Edutech Tools in Flipped Class Room in Engineering

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ABSTRACT

Technology has changed dramatically over recent decades. The increasing variety and accessibility of technology has expanded the toolbox and the opportunities teachers have to use technology. Computer devices are more powerful and come in different forms, from those that sit on our desks to those that sit in the palm of our hands. The internet connects those devices and connects students to each other in the classroom, through the colleges and around the world. In this paper we discuss some aspects of technology tools that have major applications in STEM education , namely (1) massive open online courses " MOOCS" (2)internet –of-things (3) flipped classrooms (4) virtual reality systems (5) m-Learning (6) cloud computing (7) augmented reality systems (8) Mind mapping tools (9) Database software to help preserves teachers consider the possibilities for embedding edutech tools in teaching.

Index Terms: Flipped class room, Edutech tools, High technology, STEM Education

I. INTRODUCTION

Learning with technology has become essential in today's Engineering colleges .The need to keep speed with society and prepare students for their roles in society are just two reasons to use technology in education. Educators and researchers point to the potential of technology to increase motivation and engagement of learners, provide for different learning styles and improve learning outcomes. To keep the professional level it is key to study from time to time. And long life learning gives a great competitive advantage. The big data and global information are so huge, that is impossible to get them all. And therefore on the front bummer came content value and its generalization. Every operation with information must be waiting on utmost time and cost saving at the same time with succeeding high coefficient of competence. At the present time increased demand for distant learning online courses, coaching mentoring rapidly grow. To expand the list of modern development in education we can mention such technologies as learning with tools of (instruments), we cay say edutech tools (1) massive open online courses " MOOCs" (2) internet-of-things (3) flipped classrooms (4) virtual reality systems (5) m-Learning (6) cloud computing (7) augmented reality systems (8) Mind mapping tools (9) Database software.

Technological devices and networks have changed our colleges and classrooms. In India, technological investments in colleges have been made at the state / territory level and at the national level through initiative such as the Digital Education uprising lessons that bring in new forms of technology that students can use to communicate facilitate their ability to transfer technology skills from one tool to another and to apply those skills to communicate in different modes and genres. This supports the development of the 21st – century skills called for today flexibility and commitment, Media - sharing sites allow users to communicate with each other by uploading videos, photos, and other multimedia.

Involvement of high technologies tools in education opens the door to multiple opportunities for perfection the process and results of learning. And it is extremely necessary for accelerating global technology world, technological evolution of daily living and availability requirements. New high technologies tools ((a) massive open online courses " MOOCs" (b) internet-of-things (c) flipped classrooms (d) virtual reality systems (e) m-Learning (f) cloud computing (g) augmented reality systems (h) clickers (i)brain-computer interface) (j) Mind mapping tools , (k)Database software , (k)Database software can create the impressive contributions to education , even if it wouldn't be by guiding the work of teachers. Education must help and motivate getting new knowledge, improving skills, becoming included with the new situation, widely and energetically act in unpredicted developments and maintenance pace with real practice and life.

II. NEED FOR THE STUDY

There are two major problems

One is the sheer number of students who need to be educated; the second is how do we teach effectively?. In particular, as scientist-educators, we need to make our teaching more relevant and effective for a much larger audience than simply science and engineering students. This is simply because as a species we face global scale problems (climate change, pandemics, energy, the aging population, genetic engineering) whose solutions depend upon science. Leaders (politicians) need to be science literate and citizens of every country can help guide their own destinies by understanding the science behind issues that face them individually. A second reason is that modern economics and the GDP (and hence living standards) depend upon science and technology and students need better technical understand and problem-solving skills. Therefore, there is a need to improve teaching in STEM areas not just for science and engineering students but for all.

