USE OF CUTTING-EDGE TECHNOLOGIES FOR EFFECTIVE TEACHING AND LEARNING ENVIRONMENT IN HIGHER EDUCATION

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Abstract

It is a high time that teacher educators and institutions realize to extend educational technology field ahead of its present focus and build up a strong perceptive of pedagogical matter. The educational technology field desires to accomplish and reach out, not only to teacher training institutions. By pooling up resources with our teacher education colleagues, we can increase the power of educational technology and cure any possible rifts earlier than they occur especially technology verses teachers. Teacher Training Institutions and organizations all over the world especially in Pakistan are moving ahead of traditional teaching practices and putting their efforts in order to integrate the curriculum with modern technology for desired learning outcomes. The function of education technology is constantly increasing from Overhead projectors to smart boards to smartphone apps that allow better interaction between teacher and students in the classroom. A variety of features of educational technology fitting as inbuilt part of the educational experience for students, teachers, parents, and management. Some institutes have started training of their faculty members so that they can take advantages of technology and connect their teaching with it effectively to get optimal results. However, there is still a school of thought that still believes that technology might distract students' attention from the main subject. There are teachers who do not want to come out of their comfort zones and believe that technology is being given unnecessary importance in teacher education. On the other hand there is a thought amongst many teachers that integration of technology is a need of time and it can bring a world of learning in front of students. Students will have knowledge and information of new trends in pedagogical content knowledge on their fingertips. As a result they can achieve their learning outcomes in a better way and will be able to develop an effective communication with their students. Reflecting on the present scenario about the use of technology in teacher training institutions in Pakistan, it is observed that use of mobiles, tabs and laptops have enriched students' interest and attention. They feel comfortable to connect to the available resource on internet and reflect upon it on whatsapp and telegram groups of their class. They feel comfortable to take pictures instead of copying from board. The paper discusses the need, effectiveness and impact of using and integrating technology in teacher education. In this connection the author has reviewed and analyzed relevant literature about the impact and benefits of integrating technology in teacher educations. Author has also got an opportunity to teach in different universities of teacher education that helped in linking the ideas with literature. The author has found out that use of technology in teacher education maximizes students' learning and interest and leads to active participation. However, many of the faculty members in teacher education universities and institutions particularly public sector, are not fully aware and user friendly of technology and its gadgets. They specifically do not have a clear understanding of integrating the technology with their teaching.

Keywords: Cutting-edge, CLOs, PLOs, Gadgets, Smart classroom, Smart campus, Mobile Apps.

1 INTRODUCTION

We are living in era of technology where Cutting-edge technology leaders are mostly focusing on implementing these components in commodity objects. With these phenomenal advancements of digital technologies and ubiquitous computing, it is becoming mandatory to train our society about emerging concepts of computer science and IT skills regardless of their core areas of specializations. On the other hand, for students, who are currently enrolled in any program at educational institutes, it is of utmost importance to prepare them for these technologies. Companies will be looking for candidates, who will be equipped with knowledge of the latest state of the art technologies. Industry leaders such as: Cisco, Microsoft and many others have already added IoT. Cloud Computing & Virtualization in their current academic curricula to train the future engineers and IT experts. Educational institutes on the other hand not only teach computer science concepts but also encourage critical thinking and innovation. The June 2017 issue of Computing Now from IEEE Computer Society [5] elaborates how technology can be effectively utilized by teachers in the IoT era. The selected articles introduce methods for integrating IoT into Science, Technology, Engineering, and Mathematics (STEM) education while simultaneously building educational environments that values problem solving and exploration. Additionally, the videos highlight how working with open-source IoT platforms can help foster creativity among the 21st-century learners. We further discuss various perspectives of Teaching and Education that must be incorporated while developing educational curricula to fulfill the requirements of Smart Society literacy requirements.

