

Massive Open Online Courses: EdX.org, Coursera.com and NPTEL, A Comparative Study Based on Usage Statistics and Features with Special Reference to India

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Abstract

Internet and communication technologies (ICT) have changed the way we perceive education. ICT has major impact on recent evolving Education Technology field. Internet and smart phone users are growing at rapid pace in the world as well as India. Leveraging technologies to solve India's higher education problem is the key. A massive open online course is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problem sets, many MOOCs provide interactive user forums to support community interactions between students, professors, and teaching assistants (TAs).

The present paper is an effort to analyse and compare two of the world's most widely used MOOCs i.e. EdX.org and coursera.com with MHRD funded India's own e-learning initiative NPTEL which provides open courseware to engineering students across the globe. This paper compares these three platforms of e-learning based on parameters like the usage statistics available, features, technology platform and other parameters like design approach to content etc. This paper is an effort to derive best practices from world-class MOOCs and adapt them for India's e-learning initiative NPTEL- a portal dedicated to technical e-content.

Keywords: E-Learning, Open Online Courses, Learning Management System, Open Courseware, Massive Open Online Course (MOOCs), EdX, Coursera, NPTEL

1. Introduction

Internet has changed the face of education. ICT (internet and communication technologies) has major impact on the all aspects of education, be it classroom teaching, managing student information systems or running entire universities. No one can deny the role ICT has to play in near future for making education more accessible, more intuitive and effective. E-learning and virtual universities have major part to play in ongoing education revolution. Internet and mobile penetration is increasing at rapid speed. Internet users in India are growing at rate of

14% every year (<http://www.internetlivestats.com/internet-users/india/>) (India now has over 200 million Internet users and by 2018 almost half the country will be connected through the Internet, according to Google India) India need to take advantage of this rapid growth of internet users. India needs highly trained technical professionals for its growing economy. Demand for engineering education in country is on rise. Around 700,000 students have been joining engineering programme annually for last few years. It is evident that all of them don't have access to quality technical education. As Mangala(2009) and Ravi and Jani (2011) has noted India needs 150,000-200,000 teachers for engineering education for an undergraduate population of



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about 2.6 million. Against this only 4,000 teachers are trained by higher education institutes every year.

The Massive open online courses could be a way to bridge the gap between this demand and supply. The New York Times reported that more than 5 million students globally registered for MOOCs as of 2013. As of 2013, 13% of schools offer MOOCs and the number are expected to rise to 43% by 2016. According to The Chronicle of Higher Education's survey of MOOC educators, the median enrolment per course was 33000.

In present paper, forth section introduces MOOCs. Fifth, sixth and seventh section respectively describes EdX.org, coursera.com and NPTEL with usage statistics, features and course details.

Eighth sections compare all three MOOC and courseware platforms based on various parameters and dimensions. Next sections draw suggestions and conclusion of this study.

2. Objectives of Study

- ▶▶ This paper is an effort to study two of the most widely used MOOCs in the world (i.e EdX and Coursera) with reference to India's e-learning initiative NPTEL.
- ▶▶ Derive standards and best practices for the MOOCs from users prospective.
- ▶▶ To draw conclusions and make suggestions to improve NPTEL.

3. Methodology

This study is conducted based on Usage statistics available from various sources like World Wide Web, previous research papers etc. We did Feature comparison by using all three platforms from user and technology prospective.

4. MOOC

A massive open online course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problem sets, many MOOCs provide interactive user forums to support community interactions between students, professors, and teaching assistants (Tas). MOOCs are a recent development in distance education which was first introduced in 2008 and emerged as a popular mode of learning in 2012.

MOOCs provide platform for online courses. The universities across the world record video lectures, design courseware like assignments, Quizzes, lecture notes etc and upload all these content on MOOC platform which can be accessed from anywhere in the world via web.

This is different from the open courseware (OCW) portals such as MITX OCW as OCWs provides learning content only. Where as in MOOCs learners need to enroll in courses available using registration. Learners get videos, assignments etc according to pre defined schedule fixed by course instructor. They constantly get evaluated through quizzes, assignments, tests etc. Many courses doesn't follow fixed schedule. Learner can take the lectures and quizzes at his own flexibility of time. MOOCs also have different web 2.0 features like discussion forum, blogs, chat, simulation software etc.

