The Development of Satellites and Launch Vehicles are the Boost for MOOC and other E-Learning through ICT

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Abstract - E-Learning is defined as an Electronics learning the usage of computer and internet technology to deliver a broad array of solutions for learning through the computer. Many educational institutions are using e-learning because it is an effective method when compared to the traditional methods at a lower cost. E-Learning i.e. Electronics Learning is a type of education system through the internet for Teaching and Learning. E-Learning is referred to the use of networked Information and Communication Technology (ICT) in teaching, delivering and learning in education anytime and anywhere. With the progress of ICT (Information Communication Technology), another term developed in the already flocks e-learning landscape: Massive Open Online Course (MOOC). At present NPTEL, MooKIT, IITBX, and SWAYAM are the platforms used in India by using the Internet for offering courses. The main aim of this paper is also to give a brief idea about Edusat, and MOOCs and its current scenario in India with a discussion of their features. The aim of this paper is to give a brief idea about EDUSAT and the development of MOOCs and its future and current trends in respect to India.

Keywords: EDUSAT, MOOC, NPTEL, ISRO, Satellite, ICT, e-Learning.

I. INTRODUCTION

EDUSAT launched by Indian Space Research Organization in Sep. 2004 was Indian’s first thematic satellite dedicated exclusively for educational service to provide distance education service to reach of the unreached areas of India with a total investment of Rs. 549 crores. Information technology also known as ICT is commonly referred to the branch of Engineering. It involves the use of computers and software to operate and manage information ICT deals with the storage, data transmission, manipulation of data and retrieval. Information Communication Technology (ICT) is the use of computers and computer network in various fields including education and also other technologies that are used to distribute communication and information such as telephones, televisions, mobile phones, multimedia, Bluetooth and other telecommunication equipments in general various scientific and technological application like mobile communications, Direct-to-Home services, meteorological observations, telemedicine, tele-education disaster warning, ratio networking, search and rescue operations, remote sensing and scientific studies of the space. Information and Communication Technology developed after the development of the Space Launch vehicle and Satellite.

The course on Massive Online Open Courses MOOCs is delivered online and accessible to all for free. It is designed for large numbers of participants that can be accessed by anyone anywhere as long as they have an Internet connection. A lot of opportunities have knocked on the door for Massive Open Online Courses. The term MOOC was obtained in 2008 by Dave Cormier of the University of Prince Edward Island and Bryan Alexander of the National Institute for Technology in Liberal Education. The
The vast interest of the public for MOOCs took after later in 2011, with an open online course in pretended understanding by Stanford University and Massachusetts Institute of Technology (MIT). This course entices over 160,000 students from more than 190 countries. Fig. 1. explains the details about the process of e-learning.

**Fig. 1: Process of e-learning model. Source:**

**II. SPACE LAUNCH VEHICLE**

Both solid and liquid propellants are used in rocket engines. The larger and long rockets are generally liquid-propellant engines whereas the smaller ones are solid-propellant motors. In hybrid type, solid fuel is used with a liquid oxidizer and vice-versa. Conventionally liquid-propellant rockets are known as “Engines” whereas the solid-propellant types are referred to “Motors”. Rockets take the spacecraft or satellite where they need to go into space. Launch vehicles, in space flight, are a rocket-powered vehicle used to transport a spacecraft or satellite into space.

The minimum velocity of 28,000 km/hr. is required for a spacecraft to reach beyond the earth orbit for launching the lunar vehicle. The development of the launch vehicle program was initiated in the early of 1970s and in 1980, the first experimental Satellite Launch Vehicle (SLV-3) was developed in India. From SHAR Centre of Sriharikota, India’s first experimental satellite launch vehicle was successfully launched on July 18, 1980 (SLV-3).

The second-generation Augmented Satellite Launch Vehicle (ASLV) was developed for launching the smaller satellite and it was configured as a five-stage, all-solid propellant vehicle, with a mission of orbiting 150 kg class satellites into 400 km circular orbits. The third-generation rocket Polar Satellite Launch Vehicle (PSLV) has four stages using hybrid rocket engines as solid and liquid propulsion systems alternately and this PSLV was capable of launching 1600 kg satellites in 620 km in geosynchronous polar orbit.