Researchers are approaching the impending of technology every day. Effective progress in the use of new technology is changing the society and the way we communicate with the world. In this connection advancement in everything from robotics to implicit veracity is transforming and modernizing the way that we teach students. An extremely pragmatic virtual environment is being generated by engineers and doctors where vital medical procedures are carried out that would lessen the risk to patients in operation theatres. In the same ways modern and innovative facilities are being used in order to enrich the teaching methods that would have been impossible some years ago. In addition to this assessment and feedback system has also been changed and most of the universities apply audio visual feedback system that facilitates students as to how to incorporate the feedback effectively. (a study conducted by the University of Liverpool (will mention reference later) Universities and other higher learning institutions should leverage the accurate technology in order to facilitate students so that they can get all the possible opportunities of learning both in and out of the classroom. Because today's students cannot be restricted by their classrooms due to a number of online learning opportunities as highly qualified professors and renowned institutions are collaborating across the world through educational technologies. As a result education has become more communicative and connected. In fact cutting-edge technology has transformed the features of higher education everlastingly. It is a high time for developing countries to take lead in incorporating and including cutting-edge technology in higher education in order to connect the magnificent pace of change.

Life is going very fast and technology is changing day by day. Technology has become the essential part of our life. It is the integral part of our home, school and offices. Use of the new technology has an impact of teaching and learning practice. Our life is becoming totally depend on modern technology gadgets because it is the easiest and cheapest time saving source of connection to link with the other world and to explore it. There are many example with the use of simple smart phone device we can use it anywhere and everywhere according to our need. new technology gadgets in higher education is very necessary for the development of a nation, a country and a society because the strength of a nation depends upon the quality of its higher education system and quality will improve with the new technology gadgets education system.it improves the productive skills of the students and plays an impressive role in learning and teaching.it makes the teaching work easy and more interesting. No doubt as the time passing new generation is becoming addict of technology devices especially smart phones but it depends us how much time we spend with smart phones. Modern technology gadgets and information technology has many benefits if we use it with fixed time and according to our need and demand. Now we look at the pros of new technology gadgets in higher education.

1. Time Saving

The right use of new technology gadgets can save the precious time of students and teachers in learning and teaching. The teacher can deliver their lecture more accurately within the limited time period of class and students can learn their subjects more briefly with the use of different gadgets such as tablets, smart board and smart phones. Sometimes students can't understand the subject matter and in this regard a good trained teacher helps him to understand the things with open the link of YouTube, google and other educational devices

2. Passive to Active Change

The good use of technology can support the learning and teaching in a positive way and students become more active rather than passive.it helps constructive approaches and enhance the production of knowledge and communication skills of the students and successful innovations and new creative skills and ideas and students learn the use of these gadgets in a responsible way.

3. Speed of Accessing Different Learning Material

Technology gadgets play a beneficial role to fast speed of accessing different learning material. The educational material and other information which we get from the library is a time consuming process and we can save our time and reduce the weight of books by use of different technology gadgets and in this way learning will be more entertaining. We can always have learning material with us rather in bus or car.

4. Focus on Teaching, Not Paper Work

Definitely new technology in education sector helps the teacher to focus on their teaching and saves their time for making notes and lesson planning on papers. Now with the passage of time teaching are mostly on the smart board and they assign different task to students through telegrams, mails and through other links. We can select best educational material on any topic with the use of google, YouTube and other educational websites. Trained teachers with the use of smart board deliver their lecture more accurately and in detail to clear the objective and importance of every lesson of the subject to each students. these technology gadgets make the students to think beyond their books and explore the learning skills as much as they can use of new technology gadgets has changed the entire scenario of teaching and it is beyond the teacher's expectation.it also helps the students to attain authentic knowledge for the whole academic year. Learning from the smart phones and tablets are easy and can be practiced at home.

5: Demand for Future Jobs

Now the universities are facing higher challenges to keep up the best education for society because best reading material can be found in all good educational websites.by using of these gadgets teaching has become globally more communicative and students will gain good jobs in markets and especially highly skilled jobs in the world. these gadgets has become the significant part for primary, secondary and higher education.it has changed the chalk boards into smart boards ,text books into e learning books and we can find every page of books into tablets and students wants learning information from mobile phones.

