

Technological Impact on Higher Education- Challenges and Opportunities from the Perception of Two Important Segments

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Abstract: *Technology has transformed the higher education system in this decade. Some important initiatives of this decade like, Massive Open Online Courses (MOOC), user friendly Mobile Communication Technology and Wearable Technologies have redefined the teaching/ learning process. Explosive growth in the number of online courses, pervasiveness of mobile devices, and the impact of social media have created lot of awareness and innovative ideas and practices among the present generation of learners. This is high time that the two important segments of higher education namely, the teachers and the learners (students) revisit the conventional methodologies of teaching/ learning process and upgrade their methods to be on par with the global scenario and tune themselves with the ever growing technological advancements. This study discusses some of the significant technologies in higher education, how the growth in education technology opened up both challenges and opportunities for both the communities in brief. The global views and experiences of some significant players are summarized here.*

Index Terms: *Higher Education, Technology Support, Challenges, Opportunities, Student-Teacher Perception, Global Views.*

I. INTRODUCTION

According to Merriam Webster, *higher learning* can be defined as education, learning or scholarship at the Collegiate or University level. The objective of any higher education Institution is to provide the best higher learning experience. Today, the Challenges faced by higher education Institutions are reduced funding, changing student demography, questions regarding quality and value, and increased competition.

Technology has practically affected all the activities in ones life. Until the last decade, adoption of technology in higher education was not very encouraging. But, this decade has witnessed tremendous change in the teaching/learning process due to the growth of Information and Communication Technology (ICT). Today, IT has more to contribute than ever for higher education. Very particularly, digital technology is the driving force behind the paradigm shift in higher education.

It is the era of smart devices, colleges and higher education Institutions are becoming smart campuses and digital tools are becoming part of the teaching process. On one side, Students appreciate the usage of technology in day to day activities and also in higher education. Conversely, Professors must willingly accept and adopt to the changing scenario in the teaching/learning process. Today, Professors have no excuses to start experimenting with multimedia, podcasts, social media, e-resources, YouTube clips and smart phone applications etc. This paper compiles the upcoming technologies and models that are acceptable, the impact of technology in teaching/ learning process on two important segments of higher education namely the students and teachers, the global views and experiences on the technology impact on higher education. First, the promising technologies of this decade which can make higher education system more purposeful are listed and discussed briefly with specific thrust on Massive Open Online Courses (MOOC). Second the two important theories of learning are presented. Third, the likely benefits Technological Developments to Higher Education System, with specific focus on Learners/ Students and Faculty are deliberated. Fourth, the three important Challenges due to technology in Higher Education are briefed. The revolution anticipated and the global views from major players are presented finally.

II. TECHNOLOGIES THAT HAVE IMPRESSED SIGNIFICANTLY THE HIGHER EDUCATION SYSTEM

According to (Raechelle Clemmons, 2014), some of the major technologies that impact higher education system are

- a. MOOC or On-line education
- b. Wearable Computing
- c. Mobile Computing/Wireless Communication
- d. 3D Printing
- e. Virtual Reality
- f. Games and Gamification
- g. Learning Analytics
- h. Digital Assessment and Competency based education platforms

The advancements in the above technologies are going to revolutionize higher education system globally (Chris Proulx, 2013; Hope Reese, 2015; Johnson, L., Adams Becker., S., Cummins M. Estrada, V Freeman A and Ludgate H, 2013; Raechelle Clemmons, 2014; Ronen Shay, 2013).

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A. MOOC- Massive Open Online Courses

Year 2013 witnessed a big growth in on-line education (Johnson, L., Adams Becker., S., Cummins M. Estrada, V Freeman A and Ludgate H, 2013) due to Massive Open Online Courses (MOOC). Launching of MOOC has ignited rethinking of higher education and created a ragging revolution in higher education system in highly populated country like China and India. It has created unprecedented opportunities for people who otherwise would not have access to high quality higher education. MOOC has created widespread interest among faculty in examining and improving the current teaching pedagogy and bringing in innovative practices in teaching. MOOC has been accepted with enthusiasm and has reached unimaginable number of learners and has changed the landscape of online learning. MOOC has brought forward lot of educational reforms combining research and higher learning together. Until then, these two have been perceived and treated at different levels of education.