MOOCs are different form learning management systems (LMS) as LMS doesn't concern the content part. LMS provides mere software where as MOOCs are end-to-end platforms with content plus software that enable access to these learning contents.

MOOCs has been traditionally classified into two categories.

- ▶▶ Connectivist MOOC: this model emphasizes creation, creativity, autonomy, and social networked learning. Participants in the course act as both teachers and students, sharing information and engaging in a joint teaching and learning experience through intense interaction facilitated by technology.
- ▶▶ XMOOC: This model emphasizes a more traditional learning approach through video presentations and short quizzes and testing.

Table: 1

xMOOCs		cMOOCs
Scalability of provision	Massive	Community and connections
Open access - Restricted license	Open	Open access & licence
Individual learning in single platform	Online	Networked learning across multiple platforms and services
Acquire a curriculum of knowledge & skills	Course	Develop shared practices, knowledge and understanding

4.1 Classification of MOOC Courses

- ▶▶ Based on course
 1. Paid
 2. Free
- ▶▶ Based on pace
 1. Schedule driven
 2. Self paced
- ▶▶ Based on course instructors
 1. University courses
 2. Private firms

Data from Google trends shows that interest in MOOCs has increased exponentially from 2004 to 2014.

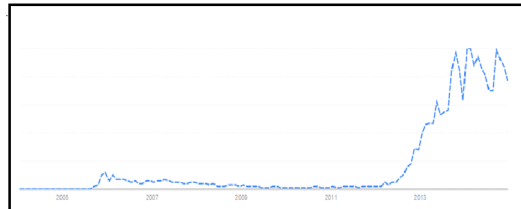


Figure:1

Interest from India is also gradually increasing. Data from Google trends tells us India is ranked 10th based on search volume index in world for MOOC related search queries.

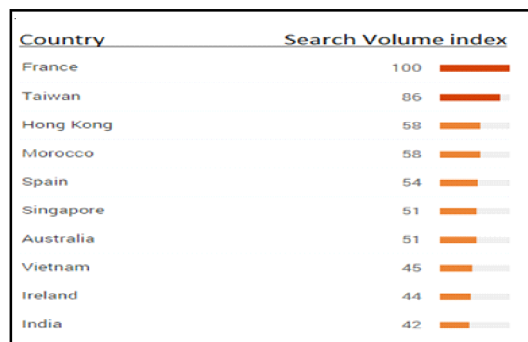


Figure:2

5. EdX.org

With the goals of expanding access to education for everyone and enhancing teaching and learning both on campus and online, EdX.org was founded by the Massachusetts Institute of Technology and Harvard University in May 2012.

EdX is a massive open online course (MOOC) provider and online learning platform. It hosts online university-level courses in a wide range of disciplines to a worldwide audience, some at no charge. It also conducts research into learning based on how people use its platform. EdX differs from other MOOC

platforms, such Coursera and Udacity, in that it is non-profit and runs on an open-source software platform.

There are currently more than 60 schools, nonprofits, corporations, and international organizations that offer or plan to offer courses on the EdX website. As of 22 October 2014, EdX has more than 3 million users taking over 300 courses online.

5.1 Features

1. Interactive video lectures with subtitles and indexing on subtitle.
2. Study materials like books, notes etc.
3. Online test of different types like video embedded quiz, practice sessions, midterm exam, final exam, etc.
4. Virtual Laboratory with interactive interface for user to view the expected simulation.
5. Calendar based schedule.
6. Multi lingual support.
7. Discussion forums.
8. Wiki edits for implementing collaborative learning.
9. Progress reports and other kinds of embedded analytics.
10. Different kinds of assessment systems for submitted assignments.(Open response problems). It includes: Peer Grading, Self Grading, Staff Grading, Machine Grading
11. Emails and Notification facilities for registered student.
12. Provision of certification.

13. Registering and deregistering from a course.
14. Students also arrange face to face study meet-ups using meetup.com
15. Contacting authors through mailing.