6: Distance learning

Now the distance learning and teaching has become easier and learning and teaching is possible anywhere and everywhere. Now the technology takes the teacher very near to the students rather of living in a long distance

7: Vast the Vision of Learning

In the past people got knowledge from the teachers and they knew what their families taught them. They got their religious and political views from their ancestors .now the time has changed and people having access of technology will farm their own views and expose them to the world.it improves the skills of both teacher and students and students learn by themselves and the teacher acts as the facilitator of learning and keeps the students motivated to learn.it plays a significant role to highlight students learning outcomes and high order learning skills.

8: Make Ready For the Future

If the students are well known of technology to collaborate and communicate as early as now, they will not have trouble fitting in competing and finding jobs in the future.by competent use of technology they can compete them in comparable labor market and become more comfortable in finding new jobs.no doubt technology promotes independent learning among students and it would be very helpful for the learners to quick accessibility and well equipped with their skills.

1.1 Use of IoT Platforms and Visual Programming Languages in Teaching

Classrooms equipped with electronic interactive white boards allow richer and consistent experience for the learners and teachers during the whole course of study making it easier to share, add, edit contents with students while bringing online contents on the fly to support the discussions in classrooms. Students are encouraged to bring their own devices (laptops, tablets, mobile phones etc.) to the classrooms allowing them to perform their classwork and assignments on their own devices. This allows the students to take the work

performed in class room when they return to their homes providing them an opportunity to revise and reinforce the concepts in their leisure time. Students can use micro-controller development boards such as: Arduino, Raspberry Pi, and STM32 Nucleo as small IoT platforms. A very prominent example of it is in British schools, where children learn to use the BBC micro:bit, a single-board computer with Bluetooth and USB connectivity, an LED display, and two programmable buttons. All of these boards offer add-ons to extend their functionality to meet the myriad requirements of IoT application development. (what happens as a result of this usage??? Elaborate in a sentence or two. The result or impact of it).

Another option is to use advanced embedded solutions, which combine micro-controllers with Field-Programmable Gate Arrays (FPGAs) The Blu5 SEcube security-oriented open platform is a good example, as it's a single-chip design that expertly integrates three main parts: a powerful microcontroller, a Common Criteria-certified smart card, and a flexible FPGA. Developers (and students) can fully control and customize Blu5 SEcube.

2 COMPETITION BETWEEN TECHNOLOGY & EDUCATION

If we look at current era of technology and popularity of automation with the introduction of industrial 4.0 there are great opportunities that at first level routine jobs scenarios will be toppled by the steady rise of the robots and human interaction, which will eventually result in increased productivity of industry. With that development there will be dire increase for need of ever smarter algorithms deployed on bigger data-sets. However, the consequences of this for learning have received relatively little sustained and thoughtful attention. If we fairly look at current situation, major part of our global education system is being led by economists rather than educators. So eventually, they will be looking for economic outcomes and profits rather than quality of education. This research [24] also reflects gaps in existing quantitative research, which focus largely on job categories, rather than skills, and on the roles likely to be automated, rather than those likely to be created. The authors explained components of Artificial Intelligence based Education system which can be combined to develop an impartial smart real-world testing and evaluation platform for the students. They further discussed requirements of having more understanding which should eventually result in more productive output by use of smart machines in day to day routine at work place. This will bring a positive change and significant impacts of globalization on existing issues in education sector. They completed two things.

- I. Mapping the catalogue of AIEd tools, which will eventually help for massive challenge by supporting the next phase of education system reform.
- II. Set out the ways in which AIEd can be deployed to help for understanding and realizing this reform agenda.

There is need of timely and actionable feedback from students. We should prioritized and made affirmed that the 'purposes' of education are than getting a job. For example, a list would include discovering your passions, experiencing the flow and satisfaction of good work, and being a moral person with the capacity and desire to affect positive change in your family. Community, country, and the world. Having said this, getting a good job is consistent with the list above. Indeed, it is one of the central reasons why governments invest in education. The table shows our mapping of the tools of AIEd against the likely requirements of the jobs market in 15 years' time

In Engineering Programs, early exposure to IoT development frameworks can help students feel comfortable with IoT fundamentals and applications. Jing He et. al. present a case study [21] in which the authors showed how a module design method can be used to develop a course lab-ware on the basis of embedded training boards. This technique was very effective as in a fun environment; the students gained understanding of computer based automation and maybe one or two more. Teachers should motivate students to innovate, with the goal of gradually preparing the students for IoT era through smart approach of doing tiny experiments to build their hands on experience for innovation in a seamlessly manner.