**III. GEOSYNCHRONOUS SATELLITE LAUNCH VEHICLE FOR EDUSAT LAUNCHING**

EDUSAT was launched by the flight of ISRO's Geosynchronous Satellite Launch Vehicle of the fourth generation launch vehicle. GSLV can also be used to launch a variety of spacecraft capable of performing communication, navigation, earth resource survey and LEO missions. The Geosynchronous Satellite Launch Vehicle (GSLV) is used to launch the INSAT–II class of satellites (2000 – 2,500 kg) into Geosynchronous Transfer Orbit (GTO). The 1950-kg satellite was lofted into an elliptical geosynchronous transfer orbit looping from 180 km at its closest point to 35,985 km. Its orbital inclination was 19.2 degrees to the equator. It matches Earth's rotation and appears parked above 74
degrees East longitude over the equator, and be co-located with the Indian KALPANA-1 and INSAT-3C satellites. **Figure 2 shows the GSLV While Launching EDUSAT.** The GSLV is a three-stage vehicle with a height of 49 meters. The first stage, GS1, comprises a core motor with 138 tonnes of solid propellant and the second stage has 39 tonnes of the same hypergolic liquid propellants. The third stage (GS3) is a cryogenic stage with 12.5 tonnes of Liquid Oxygen and Liquid Hydrogen.

![GSLV F1 IGNITION ON](image)

**Fig.2: GSLV While Launching EDUSAT**

### IV. SATELLITE WORKING PRINCIPLES

A communications satellite is a wireless communication device and it is a type of artificial satellite that is placed in Earth’s orbit that uses a transponder to send and receive data from Earth. It is primarily used to redirect communication data from one Earth-based communication for the purpose of sending and receiving communication data between a source and destination. It is used to provide data communication and relaying services for televisions, radio, telecommunication, weather and Internet services. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide. Above 36,000 kilometers from the earth ground, the Geosynchronous orbiting satellites are located which are mainly used for fixed satellite services, namely for broadcasting and for communication. INSAT (Indian National Satellite System) is an example of a geosynchronous orbit satellite. Currently, INSAT-2B, 2C, 3B, and EduSat operate from this orbit. **Figure 3 shows India’s First Education satellite.** In satellite communication, signal transferring between the sender and receiver is done with the help of a satellite.
V. THE FUNCTIONING OF EDUSAT FOR ONLINE EDUCATION

The audio and video signals get beamed to the satellite when the teacher uplinks the station in front of the camera. The satellite sends signals back to the earth. All over India, seven different educational organizations have been provided a bandwidth of the EDUSAT network. Fig. 4, shows the Potential Use of Educational Satellite for various fields. The national beam network operates at Ku-band (14/11 GHz) frequency. One of the transponders of the geostationary satellite, i.e. GSAT - 3, is utilized to operate this broad footprint. Sarva Shiksha Abhiyan (SSA), is used to connect different states in India with the “Education For All Project”. The state Madhya Pradesh has been covered in the Indira Gandhi National Open University national beam. A pilot project was inaugurated to network for 800 primary schools, 100 secondary schools and 75 higher secondary schools with a hub at Sidhi district headquarters.

Fig. 4: Potential Uses of Educational Satellite

VI. WHAT IS A MOOC?

A massive open online course (MOOC) is a model for delivering learning content online to any person who wants to take a course, with no limit on attendance. The massive open online courses designed to attract students in developing countries like India. Fig. 5: Shows the Outline of MOOC Course. This MOOC course offering real-time interactions and solid student support was the key to success. The experience proved successful in other ways as well, creating a powerful and, given the course's size, perhaps surprising connection among the students, instructor, and course team members. At present around 81 million learners of MOOCs. Massive Open Online Courses (MOOCs) have established a
change in inculcation. As per the proclamation of The New York Times and other periodicals, the year 2012 was the "Year of the MOOC"\(^{15,16}\). At present, NPTEL, MooKITT, IITBX, and SWAYAM are the platforms used in India for offering courses.

6.1. OBJECTIVES OF THE MOOC

- Meet the demands of learners and societies.
- MOOCs increase flexibility for learning (for those new learners/students).
- To develop and strengthen the online collaborative education system (MOOCs).
- To expand the level of education institutions in order to boost the online education, so that its benefit to all.
- To empower sustainable development among the youth of our nation.