5.2 General Information and Statistics

Table : 2

Funded and owned by	MIT & Harvard University
Launched	May 2012
Web Address	www.EdX.org
Participating Institutes	As of July 2014, there are 35 charter members, and 15 members
Funding (in USD)	\$60 million
Number of Registered users	More than 3 million (as of October, 2014)
Content License	Copyright of EdX
Available Languages	English, Chinese, Mandarin, Hindi, French, Spanish
Type of organization	Non-profit
Technology Platform	Open Source Platform
Registration Required?	Yes
Alexa Rank	Global: 3,314
	India: 2,243 (as of December , 2014)
Number of Courses	Total: 371
	Verified Courses: 235 Part of an Xseries: 26 High-school: 44 Mobile-friendly: 61 Professional Education: 5
Course Categories	• Architecture (8)
	• Art & Culture (31) • Biology & Life Sciences (53) • Business & Management (40) • Chemistry (15) • Communication (14) • Computer Science (74)

	<ul style="list-style-type: none"> • Design (3) • Economics & Finance (28) • Education (13) • Electronics (21) • Energy & Earth Sciences (10) • Engineering (83) • Environmental Studies (27) • Ethics (12) • Food & Nutrition (9) • Health & Safety (29) • History (50) • Humanities (80) • Law (16) • Literature (32) • Math (45) • Medicine (22) • Music (6) • Philanthropy (1) • Philosophy & Ethics (24) • Physics (48) • Science (78) • Social Sciences (64) • Statistics & Data Analysis (42)
Completion rate (certificate issued)	8.62% (based on 18 courses)
Mobile Friendly	Yes
Mobile App	Android: installs(10,000-50,000)

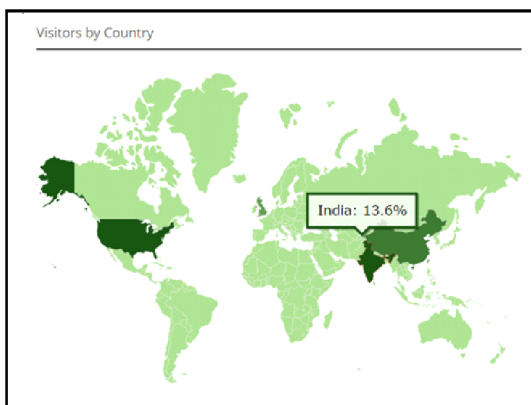


Figure: 3

Country	Percent of Visitors	Rank in Country
United States	35.7%	2,164
India	13.6%	2,243
China	4.2%	10,984
United Kingdom	2.7%	4,004
Taiwan	2.0%	1,905

Figure: 4

6. Coursera.com

Coursera is a for-profit educational technology company founded by computer science professors Andrew Ng and Daphne Koller from Stanford University that offers massive open online courses (MOOCs). Coursera works with universities to make some of their courses available online, and offers courses in physics, engineering, humanities, medicine, biology, social sciences, mathematics, business, computer science, and other subjects. Coursera has an official mobile app for iOS and Android. As of October 2014, Coursera has 10 million users in 839 courses from 114 institutions.

The contract between Coursera and participating universities contains a “brainstorming” list of ways to generate revenue, including verified certification fees (started in 2012 as Signature Track), introducing students to potential employers and recruiters (with student consent), tutoring, sponsorships and tuition fees.

6.1 Features

1. Interactive video lectures with subtitles and indexing on subtitles.
2. Study materials like books, notes, cheat sheets, etc.
3. Emails and Notification facilities for registered student.
4. Provision of certification.

5. Online test of different types like video embedded quiz, practice sessions, Midterm exam, final exam, etc.
6. Calendar based schedule.
7. Multi lingual support.
8. Discussion forums.
9. Contacting authors through mailing.
10. Different kinds of assessment systems for submitted assignments (open response problems).It includes: Peer Grading, Machine Grading
11. Wiki edits for implementing collaborative learning.
12. Registering and deregistering from a course.
13. Progress reports and other kinds of embedded analytics.
14. Students also arrange face to face study meet-ups using meetup.com
15. Analysis of keystroke dynamics during typing is used in combination with webcam images to confirm the identity of fee-paying "signature track" students during tests and quizzes