According to Bernd Girod, Senior Associate Dean, Stanford School of Engineering, "Technologies like broadband Internet and social media have helped to make MOOC possible and have ultimately reduced the friction that is holding together the building blocks". According to class central, the cumulative number of on-line courses scheduled reached 2031 in December 2014 and exceeded 2400 by August 2015. Figure 1 shows the result due to a study by class central.

Source: Class Central

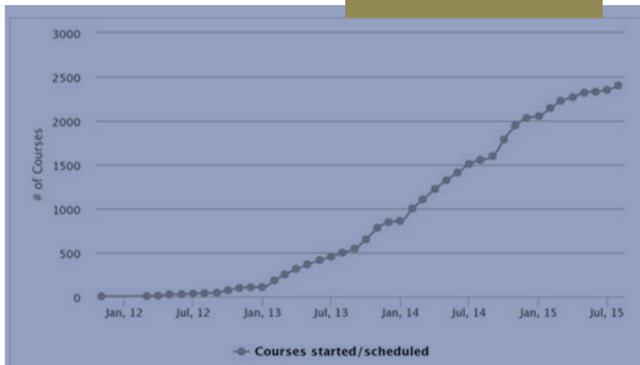


Figure 1: The Cumulative Number of MOOCs Scheduled Between 2011-2015

The number of Universities offering MOOCs doubled to 400 in 2014, and 22 out of the top 25 US Universities (according to the *US News & World Report* rankings) offer online courses for free.

The leading platforms offering MOOC emerged from those initial Stanford courses in 2011 and they remain among the top five providers today. Table 1 shows the number of student enrolments in different online platforms. Coursera, edX, Udacity, MiriadaX and FutureLearn are some of the platforms (Johnson, L., Adams Becker., S., Cummins M. Estrada, V Freeman A and Ludgate H, 2013) popular today.

Table 1: Student Enrollements for Different On-line Courses

Provider	Number of Students Enrolled
Coursera	11+ million
edX	3+ million

Udacity	1.5+ million
MiriadaX	1+ million
Future Learn	800,000+

In terms of the distribution of course offerings, Coursera is leading followed by edX. Figure 2 shows the distribution statistics of MOOC Providers.

Source: Class Central

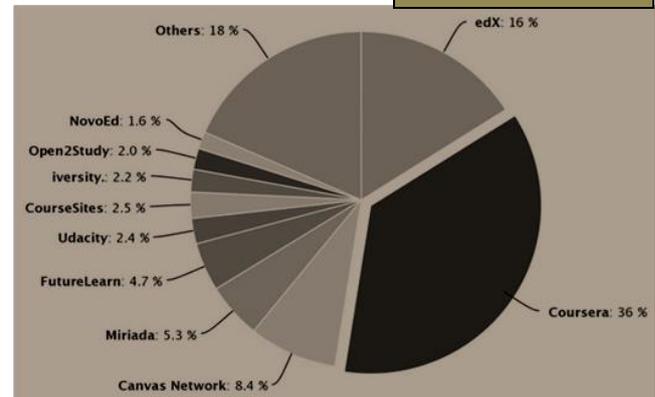


Figure 2: Course Distribution by MOOC Providers

Under MOOC, many top-tier Universities worldwide are offering courses. Though, it is perceived that MOOC has been adopted widely by developed countries, a statistics taken country wise is shown in Table 2. It is really encouraging to see that India is on top among the Asian countries with 9.47% enrolment.

Table 2: Statistics of MOOC Enrollement Continent wise

S. No	Continent	Country	Number Registered	% of Registration
1	North America	US	2,42,279	42.29
2	Asia	India	54,230	9.47
3	North America	Canada	21,853	3.81
4	Australia	Australia	12,474	2.18
5	Africa	Nigeria	12,067	2.11
6	South America	Brazil	11,243	1.96
7	Europe	Spain	10,582	1.85
8	Asia	Philippines	10,099	1.76
9	Asia	Pakistan	9,505	1.66
10	Europe	United Kingdom	8,066	1.41

A glimpse of student enrollments and the major payers of on-line courses are discussed. The next section briefs some of the general advantages and the challenges observed.