3 RELATED WORK

Intensive research is going in the field of education to fulfil latest technological needs and align it with cutting edge technologies. Here is work from leading researchers and educationists.

It is pointed out that Higher education is becoming extra vigorous and has now focused professional development. A few of the developments in modernized education are: Collaboration platforms (For group and remote work), Learning Management Systems (LMS), Data Visualization/Big Data, Video (streaming and live). It is important to look at the effects of these trends on students' learning

3.1 Video

Video has turned into a key player in higher education. The trend of flip classroom is on the rise where students get advantage of pre-recorded video lectures and they complete their homework during classroom with their teacher. In addition to that universities and institutions are using videos both streaming and live for online courses and thousands of students from remote location get benefit of this great resource. As a result education has become more accessible, resourceful, well organized and effective. And students are preparing them for future technology-driven work place

3.2 Learning Management Systems

Learning Management Systems enable institutions and universities to facilitate, plan and monitor teaching and learning process in efficient manner. They get centralized content, resources and planning through the software of LMS; moreover, the administration can track a number of activities performed by students. This system has made assessment of students secure and private by presenting behind a virtual wall. Now the administration and faculty can evaluate students' performance and information in a different viewpoint

3.3 Collaboration Platforms

The Horizon Report; Higher Education Edition, 2014 recommends that education representations are gravitating towards including, online learning, intermingle and crossbreed learning, and mutual models innovative joint learning procedures to connect with learners. Online settings of educational environment are comprehensive and make the content and activities more vibrant and lively for students and they get a lot more opportunities to get connected with each other while working on different projects.

3.4 Data Visualization and Big Data

Students get benefit of grasping the concepts in easier way through merging and joining big data with mobile technology. This technology facilitates releasing complexed environmental datasets, and further helps the newest computational form, as well as the study of earth and satellite. In this connection the process of data analysis and record of statistical data are now comfortably done with the support of new technology. It has become guite evident that the latest technology is going to capture a major responsibility in the future of higher education in the world. Students from various backgrounds, age and culture have established an understanding that the technology is a prevailing and dominant means for classroom teaching and learning process. In current situation the procedures of exchanging information and interaction have changed radically and significantly as a result of online learning resources. Internet, mobiles and computers have prepared higher education significantly more reachable to a bigger diversity of learners. Nowadays the learners are free to make long traveler campus, live in dormitories, or learn from textbooks in order to collect evocative awareness and understanding from their academy years. The user-friendliness of mobiles has facilitated to make sure that hectic and busy persons can carry on with their assignments all the way through; it has become easier for the students across the world to access high quality courses and learning material and research tools through online platforms. One of the prominent reasons of becoming online learning famous is the flexibility in students' lives. The online courses happen to be more advantageous to students' own learning style. Furthermore, students are allowed to chose their suitable timings to grasp the learning material. Hence the passive students have also become active and interactive during group discussions by virtue of latest technology. Online course environment provides learners with the distinctive chance to exchange of ideas with their class fellows, provide connections to videos, learning, and reflection piece to take the dialogue onward. "They're very dynamic discussions. In a class of 12 people, we might have a discussion question on reading a particular article of how a business has developed a sustainability plan. And out of 12 students, there'll be a hundred different comments they're extensive. Our students are literally talking books. They're bringing in resources. They're bringing in links to videos-things that you can't do in a spontaneous classroom." (Paul Ventura, 2017). A few teachers have noticed that they have a powerful association with their online students. Due to advancement of technology students will find education in a more affluent manner and the classroom experience will be greater than before. (Nathan, R 2016) Consequently use of cutting-edge technology has facilitated innovative instructional strategies for example collaborative, self-directed and independent learning. Students get instant response and feedback and therefore learning becomes feasible and more attainable. However, there is a great need to structure these methodologies in order to get better and more advanced advantage of the technology especially in developing countries. According to, Al-Zahrani (2016) there is a deficiency of skilled teachers to meet an escalating demand. Skilled teachers are those who have the pedagogical content knowledge and teaching technology friendly.