6.2 General Information and Statistics

Table :3

Funded and owned by	Andrew Ng and Daphne Koller
Launched	April 2012
Web Address	www.coursera.com
Participating Institutes	As of December 2014, there are 106 University members, and 7 non-university members
Number of Registered users	More than 10 million (as of October, 2014)
Available Languages	English, Spanish, French, Chinese, Arabic, Russian, Portuguese, Turkish, Ukrainian, Hebrew, German, Italian, Portuguese
Type of organization	For-profit
Technology Platform	Closed source, Proprietary software

Registration Required?	Yes
Alexa Rank	Global: 918 India: 646 (as of December 2014)
Number of Courses	839
Course Categories	Arts (45) Biology & Life Sciences (111) Business & Management (142) Chemistry (29) Computer Science: Artificial Intelligence (38) Computer Science: Software Engineering (61) Computer Science: Systems & Security (39) Computer Science: Theory (48) Economics & Finance (114) Education (113) Energy & Earth Sciences (45) Engineering (77) Food and Nutrition (26) Health & Society (124) Humanities (161) Information, Tech & Design (117) Law (36) Mathematics (70) Medicine (98) Music, Film, and Audio (47) Physical & Earth Sciences (48) Physics (48) Social Sciences (155) Statistics and Data Analysis (69) Teacher Professional Development (83)
Completion rate (certificate issued)	7.75(based on 40 courses)
Mobile Friendly	Yes
Mobile App	Android: installs(1,000,000-5,000,000) iOS: rated above 4

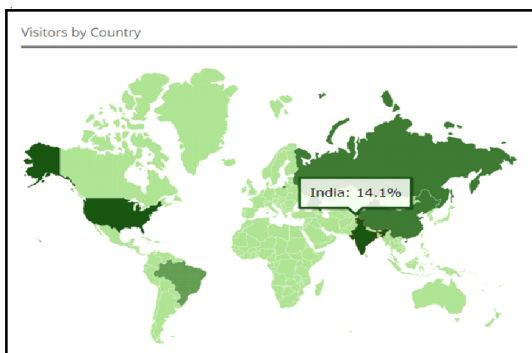


Figure :5[22]

Country	Percent of Visitors	Rank in Country
United States	30.2%	928
India	14.1%	670
China	8.4%	1,264
Russia	3.7%	1,716
Brazil	2.7%	1,214

Figure :6[22]

7. NPTEL

The National Programme on Technology Enhanced Learning (NPTEL), a project funded by the Ministry of Human Resource Development (MHRD), provides e-learning through online Web and Video courses in Engineering, Sciences, Technology, Management and Humanities. This is a joint initiative by seven IITs and IISc Bangalore. Other selected premier institutions also act as Associate Partner Institutions.

NPTEL is a curriculum building exercise and is directed towards providing learning materials in science and engineering by adhering to the syllabi of All India Council for Technical Education and the slightly modified curricula of major affiliating Universities. It has developed curriculum based video

courses and web-based e-courses targeting students and faculty of institutions offering UG engineering programs.

NPTEL provides free online courseware in the form of web courses and video lectures. These lectures utilize a multitude of facilities of the video medium such as chalk-and-talk, tablet writing, power point, two and three dimensional animations, interactive codes, etc. Each course comprises approximately 40 video lectures of about 1 hour duration. An online discussion forum is incorporated wherein students can post and review questions. Wherever applicable, course assignments, handouts, self-evaluation tasks, etc. Have been integrated. Workshops are routinely conducted for institutes, students, mentors, etc. Under the auspices of NPTEL. [24]

7.1 Features

1. Interactive video lectures with subtitles and indexing on subtitle (Downloadable).
2. Text transcriptions of all the video lectures are available in the following formats:
 - a. audio file (mp3 format)
 - b. transcript (pdf format)
3. Study materials like ppt with audio, notes, etc (Downloadable).
4. Different lecture add-ons like illustrations, 2D and 3D animations, lab demos etc.
5. Online test of different types like quiz, final exam, etc.
6. Discussion forums.
7. Progress report.
8. GATE Mock test.
9. Ordering course DVDs online.

10. Evaluation through problems, quiz and assignments.
11. It also has YouTube channel for viewing course videos (<http://www.youtube.com/user/nptelhrd>).
12. Emails and Notification facilities for registered student.
13. Provision of certification.
14. Registering for a course using your Gmail credentials.
15. Ask a Question: learner can directly ask question to course co-ordinator.
16. Support for a large traffic (Users at particular time).