B. Advantages of MOOC/On-line Courses

It is noticed that the design of the classroom course is ripe for innovation and it has reached a saturated level. Faculties are provided with learner analytics like who is learning, what they are learning and how. This is automatically done through the tools, which is otherwise difficult in conventional teaching/learning methods. Accurate analysis is rather very difficult. Following are the advantages of the on-line or MOOC courses:

- a. Students are able to learn from the leading faculty at Elite Institutions across the globe.
- b. Professors are collaborating across Universities to collectively create and distribute credit courses online. This promotes quality material on specific topics to learn the course in depth.
- c. Universities have started aligning the courses in the interactive platforms, because online certificate programs have become more robust and hyper targeted towards professional development.
- d. Majority of the learners look forward to gain these credentials due to the reason that online certificate courses have become the major differentiators in the workplace.
- e. The most effective formats for learning and rethink of better usage of classroom space and time.
- f. MOOC courses may automatically lead to packaged Certificate/ Degree programs.
- g. The very benefit of universally accepted courses may also lead to migration or credit transfers to get the Certificate / Degree.
- h. May lead to introduction of hybrid programs where part of the program taught on-line and part in person.

C. Limitations of MOOC/On-line Courses

MOOC has opened up lot of benefits to both the Teachers and Learners. Though there are significant benefits to the learners, there are certain apprehensions due to some of the limitations experienced by on-line platforms (Ronen Shay, 2013).

- a. Many Professors require training for the application of technology.
- b. Intellectual property ownership is difficult to protect. Piracy is inevitable.
- c. Possibilities of decreased revenues of Institutions of higher learning.
- d. Difficult to regulate and therefore potential for corruption is high.
- e. Potential to diminish the overall value and experience of an in-person education.

Apart from MOOC, there are other allied technological factors that can enhance the teaching / learning process.

D. Other Allied Technologies

Of all the technologies, on-line system has been identified as the significant milestone in higher education system. Games have been increasingly introduced in the curriculum as instructional tools. Gamification takes some of the mechanics and culture of games and uses them to shape the curriculum. 3D printing enables more authentic exploration of objects that may not be readily available for exploration and learning.

For example, interior design, textiles and apparels students, bio-informatics, mechanical engineering, civil engineering and chemistry students can study complex object modelling through this. Access to information could increase even more, if wearable computing and cellular modem technology evolve better. Like programmable calculators, wearable computers can be part of the examination system. This may particularly promote better inclusive education.

Wearable technologies could automatically send information via text, e-mail, and social networks on behalf of the user based on voice commands, gestures or other indicators that would help students and educators to communicate with each other better, keeping track of updates and better organize notifications. Access to last year's information through on-line materials, journal articles and publications provide access to current learning materials to the students and can facilitate them to build better understanding of specific topics. It forces the Professors to constantly innovate. Professors can no more recycle the old materials. Beyond MOOC and on-line learning portals, other concepts are also getting geared up. One significant concept is BYOD- Bring Your Own Device. Usage of portable devices and move towards BYOD, Cloud computing and increasing integration of geospatial literacy have greater impact on the overall learning process. BYOD concept increases the usage and adoption of consumer devices like laptops, portable devices, smart phones, personal devices and tabs which can be used as aids in teaching, learning and administrative functions. Cloud computing promotes options for sophisticated learning management system software and other email based management system. Some of the technologies that revolutionize the teaching/learning process are briefly explained in this section along with certain statistics that shows the welcoming response on the whole. The promising technologies that have supported the Teaching/Learning process with the specific thrust on on-line courses are discussed. Before exploring further it is imperative to understand the two important notions in learning.

III. IMPORTANT THEORIES IN LEARNING

The two important concepts in student learning (Ronen Shay, 2013) are Learning Modalities and Learning Analytics. Learning Modalities cover alternate modes of delivery of materials which allows increasing access and decreasing cost for students. Some important learning modes are on-line courses, MOOC, flipped class rooms, hybrid or blended learning. Naturally, they have increased the access to quality learning material across the globe. Sooner or later they may also promote decrease in the cost of learning. The other parameter is Learning Analytics. It covers data analytics tools to assess, analyze and predict the student's success in the learning process and identify at-risk students. A separate pattern of interaction can be designed and students can be provided extra support to succeed – i.e. personalized learning experience, individualized learning plans and adaptive tools to measure students' learning skills.