4 TECHNOLOGY AND EDUCATION

Teachers today are using digital devices and gadgets to help their students learn better. Though there are some views of the negative impact on the young learners.

"Teachers will not be replaced by technology but teachers who don't use technology will be replaced by those who do "Sheryl Nussbaum-Beach.

There are multiple reasons for the technology love in teaching and learning.

- 1. One of the main reason is that students love using technology and they feel comfortable with these devices. They are more interested and engaged while using technology for learning.
- 2. The other reason is that it engages the four components of learning: active engagement, group work participation, frequent interaction and feedback and connection to the real world experts.
- 3. It also provides professional development opportunities to the students. When these kids would go to job and workplace their computational skills would help them to do the work more efficiently. In addition, a small incident, or a viral video on social media can make someone a celebrity.
- 4. The technology has made the teachers' lives easier. They can get material for the lessons, post online tests with auto corrections, and have the online meeting with parents saving time.
- 5. The research shows that the use of technology has improved the test scores. The students retain the information learned at their own pace and perform better in the tests.
- 6. Technology helps the learners with low attention spans. Technology is a famous tool for teaching kids with special needs and teaching languages.
- 7. It provides an opportunity to go beyond the class. The learners can learn from the experts while staying in the classes, though online available resources.
- 8. Improved homework responses. The technology really helps kids to do homework on the computer using online platforms. They can review the lesson videos, and watch other related resources.
- 9. It helps in saving resources and money. There could be more functional teachers in classes using technology.

The technology helps in removing obstacles. i.e. the audio-visual aids though amplifiers and multimedia. If the audiovisual aids are effective than the class management becomes way easier and effective

4.1 Impact of Technology on Teaching and Learning

"Throughout history, advances in technology have powered pragmatic shifts in education". Thomas Frick, 1991, Research Education through Technology. How we acquire knowledge then and now?? That is a question to the history, present and future. The way we use the acquired knowledge in past has totally been transformed in the present days and it is continuously transforming especially with the digital and smart devices. "Books will soon be obsolete" Thomas Edison. We are in a time where there are no more classrooms, no more books, no more teachers and fixed schedules. E-books, digital devices, and smart gadgets are bringing a great shift in the learning ways. Now learning can be done at a distance with no limits of time and space. The education is morning towards a totally virtual system with computing complexities and artificial intelligences. The introduction of robots is going to bring a greater shift in the future, by which human interaction is becoming minimum. A new paradigm of education transforming professional development and focusing on assessment connection, leadership, innovation, knowledge, discovery, creativity, ethics and risk. The emotional reaction to uncertain and fast rapidly changing future. The change in everything is so rapid that sometimes we cannot expect and judge and develop a right reaction to that. 10 million people out of which 5 million are high school students from the USA, requesting the online web developer for a continuous update to make things more relevant. The company works for the big companies in the area of uncertainty, which has low probability but high impact risks.

Future is about emotion. Emotional reaction shape realities. Anything can have high impact when it's linked with emotional reactions. I.e bird flu had developed that reaction in people where people even left eating chickens. Almost all the incidents have an impact on emotion. We need to make the right choices so that the kids who are taught in schools today should not feel bad when they are in their 30s.

5 THE FUTURE OF CLASSROOM EDUCATION

The traditional classroom has been redesigned with the help of technology and digital devices. The books are becoming impractical and a burden, as one source can provide access to countless books with no worries of carrying them. Computers and the smart gadgets are replacing the books. In 2008, 58% of the school had public laptops and 39% had on campus WiFi access throughout the schools. The digital resources save time and improve the efficiency of finding the correct sources in less time. More than that, searching an information through a book would take hours, however that task can now be done with one click of word search in computers. Technology has helped with a great deal in improving education through the use of the computer, internet, and online resources, online learning management systems, open ware courses, CBTs.

6 FUTURE LEARNING TRENDS

IT is shaping the way how higher education is evolving with internationalization. Researchers at Pearson and UCL Knowledge Lab [19] proposed use of Artificial Intelligence based system to improve the learning and teaching in education. Figure 3 shows their envisioned concept. The Horizon Report [25] portrays how higher education will evolve with the improvement of technology. It highlights different aspects along which teaching and education will evolve.