7.2 General Information and Statistics

Table:4

Funded and owned by	Indian Institute of Science (IISc) & Indian Institutes of Technology(IIT)
	Funded by Ministry of Human Recourse and Development, Government of India.
Launched	2003
Web Address	http://nptel.ac.in/
Participating Institutes	As of December 2014, there are 8 coordinating institutes, and 5 Associate Partner Institutions
YouTube channel subscribers	3 lac+ as of December,2014[25]
Content License	MHRD,IITs/IISC and Faculty
Available Languages	English
Type of organization	Non-profit
Technology Platform	Open Source Platform (Google course builder)
Registration Required?	No
Alexa Rank	Global: 12,353
Number of Courses	India: 1438 (as of December , 2014) Total: 1267 Web Courses: 621

	Video Courses: 646 (as of 9th January , 2015)
Course Categories Total Course Categories:24	<ul style="list-style-type: none"> • Aerospace Engineering (49) • Atmospheric Science (6) • Automobile Engineering (2) • Basic courses(Semester 1 and 2) (38) • Biotechnology (35) • Chemical Engineering (92) • Chemistry and Biochemistry (57) • Civil Engineering (131) • Computer Science and Engineering (94) • Electrical Engineering (77) • Electronics & Communication Engineering (103) • Engineering Design (14) • Environmental Science (4) • General (5) • Humanities and Social Sciences (70) • Management (50) • Mathematics (75) • Mechanical Engineering (163) • Metallurgy and Material Science (54) • Mining Engineering (2) • Nanotechnology (11) • Ocean Engineering (29) • Physics (73) • Textile Engineering (28) • (As of December,2014)

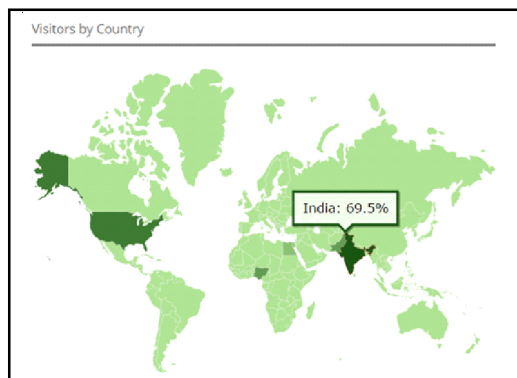


Figure: 7






Country	Percent of Visitors	Rank in Country
 India	69.5%	1,500
 United States	6.1%	38,355
 Nigeria	3.0%	3,755
 Pakistan	2.1%	6,653
 Egypt	1.4%	6,472

Figure: 8

8. Comparison

All three MOOCs are compared here on 9 parameters. Parameter number 3 use of multimedia, 6 certificate courses, 9 catalogue diversity are taken from the new classification for MOOCs[3] suggested by Grainne Conole in her paper. Dimension 1 "Open" from Conole(2013) is further nested into two parameters: 1 openness of content and 2 openness of technology.

Parameters 4, 5 and 7, 8 are added to evaluate MOOCs.

Table :5

Sr. No.	Dimension/parameter	EdX	Coursera	NPTEL
1	Openness of content	Medium	Medium	High
2	Openness of technology	High	Low	Medium
3	Use of multimedia	High	High	Medium
4	Use of social media	High	High	Low
5	Language support	Medium	High	Low
6	Certificate Courses	High	High	Low
7	Responsive web design	High	High	Low
8	Mobile apps	Medium	High	Low
9	Catalogue diversity	High	High	Low

8.1 Comparison Parameters:

Table: 6

Sr. No.	Dimension/parameter	Description
1	Openness of content	Whether MOOC provides access to content without registration or not and type of licence used for content. If MOOC uses creative license and allows access without registration.
2	Openness of technology	MOOC is built using open source tools.
3	Use of multimedia	Along with videos, ppts, animations specialized simulation software used.
4	Use of social media	Presence on social media platforms. Collaboration with social media platforms to promote MOOC.
5	Language support	Number of languages in which courses available.
6	Certificate Courses	Number of courses which have provision of certificate.
7	Responsive web design	Has mobile version of website
8	Mobile apps	Availability of smart phone apps on different mobile operating systems like android and iOS.
9	Catalogue diversity	Type of courses. Engineering, humanities etc.