Consider Mathematics education in engineering colleges. Traditional teaching the method in Mathematics is hierarchical where the professor lectures and evaluates students through homework, problem sets and exams. The professor lectures on subtopics such as Real analysis, Calculus, Differential equations, usually expanding on that topic or more often simply regurgitating the textbook. Problem sets involve plugging numbers into problems which are similarly structured, essentially reproducing what was presented in the textbook. All of this makes for a very passive classroom experience. Such a learning process does not encourage creativity nor does it highlight the intellectual pleasures of Mathematics. This rote learning experience can discourage students from continuing their education in Mathematics. The effectiveness of such teaching has been studied by a number of Mathematics education researchers. Is there a better way to teach STEM that avoids the problems of traditional teaching? There are numerous studies that say the answer is these teaching methods include (1) Basing the pedagogical technique on education research and data rather than on tradition (2) spreading and copying of previous results (3) adapt new technological tools to enhance student learning. Now in this paper, we are going to concentrate on new technological tools. We believe that optimally using new technological tools will enhance student learning, allow the instructor to teach their classes to suit that we will be dealing only with process and methods that are enabled by information technology.

III. OBJECTIVES OF STUDY

1. To study and understand the edutech tools for enhancing

Engineering education for professional development.

2. Understand the role of edutechtools in technical education

3. Identify technology and edutech tools of their applications,

recourses used in classrooms.

4. Evaluate edutech tools to support teaching and learning.

5. Understand possible challenges and barriers you may face

as a new teacher using edutech tools.

IV. USE OF NEW TECHNOLOGY

As 21st-century learners, students, researchers are expected to be able to create a huge number of products in the college environment. The creation of new ideas can be exemplified through stories, maps, projects, games, journals and much more. So, we need one new platform to enhance Engineering education using edutech tools for professional development.

In this paper, we will discuss the following some aspects of edutech tools that have major applications in STEM education, namely (1) massive open online courses " MOOCs" (2)internet-of-things (3) flipped classrooms (4) virtual reality systems (5) m-Learning (6) cloud computing (7) augmented reality systems (8) Mind mapping tools (9)Database software

(1) Massive open online courses "MOOCs"

Growing in number in recent years, there are millions of registered users of MOOCs offered hundreds of courses around the world. MOOCs are often released by third-party online platforms and developed independently by academics. The history of MOOCs is not very far. The term first appeared in 2008 by Stephen Downes and George Siemens and based on ‘connectives’ distributed peer learning model. Following it, in 2011, a few more educational videos were developed by the professors from Stanford University and released through open online platforms supported with free web resources. This was the year, MOOCs exploded around the world; the number of it still extends each day increasingly. Later, they established **Coursera** as an independent for-profit technology in early 2012. In the same year, other independent non-profit initiatives such as **Udacity** (set up Sebastian Thrum) and **Udemy**was established. Following it, MIT and Harvard incorporated their MITx platform into EdX. The otherplatforms Future learn and Iversity followed them which are not US platforms but European. They are delivering their courses around Europe. Future learn is owned by the UK’s Open University which a well-known name in the field of distance education with great pedagogical expertise and experience. Iversity is a German initiative which is proud of being able to take advantage of the European Credit Transfer System. They state that their partnered institutions have the opportunity to offer exams that award ECTS credits. Being the only MOOC platform to have courses that offer ECTS credits, they are working to expand this possibility further.

(2)Internet-of-things

When TCP/IPv6 launched in 2006, the new network expanded the capabilities of the Internet and enabled objects, sensors, and devices to be addressable and communicate across the Internet.[79] The Internet of Things (IoT) is a network of connected physical real objects that link the physical world through the web. The physical objects have embedded computational and networking capabilities which can communicate and interact with one another, with other computing devices as well as with users on the Internet. With the advent and growth of the IoT, homes, workplaces, and educational institutions can become "smart" and interconnected, with resultant enhancement or improvements in the way we live and learn. which promises to substantially enhance or change the ways in which we live, play, work, and learn[80]. There have also been great advances in wearable computing and electronic technologies that have made possible the "Internet of Me"[81] Such technologies and products include smartwatches (Apple Watch), smart clothes (Fitbit, Nike+, FuelBand), smart glasses (Google Glass, Oculus Rift), head-mounted cameras (GoPro), etc. These wearable technologies and the IoT hold much potential for and have many possible application in education and training Wearables can provide real-world contexts and enable learning to occur anywhere and anytime. Companies are developing apps for wearable devices that allow students to demonstrate their learning. Devices such as the Oculus Rift can be used to provide virtual reality systems. The use of IoT in educational environments has given rise to terms such as "hyper situation" to explain the potential of IoT in learning situations. Hyper situating is the ability to amplify knowledge based on the user's location. In other words, students that carry connected devices with them can benefit from having other interdisciplinary information relayed to them from their surroundings. For instance, a student in a city can explore his/her environment via the architecture, politics/history, or biology depending on how the surroundings are equipped. IoT can also create crowd sourced contributions and observations from the community via networked objects. Cisco Systems has laid out a vision for networked technologies that incorporate people, processes, and data[83]. For instruction, IoT in higher education takes the form of blended learning models that integrate personalized materials and formative assessment technologies that deliver instant feedback. Therefore, students will have the ability to monitor their own environment and collect real-time data for further study.

