to stream presentations or collaborates with students in the class remotely	It is not that user-friendly. The notifications are sometimes not reliable. Files collaboration has lots of problems and is not reliable also. Chat window organization does not serve all needs.
Poll Everywhere	This web-based audience response system lets you embed interactive activities directly into your presentation.	Its capabilities as a teaching platform are not that good while it is recognized as an excellent communication tool.
Shindig	It is used primarily for video conferencing to cater to the need of thousands of audiences at a time while comparing to the other software available in the market. This makes Shindig being used for remote conferences and media interviews.	Remote nature of video conferencing
Zoom	Zoom allows multiple users to engage in live meetings using their webcam and microphone devices, present using screen share, and provides a chat for side conversations or questions while within a call. The platform has been praised for its intuitive design, efficiency, and customizable backgrounds.	It lacks a discussion board or virtual classroom space that other communication companies offer features that may be necessary for the class.

Table 3. Comparison of Engaging Tools with respect to advantages and disadvantages

Engagement Tools	Advantages	Disadvantages
Kahoot	With Kahoot, you can both host live quizzes and self-paced challenges for out-of-class review. You can play Kahoot games in single mode or team mode and offer plenty of fun features to stimulate students to play and learn.	Multiple questionnaire types cannot be implemented in a presentation. Fast and stable Internet connection is also necessary, since any progress is eliminated in the event of an interruption because there is no automatic save option.
Wakelet	Synthesize a bunch of different content, filter out the noise, and keep what is valuable in one sole collection to better communicate about a specific concept or topic. Wakelet is completely free and its potential is amazing.	The linear layout lacks excitement, and kids are bound to come across inappropriate content in the public collections
Flipgrid	It is a magnificent tool for reflective learning and for building solid learning communities within your classes. As an educator one can post discussion prompts and students may respond with short videos, whether they are learning in class or at home.	Teachers can grade using embedded rubrics, but they are very basic. Teachers must upgrade if they want detailed rubrics.
Slack	Slack is compatible with Zoom, so when running a virtual classroom on Zoom you can directly access slack channels and questions. You can use threads to organize smaller group discussions around specific topics during the class. Slack is free, but for a better experience and more control over one's interactions, and data premium plan is a better option	Slack is built primarily for synchronous communication, meaning that the entire class should be online concurrently to fully make use of its instant messaging tool.
Padlet	It is an outstanding tool for making classes more interactive as it has a wide range of features such as sharing and collaborating documents, videos, posts.	Inappropriate content may be created by other users on the site. Browsing walls can turn up material that is not suitable for children
BigBlueButton	BigBlueButton is amazing because one can have the same Zoom pro functionalities for free. The software is user-friendly.	Overall customization of different parts is not so easy and there is very limited resources available for helping in this. Something like greenlight installation is not easy and support on web is almost nowhere about this.

Conclusions and Recommendations

- The online classes are here to stay after the pandemic is over.
- The technology used for teaching online is getting better.
- It is possible to get overwhelmed with what choice an educational institution or individual is going to make when it comes to choosing the right tools for online teaching.
- The decision of having the required online tools depends on cost, convenience and needs.
- There are plenty of online tools available for use and choosing the right ones for an organization is going to be very difficult.
- A lot of these online tools are going obsolete quickly before the user becomes familiar with their functionalities.

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