9. Suggestions

▶▶ Analytics about usage of courses by learners can play major role in future decision making process. Data about MOOC usage can tell us about how students and learners interact with MOOC platform and courses. Thereby using statistics reports, next versions of MOOC platforms and Courses can be improved. Researchers at MIT[29] are working on standard analytics Database schema called MOOCdb that can be used to log usage statistics. Using for analysing course usage data.

▶▶ It is found in this study that EdX and Coursera MOOC platforms have responsive websites. While NPTEL doesn't have mobile friendly responsive website. It is important to note that large portion of internet users India access internet from their mobile phones. Considering low bandwidth scenario in India, it is recommended that learning platforms have light weight mobile versions of website.

▶▶ Coursera has Smartphone applications for platforms like android, iOS and kindle fire. Coursera's Android app had installs between 1 to 5 million[35]. This is important as Mary Meeker Report notes India had third largest Smartphone base with 117M users in 2013; to grow 45% in 2014[31]. By 2017 India will have 32% of the Smartphone share in the world [32]. We can't be ignorant to this fact. Developing mobile apps should be priority for MOOCs.

▶▶ NPTEL has made most of the content accessible without any registration from learner's side. While other two MOOCs described in paper need registration to access content. It is important to have OPEN access to all content as many users would only be looking for some specific topic related videos or content.

▶▶ It is noted that nearly all NPTEL course videos are of duration near of an hour. While other two MOOCs have videos divided according to topics or concept therefore not exceeding 15-20 minutes. It is suggested that NPTEL also start managing videos according to topics or concepts rather than hour long lecture format. Video length is one of the most important factors when it comes to keeping learners engaged. The longer the video, the less likely your user will watch it to completion [37]. From learners point of view it is much easier to navigate through videos based on topics and concepts.

▶▶ EdX has support for over 6 languages and coursera has support for over 13 languages in terms of courses and subtitles. While NPTEL only supports English language. Considering multilingual demographics of India it is suggested that courses should also be available in local languages. As Ravi and Jani(2011) noted in their paper, total of 124 (43.97 %) out of 282 people want NPTEL in local languages. About 70(24.82 %) do not want it to be in local language, while 88(31.21 %) are neutral.[2]

▶▶ EdX and Coursera both have active presence on social media platforms like facebook, twitter, LinkedIn, meetup and Google+. Both of these MOOCs have been found actively using these social platforms to engage with learners and for the promotion of the new courses and other announcements. NPTEL doesn't have any official account or presence on social media platforms. It is suggested that NPTEL take benefit of these social media platform for promoting its courses and engaging with learners.

▶▶ It is suggested that MOOCs make the usage statistics available time to time to encourage research work.

► EdX has made its technology platform open source. China is using this open source EdX platform for powering its own e-learning portal called XuetangX (<https://www.xuetangx.com/>) [32]. France has also announced to use EdX platform for its national massive open online course (MOOC) [33]. This Technology platform is sophisticated and it also open source. It is suggested that NPTEL take note of this and if possible take advantage of EdX's open source technology platform.

10. Conclusion

Massive open online courses are making huge impact on distance education. Large enrolment numbers clearly provide proof of that. While coursera and EdX have made great progress in terms of user base in just two years of launching, NPTEL hasn't evolved fast enough. While it is commendable that NPTEL is made great progress in terms of developing content, making it one of the largest open accessible repository of education content. India and other developing countries face different set of problems like low bandwidths, lack of digital infrastructure and less digital literacy etc. NPTEL's effort to reach out to libraries and colleges and even to students across the country through sending course DVDs and Hard disks is prime example of innovation driven by circumstances. Though more efforts needed in technology enhancement and promoting the NPTEL platform. We noted in the study that both on EdX and Coursera, highest number of visitors are from India only second to United States of America. This clearly tells us that students and learners across the country are looking for quality and diversified education content. Integrating innovations like mobile learning with MOOCs like NPTEL is equally important as cell phone users in India are growing at double digit rate.

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