6.2. MODE OF TEACHING ROUGH THE MOOCS
The following are the four Quadrants approach implies in an e-learning system:

- E-Tutorial might through Video & Audio interaction, Virtual labs, and Animation.
- E-Content may include PDF, e-books, Simulation, etc, wherever required.
- Web Resources that might obtain through e-mails, databases, related links, case studies, and historical articles.
- Self-Assessment might through Assignments, Quiz’s, and discussion.

6.3. POPULAR MOOC PLATFORMS IN INDIA
India has a population with 356 million in the age between 10 to 24 years old. Today, at present India is having a lesser population compared to China and India will continue to have one of the youngest populations in the world till 2030 according to UNPFA\(^{17}\). In a developing nation the greater part of the economies gone in giving fundamental education, health and to protect youth rights. There is a need for more education infrastructure as compared to the developed country, and even it is not possible to enroll every learner on classroom teaching methods. There are also much other reasons too, but it is the responsibility of the respective Govt. to provide the basic infrastructure for education to every citizen. So with the advancement of ICT, the education methods change from traditional to technology-based methods of education i.e. variable. In India, many elite institutions are imparting the courses on MOOCs pattern and as far as enrolments in courses offered by various MOOCs suppliers including edX, Coursera, and Udacity, India are among the main nations. Information Technology also known as ICT is commonly referred to a branch of Engineering involves the use of computers and software to operate and manage information. A satellite works by receiving radio signals sent from the Earth and resending the radio signals back down to the Earth. The Indian government has taken numerous steps to support open education. The objective to prove open resources in the form of e-books, repositories, libraries, etc. Therefore, developing their own platform by government to offer online courses, presently only a few main institutes have initiated to support such steps. Some of the online courses offering by the Institutes are as under:

VII. NPTEL

With the joint activity of the seven IITs (Indian Institute of Technology) and IISc (Indian Institute of Science Bangalore), National Program on Technology Enhanced Learning (NPTEL), project emerge which is funded by MHRD, started in 2003 \(^{21}\). The main aim of NPTEL is to provide quality education to anyone interested in learning from the IITs. Through this NPTEL activity, it offers online
courses and accreditation in different topics related to engineering and science. From Jan- April 2018, 226 courses are offered online in two sessions. The main aim was to create web and video courses in all major branches of engineering at the U.G and P.G. level.

It also initiates the NOC (NPTEL Online Certification) with co-operation of Google and NASSCOM (National Association of Software and Services Companies). As of Aug 2015, 420 web courses and 509 video courses developed and hosted, which can be accessed freely through the website http://nptel.ac.in. The fundamentals goals of the project to bring all the best teachers in the country under one roof of NPTEL and collaboration with IITs/IISc record the lectures and made available to people under the open-source accord.

7.1. THE HIGHLIGHT OF NPTEL
- NPTEL is the largest online repository in the world.
- NPTEL covers all the courses in engineering, basic sciences, and selected humanities and social sciences.
- Online web portal http://nptel.ac.in is viewed by more than 471 million.
- NPTEL is the most viewed YouTube educational channel,
- More than 1.5 million+ channel subscribers.
- More than 404 million+ views.
- More than 56000 hours of video content.
- 52000+ hours of transcribed content;
- 51000+ hours of subtitled videos

7.2. BENEFITS TO STUDENTS THROUGH THE NPTEL
- Exposure to various courses and topics.
- Easy modular course structure
- Helps in In-depth understanding
- Doubts cleared by experienced faculty or sometimes the research scholar.
- Self-satisfaction of learning thoroughly
- Best for the students who want to learn with interest.
- Competitive assignments.
- Subject knowledge and add on to resume.
- If a faculty is available, get help when required.
- Can use college infrastructure for course access.
- Those who are working or employed in industries can get continuous training and updating their knowledge.

VIII. MooKIT
IIT Kanpur entered the MOOC space with a course on Software Architecture for the Arch4Cloud from the department of computer science with the latest telecommunication tools to meet the learner’s need and are also well known for its distinction in education and research during the year 2012. The MooKIT was seeded by initial funding from TEQIP IIT Kanpur. MooKIT is an open-source MOOC Management system designed with usability and scalability in mind. MooKIT is a powerful system that can be used to offer online courses at any scale, from micro to massive. It is designed to offer MOOC (connectivity MOOC). It has been used in 15 courses with about 100,000 registered learners. Following are the key features of MooKIT:
• Flexibility in varying bandwidth, choose the delivery mode as per available bandwidth.
• Need for Interactions – especially, learner-to-learner, content to learner, and learner to contents – enabling the same in the proposed platform.
• Learners are allowed to participate in Twitter or Facebook forums to access.
• The merger of a new language easily.
• Assessments are done through the evaluation of assignments.
• Issue of certificate online.
• According to the need of the students, courses can be Customizable (made).