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The next section briefs the benefits of the technological advancements in higher education system on the whole.

IV. POTENTIAL BENEFITS TO HIGHER EDUCATION SYSTEM DUE TO TECHNOLOGICAL DEVELOPMENTS

Definitely, technology is going to provide flexibility to the entire teaching / learning exercise. As mentioned earlier, distance and lifelong learning are very important for career growth and development. Employer and Employee needs to evolve and keep abreast of the technological advancements in their own domain. Working adults need opportunities to expand and enhance their skills throughout their career. Some of the feasibilities are presented below.

- a. Greater choice for Students-virtually to take a Course
- b. Opportunity to take more specialized courses by at least some Students
- c. Students become more marketable
- d. Many Students can attend the same Course
- e. Only fewer Professors are required to teach the Courses
- f. Professors/Courses are chosen by Students
- g. Opportunity for more Teaching Assistants (TAs)
- h. Asynchronous Courses with less fixed in location and time.

Universities must work together to mutually approve courses and agree on grades. Universities must work on *conflict analysis* when a student takes course from multiple Institutions. Comparison of Courses and Credits offered by different Institutions- whether the same weightage is given. These are some of the important concerns that must be addressed carefully for the potential benefits of the student Community.

Though technology today reaches many, there are certain views on the impending benefits and the limitations. The potential benefits of introduction of technology to the two important segments students and teachers are discussed below.

A. Benefits to the Students

Following are some of the benefits to the Students.

- a. Prepares the students for the future. All careers are technology oriented. Today ICT is an integral part of all the systems.
- b. Increases student engagement and motivation. Provides the students a different learning experience. For example, a teacher can take the students to a virtual field trip.
- c. Supports collaborative skills. Students can work in teams, use conferencing facilities, good learning experience can take place outside classroom also.
- d. The classes will become more interesting and will definitely give a novel experience in learning as some significant learning has happened already outside class room. The students can discover their own obstacles and remove them at their own pace. Learning by fast and slow learners are different. This technology enabled learning will keep all the students at the same understanding level in the class room once the hurdles are crossed. Even if a student misses a class, all the in formations are available easily.

- e. Digital materials have replaced the use of text books. Students need not carry the books. It is convenient to upload assignment, notes and syllabus.

B. Benefits to Teachers

Following are some of the benefits to the Teachers.

- a. Improves instructional delivery of a Teacher. Class room time can be used in critical thinking and problem solving. For example, flipped class rooms.
- b. Supports differential instructors. Teachers can use the latest technologies for teaching. For example, mobile or other apps, web sites and specific programs.
- c. Supports universal design for learning practices. All the students can access the same materials irrespective of distance and demography. So the teacher can reach all the students comfortably-need not wait much for the students to follow equally.
- d. The classes are well organized and the Professors are very engaging.

Though there are benefits to the students and the teachers, there are some off-putting features that may be experienced. Some of the worth mentioning points are discussed below.

C. The Interesting Part

Some pessimistic views are also available.

- a. Many students tend to copy directly from the Internet for assignments.
- b. A teacher must know her/his students' academic strength and weaknesses for effective delivery. This can happen only when there is personal interaction.
- c. The basic tenet of education is the student/teacher interaction. This can happen only through personal interactions.

This section briefly discussed some of the constructive sides and downsides of the impact of technology on higher education. More advancements in technology and accessibility and availability of the same may redefine the higher education system better. In other words, distance education programs may be widely introduced. The next section deals with the important observations for feasible distance education.

V. CHALLENGES DUE TO TECHNOLOGY IN HIGHER EDUCATION

There are three main challenges the technology can bring forward. They are Digital illiteracy, Affordability and Support.

Digital literacy: the ability to understand information presented in different forms due to the changing nature of the landscape and advancement in technology.