(3) Flipped classrooms

The flipped classroom concept has been aroundfor a number of years, and it has garnered much attention from educators around the globe. We began using teacher-created video as an instructional tool in 2007, and we have since been regarded as some of the pioneers of the flipped classroom. There is no universal definition of the term 'Flipped Classroom'.[1] However, it appears that academics agree that a flipped classroom generally provides pre-recorded lectures (video or audio) followed by in-class activities. Students view the videos outside the classroom before or after coming to class where the freed time can be devoted to interactive modules such as Q&A sessions, discussions, exercises or other learning activities.[2] Since Flipped Classrooms 'invert' activities inside the classroom with activities outside the classroom, they are sometimes also referred to as 'inverted' classrooms.[3]

Benefits of the flipped classroom: Students Get Help on Difficult Topics

One of the challenges in a traditional classroom, when the instruction is delivered through a lecture, is that students are often sent home to apply what they have learned without any assistance. At home, students can often get stuck and cannot complete the assigned homework. At this point, the

students have a number of options. They can spend hours wrestling with an assignment they are not prepared to do, give up, call a friend, ask the teacher the next day, or in the worst case, cheat. In a flipped classroom, the work done at home is simply to view a video, and when the student is struggling with what was traditionally sent home as homework, the teacher is present to help because this higher-order thinking is done in class.

(4) Virtual reality systems

Virtual Reality is a term used to describe a computer-generated virtual Environment that may be moved through and manipulated by a user in real time. A virtual environment may be displayed on a head-mounted display, a computer monitor, or a large projection screen. Head and hand tracking systems are employed to enable the user to observe, move around, and manipulate the virtual environment.

Virtual reality makes the participant in course fully dip into the learning process and pay no regard for ambient noise distraction. Such actions increase the effectiveness of gaining knowledge. Virtual reality technologies most accurately for creating and using in the learning process for creating educational simulators which improving skills.

Virtual Reality is now involved everywhere. You can’t imagine your life without the use of VR Technology. Now we use mail or conference for communication while the person is not sitting with you, but due to technology distance is not matter. This technology gives enormous scope to explore the world of 3D and your own imagination.

It has many applications from product development to entertainment. It is still very much in the development stage with many users creating their own customized applications and setups to suit their needs.

Advantages

Virtual reality has also been used extensively to treat phobias (such as a fear of heights, flying, and spiders) and post-traumatic stress disorder. This type of therapy has been shown to be effective in the academic setting, and several commercial entities now offer it to patients.

Although it was found that using standardized patients for such training was more realistic, the computer-based simulations afforded a number of advantages over the live training. Their objective was to increase exposure to life-like emergency situations to improve decision-making and performance and reduce psychological distress in a real health emergency.

Challenges

The big challenges in the field of virtual reality are developing better tracking systems, finding more natural ways to allow users to interact within a virtual environment and decreasing the time it takes to build virtual spaces. While there are a few tracking system companies that have been around since the earliest days of virtual reality. Likewise, there aren't many companies that are working on input devices specifically for VR applications. Most VR developers have to rely on and adapt technology originally meant for another discipline, and they have to hope that the company producing the technology stays in business. As for creating virtual worlds, it can take a long time to create a convincing virtual environment

- the more realistic the environment, the longer it takes to make it. It could take a team of programmers more than a year to duplicate a real room accurately in virtual space.

(5) M-Learning

M-learning or mobile learning is defined as "learning across multiple contexts, through social and content interactions, using personal electronic devices.”. A form of electronic learning distance education, m-learners can use mobile device educational technology in many locations at their time convenience.