IX. IIT BombayX

IIT Bombay has developed an IITBombayX is a non-profit MOOC platform by using the open-source platform Open edX, in 2014. National Mission on Education through Information and Communication Technology (NME-ICT), and Ministry of Human Resource Development (MHRD), Govt. of India has funded for the creation of IITBombayX. Currently, IIT BombayX is offering many courses on different subjects with multiple disciplines. IIT BombayX is implemented as the basic version of the blended learning MOOC with the help of the edX organization. Blended learning is a combination of both face-to-face classroom learning and online education methods. The courses of IIT BombayX are categorized as follows:
EduMOOCs,
LifeMOOCs,
SkillMOOCs &
TeachMOOCs.

X. SWAYAM

The SWAYAM (22-24) is initiated by The Ministry of Human Resource Development (MHRD) a major and new initiative called 'Study Webs of Active Learning for Young Aspiring Minds'. SWAYAM provides one integrated platform and MOOCs (Massive Open Online Courses) portal for online courses, using Information and Communication Technology (ICT) and covering all higher education subjects and skill sector courses. To date, more than 39 Lakhs learners have been enrolled in more than 1600+ MOOCs courses that have been run through SWAYAM. 60,000 persons have completed the courses.

Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM), the free online education program initiated by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) started in 2016 with the support of Microsoft covering different discipline i.e. diploma, school level, graduate, postgraduate, law, skillful and other courses keenly able to introduce eighty thousand hours and almost two thousand courses for study. It offers hundreds of courses with transferable credits. Swayam program is designed to achieve the three cardinal principles of Education Policy viz., access, equity, and quality. The course provides high-quality multimedia audio and video content along with textual study material. The courses have been made highly interactive by incorporating discussion forums and self-assessment tests. Anyone interested can also get a certificate after paying a nominal fee and appearing in an exam.

Former President of India Shri. Pranab Mukherjee launched the Swayam and Swayam Prabha. Courses provided via SWAYAM are accessible free of cost to learners, however, learners need a certificate are required to register themselves and completing the course successfully are required to pay a small amount of fee. Right now, the SWAYAM program manages 350 free online courses. For the objective of the advancement of the communication of online courses, e-content and supervise the appraisal measure of courses extent on SWAYAM, the different National coordinator appointed. But, the MHRD
can add the Coordinators according to the growing requirement of courses. So ensure to provide the perfect quality content and made easily available to learners the following coordinator has been appointed.

1. AICTE for self measure courses
2. NCERT & NIOS for school education
3. CEC for Under Graduate program.
4. UGC for Post Graduate program.
5. NPTEL for engineering

XI. CONCLUSION

India is a widely diversified country having multicultural societies and different languages are spoken. One of the major challenges faced by the Indian education system is the mismatch of employer needs and curriculums of education. India is a developing country, and as per the survey by MHRD, Govt. of India there is a need of 6 universities and 270 colleges each and every month to cope with the learning need\(^\text{29}\).

The Edusat and MOOC concept has expanded rapidly over the past few years. The colleges in remote and rural parts should be provided with broadband connectivity and smart classrooms to embed the e-content in teaching. Teachers should be trained to be technology savvy and adapt to incorporate the e-content in the university curriculum. Students should have made aware of the free availability of digital content by organizing special campaigns and promotional events.

Satellite communication technology using EDUSAT is a strong tool for the development of distance education. The nation has emerged as a role model for the rest of the world eager learners by providing a high-quality education system at a lower cost. Students who register for MOOC pursue different goals. There are various MOOC platforms that are being used in India for offering the courses, such as, NPTEL, MooKIT, IITBX, and SWAYAM. According to “Higher education in India: Vision 2030” report India must achieve the target to bring the Indian universities within twenty among the world. Obviously 2030 requires to plan out a model to achieve it otherwise worsens the higher education vision. It’s not premature to say that MOOCs might have an influence on higher education in the long run. Students can visualize the experience as if they take part in it, which helps the learning easier for difficult topics.

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