The young people know a whole lot more about a lot of technologies that we know. The digital media is actually transforming the nature of learning from the passive receipt of information to active participation in production. It is not important that how young kids are learning, but what are they learning.

6.1 Long-term evolution (in half decade or more duration)

Cultural evolution towards innovative education: Universities will be required to inculcate education and skills which promote self-employment, startups, curiosity and hands-on experience. More in-depth practical knowledge: Higher Education institutes will have to customize their training methodology to become student centric as opposed to traditional teacher centric approach that will allow project oriented teaching to enhance the psycho-motor skills of the students, while challenging the logical thinking abilities of the pupils.

6.2 Medium-term evolution (3 years to a period of half decade)

Education with measurable learning goals: Newer techniques to examine and assess the learning quotient will be emphasized. Graphical representations of students' progress will provide more accurate and focused feedback on the outcomes of student learning.

Futuristic Classrooms: For more immersive and interactive teaching the classrooms will transform into Smart Spaces that foster thorough understanding of concepts and knowledge.

6.3 Short-term evolution (In a couple of years)

Multi-source Multimedia learning environments: Novel Internet enabled teaching approach with greater participation of students in explaining the concepts discussed in the classrooms will be adopted.

Online interactive teaching methodologies: Collaborative teaching and learning where teachers and students concentrate to find answers of practical problems some of which will require specialized skills and technological advances that the pupil must learn in order to succeed. Incremental difficulty level enhancement: Students will begin with easier concepts and tasks while progressing with their learning abilities, more complex problems will be offered to them to challenge them to apply their knowledge yet requiring further research of unknown concepts.

Grand Challenge Problems: Eventually, the students will have to apply their understanding of fundamental concepts, interpolate their skills and evolve their understanding to devise novel approaches in solving problems that were otherwise considered unsolvable by traditional approaches. By attempting to solve such complex problems, the students will evolve into next generation scholars of the future.

7 TECHNOLOGY TRENDS (IN A COUPLE OF YEARS)

Dynamically self-tuning learning technologies: Modular Hardware and Application Software will adapt itself according to the learning progress and teaching goals set by the instructor.

Portable learning technologies: New cloud-based smart platforms and services will be introduced in educational sector that will allow students to use their own mobile devices such as laptops, tablets, Smart-

phones etc. through learning apps that will augment or disrupt the conventional teaching methodologies.

7.1 Technology trends (In a period of 2 to 3 years)

IoT enabled everything: The learning spaces, classrooms, labs and the environment will always be connected to the Internet through processors, effectors, actuators and sensors.

Newer immersive teaching and learning: Conventional classrooms will be entirely replaced by online software and web based platforms that allow creation of dynamic learner-centered social networking communities for teaching, discussions and learner's interaction.

7.2 Technology trends (In longer periods up to half a decade)

Al based technologies: Highly effective, human like interaction with Chat-bots and Al based expert systems will provide customized teaching sessions for all students tailored to their individual needs while maintaining synchronization at class level for all students.

Intuitive and Natural Language based Interaction with Machines: The students and instructors will have more natural human computer interaction then ever by utilizing gestures, expressions and audio visual interactions with technology thus focusing more on the concept and subject matter as opposed to spending time on learning the use of digital technology devices to achieve the following two goals.

- I. To identify the best possible pedagogical techniques for effective outcome based learning requires thorough knowledge of teaching and learning scenarios.
- II. To develop authentic, impartial and fine grained mechanisms to ascertain the learning progression of students in all areas of competency that are required to excel in the future practical fields at global level.

8 CONCLUSION

There is a great need to train our teachers and make them comfortable to use cutting-edge technologies as a major tool to for learning. We we can't change their fear from technology we won't be able to attain our goals in optimal way. As there are various ways to teach skills that students will need in a global IoT world, which has totally changed our perception for different services [23], but we don't always implement them effectively in the classroom. To fulfill the requirements of future-proof education, the educators and institutions need to integrate IoT platforms into science and engineering curricula to help students develop digital literacy and innovation skills.

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