Mobile devices such as smart phones, iPods, notebooks, and tablets are widely used and play a major role in how people communicate and access information. As a result, there has been considerable research on novel applications in mobile learning over the last decade, taking advantage of the user and device mobility for facilitating learning across multiple contexts, involving different locations including classrooms, tasks, and modes of interaction among users. Mobile devices have been used in classrooms for note taking and presentations, as formative assessment tools, for games, participatory simulations, and problem-solving activities. They can be used in collaborative learning activities.

The Educause Center for Applied Research [ECAR] survey on Mobile IT in higher education states that students are driving the adoption of mobile computing devices, such as cell phones, smartphones, and tablet computers, in higher education, and 67% of surveyed students believe mobile devices are important to their academic success and computing devices on college campuses has the potential to create new options for higher education students and the exploration of mobility and social media as an instructional strategy. A recent major study reports that mobile computing devices and the use of social media created opportunities for interaction, provided opportunities for collaboration, as well as allowed students to engage in content creation and communication using social media and Web 2.0 tools with the assistance ofconstant connectivity. This study supports the statement that mobile learning offers much more educational potential than simply accessing resources. It has been noted that "education in the mobile age does not replace formaleducation, ...; rather it offers a way to extend the support of learning outside the classroom, to the conversations and interactions of everyday life". Various issues dealing with m-learning are discussed in a recent book. Form-Learning even social networking systems such as Twitter have been used to enable effective interaction and engagement in the large classroom. Various technologies for facilitating the implementation of collaborative learning environments in the classroom supported by one-to-one mobile computing have been developed. Because technology is moving at a faster pace than research, mobile learning research is still in the relatively early stages with mobile phones and PDAs the most studied devices. The use of other mobile technologies, namely tablets, net books, and e-book readers on learning are areas that need further study.

(6) Cloud computing

"Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Cloud computing has emerged as a popular solution to provide cheap and easy access to externalized IT (Information Technology) resources. An increasing number of organizations (e.g., research centers, enterprises) benefit from Cloud computing to host their applications. Through virtualization, Cloud

computing is able to address with the same physical infrastructure a large client base with different computational needs. In contrast to previous paradigms (Clusters and Grid computing), Cloud computing is not application-oriented but service-oriented; it offers on-demand virtualized resources as measurable and billable utilities.

(7) Augmented reality systems

Nowadays, with the development of high performance and low-cost hardware, computers are already considered part of our everyday life. High-performance electronics is now ubiquitous and offer great and continuously improving resources ready to support us in the execution of ordinary tasks. A way to exploit these new resources is given by *Augmented Reality* (AR). Application of augmented reality for 3d model presentation can be used in all field of engineering where we use virtual three-dimensional models in process of projecting. However, the most commonly AR is used in the area of mechanical engineering, civil engineering, architecture and for purpose of education in engineering.

Augmented Reality is a breakthrough technology that could considerably ease the execution of complex operations. Augmented Reality mixes virtual and actual reality, making available to the user new tools to ensure efficiency in the transfer of knowledge for several processes and in several environments. Various solutions based on Augmented Reality have been proposed by the research community: particularly in maintenance operations Augmented Reality tools have offered new perspectives and have promised dramatic improvements. On the other side Augmented Reality is an extremely demanding technology and, at the present day, it is still affected by serious flaws that undermine its implementations in the industrial context. VR technology creates an environment in which the user feels andseems to be moving inside a computer-created virtual world in the same way people move inside the natural environment;while immersed in the virtual world, the user cannot perceive the real one which still surrounds him.

Augmented reality can be used for improving the spatial abilities of engineering students. AR can provide 3D virtual models that help students to perform visualization tasks to promote the development of their spatial ability during a study.One of the most known AR educational applications is the ‘‘MagicBook’’. The ‘‘MagicBook’’ interface uses normal books with AR markers (Fig. 4) as the main interface objects. People can turn the pages of the book, look at the pictures, and read the text without any additional technology. However, if they look at the pages through an AR display they see 3D virtual models appearing out of the pages, thus introducing an interesting way for smoothly transporting users between reality and virtuality using a physical object. The ‘‘basic" augmented book experience requires only adding a webcam to a typical PC configuration and the proper software. Using the computer screen to visualize the augmented scene is a cost-effective and eye-catching alternative in the educational context. It confirms previous works in the field of presence performed by the research institute, about the idea that if the content is of high quality, and then even simple technology will be effective.Tallyn et al. Make a comparative study of a paper book, a multimedia CDROM, and an AR book, concluding that a book’s ergonomics provide a flexible and easily accessible interface that engenders fluid collaboration between pairs of children, and that these qualities are also observed when children work with the AR book