Affordability: teachers must know to match the affordances of technologies with the teaching and learning process. Affordances are the action possibilities of the appropriate technology enablement to assess the learning outcomes.

Support: managing time and space and workloads in academic environment in relation to developing digital

Illiteracies and explore the affordances of technologies that enable rich opportunities. Availability of the technological support to remote places. So far, a brief discussion on technological advancements, their impact on higher education system from two different sectors are discussed. The following section presents the revolutions anticipated from the major role players.

VI. REVOLUTIONS ANTICIPATED AND GLOBAL VIEWS

The revolutions that technology enabled higher education is still a million dollar question. Some of the innovative and exploratory features that can come may be in terms of assessment, applicability in advanced technological fields and contribution to high-tech industries. Following are some of the points for discussion due to MIT and UWaterloo. *Assessment:* Many evaluation types like open-book exams, take-home exams have changed the conventional form of evaluation which tests only the retention power of the individuals. Academia has realized that information is useless by itself, rather, where the information is available and the application of the same is important.

Applicability of education to advanced technology fields: high tech companies who are the biggest employers of students affect the education; because they make higher education more practical and less theoretic. Because of this, Universities become places of training for work, rather than higher learning. They should strike a balance between learning specific skill set and abstract understanding. This concept may help the self-motivating students. Whereas, advanced courses require learning, discipline, organization, stability and determination. *Continuing contributions of high-tech industry:* what ways high-tech firms continue to feed higher education- continue to hire more and more students in the qualified work place. High-tech firms donate computer labs and software to Universities to produce graduates with better skills and experience. High-tech firms will offer scholarships for certain disciplines. High-tech firms will increase funding for University research studies to get technically advanced work force. According to NMC Horizon Report 2013, six technologies that have the potential to improve student success rates: make mobile learning a reality, break down educational barriers, enable new approaches to teaching and learning, bring desktop manufacturing to the mainstream, and allow one to interact with the new world around.

According to Lev Gonick, VP and CIO, Case Western Reserve University, The key trends that drastically alter higher education landscape are:

- a. The death of personal computers.
- b. The proliferation of mobile devices.
- c. The rise of social networks.
- d. The next generation of networks.
- e. The privatization of the cloud.
- f. The valuation of X-as-a-service.
- g. The promise of big-data.
- h. The implementation of the flipped classroom.
- i. The future of the learning space.
- j. The legitimization of online learning.
- k. The evolution of the College/ University to create partnership for development.
- l. The advent of the urban operating system.

According to eCornell's (Chris Proulx. 2013) based on their experience with Cornell University's online program,

- a. Growth in online education will be particularly strong in the top tier.
- b. Expectations to see more innovations around flipping the classrooms.
- c. Coming years buzz word, "Hybrid Program".
- d. The race will be for the New Instructional model
- e. Higher education costs may start to decrease.

According to Bastyr University, related trends in education will pick up soon. More and more education in pseudoscience will evolve. More and more older people will get degrees. Distance education will be used by masses of hobbyists. On the other hand, EDUCAUSE2014 Annual Conference, UK sees changing role of IT and perception of IT in higher education as a new model for IT leadership. Georgia Institute of Technology has already experienced a scope for new model for higher education through online programs.

VII. CONCLUSION

In a knowledge economy, there is no substitute for higher learning Institutions which are critical for societal growth. Higher Education Institutions in their present form will survive only if they significantly reform face-to-face learning model with the help of technology. The science of learning needs to be incorporated into education system and new blended learning models must evolve. Colleges and Universities can offer their introductory courses online. Colleges and Universities can change their admission practices if students complete a first year of introductory courses online. Online education provides for lifelong learning. Through technological advancements, country like India can benefit to develop a skilled workforce for the growth and the development of the Nation.

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Dr Padmavathi Ganapathi is working as Professor in the Department of Computer Science. She has 29 years of teaching experience and 1 year of Industrial experience. She has more than 200 publications at National and International Journals/ Conference Proceedings. Her area of interest includes cyber security, wireless communications, Analytics, Education Technology. She has executed funded projects worth 2 crores and she is a life member of CSI, ISTE, ISCA, WSEAS, AACE and AIWC.