Furthermore, AR technology is particularly suited for the maintenance industry, as it can be easily implemented in several processes. AR can enhance the user's view of the surrounding scene with different

content that includes visual animations, sounds, written instructions or static images. Using AR can potentially reduce the numbers of errors during maintenance tasks; in fact, AR provides information that is generally not easily available or whose retrieval is relatively demanding. In general, many processes in the manufacturing, aviation, and automobile industry have to deal with assembly tasks. During maintenance operations, mechanics have to deal with a large number of different parts that represents a large proportion of search time: standard manuals or handbooks can lead inexperienced operators to frustration and poor performance.

Main advantages of AR systems

AR technology is extremely flexible and, particularly in the maintenance industry, it can be easily implemented in several processes. Thanks to the additional knowledge provided by AR, the number of errors during maintenance tasks can be greatly reduced. In fact, AR provides information that is generally not easily available or whose retrieval is relatively demanding. In general, many processes in the manufacturing, aviation, and automobile industry have to deal with complex assembly tasks, whose execution involves a large number of different parts. In these situations, standard manuals or handbooks can lead inexperienced operators to frustration and poor performance.

(8) Mind mapping tools:

These tools help learners to identify and link relevant concepts and represent those concepts visually.

(9)Database software: This type of software allows learners to record, sort and report on a variety of data in numerical, textual and media forms.

V DISCUSSIONS AND CONCLUSIONS

Using technology to construct artifacts and products allows learners to display creative thinking and their construction of knowledge. Learners of all ages can apply their existing knowledge to generate new ideas and create products as a means of expression.

This chapter has presented a range of tools and a range of teaching and learning strategies. These strategies are based on theories of learningthat allow teachers to provide different experiences for their students. Technology is changing all the time and what we know about how to use that technology effectively is developing continuously. As a future teacher, you will continue to develop your understanding and practice regarding the use of technology to help your students learn effectively.

By integrating technology in terms of edutech tools in STEM education, the program encouraged students to become self-motivated learners and researchers, student.s these edutech tools for independent research, study, and learning through a technology-rich lesson plan. i.e Additionally, the paperless classroom model and the methodology utilized for this summer program also increased the percentage of students who desired to pursue a science-arts and other related fields in the future.

Using above mentioned edutech tools stimulates creating new informational trends and a strong interest in the educational values. Consequently, new edutech tools could be implemented in a teaching - learning process.

These edutech tools in engineering education have existed for more than 15 years. New effective practices come into ordinary life every day. But such technologies have to become part of our ordinary life.

For teachers' use ofedutech tools in instructional planning:

- Teachers plan and design effective learning environments and experiences supported by edutech tools.
- Teachers implement curriculum plans that include methods and strategies for applying edutech tools to maximize student learning.
- Teachers apply edutech tools to facilitate a variety of effective assessment and evaluation strategies.
- Teachers use edutech tools to enhance their productivity and professional practice.

Teachers are using ICT to support their role in providing students with structure and advice, monitoring their progress , analyzing their performances and assessing their accomplishments. When students use technology to conduct research projects, analyze data, solve problems, design products and assess their own work and so on , they work with others to create and communicate new knowledge and understandings.

Recommendations:

It is concluded that studies are mostly carried out with basic science teachers but technology is changing all the time and what we know about how to use that technology in terms of edutech tools effectively, which is developing continuously in the present world. As a future teacher, you will continue to develop your understanding and practice regarding the use of technology to help your students learn effectively.

Therefore, similar studies can be conducted with teachers from different fields. STEM education applications along with edutech tools can be carried out with Colleges (Technical & non-technical) students. Foreign studies and applications on STEM education along with edutech tools can be investigated and comparisons can be made. Studies integrating STEM applications along with edutech tools into the curriculum to increase the teaching of STEM education can be conducted. STEM education studies along with edutech tools defining different aptitudes and information that would be helpful in determining students' career in engineering education can be conducted

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