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Knowledge Creation through NPTEL Knowledge Portal: A Case Study

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Abstract

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Purpose – There is a growing interest among academic institutions in collecting, preserving, and creating value-added services from digital content produced in class room teaching. NPTEL portal plans to build on existing initiatives to create a national level repository of knowledge content. The objective of the study is to determine the extent to which the NPTEL portal is successful in creation, sharing and transfer of knowledge to its viewers in India and abroad.

Design/ Methodology/ Approach – Adopting a case based approach, the field work of this research are based on responses of 2323 engineering student, faculty members, serving engineers across the globe who are regular viewers of NPTEL portal from time to time. A qualitative and quantitative survey has been done which has been analyzed further in light of SAP-LAP and SWOT model.

Findings – All respondents have indicated richness of knowledge content of NPTEL portal and summarizes that its lecture videos and web courses are a good supplement to regular class room education. NPTEL site should be enriched further by adding more quality video courses having laboratory practical knowledge component embedded in it.

Research Implications –To increase respondent's acceptance of NPTEL portal few problems like reducing the video lecture duration to smaller duration multiple strips with suitable searching options be incorporated. In addition to above interactive facilities, more number of animations, PPTs, diagrams, transcripts, syllabus, table of content be embedded in a video course. There is also a growing demand to add more number of technical course.

Research Limitations - Findings are based on a sample of some group of working professionals and students of various engineering institutions who all use NPTEL site regularly. Since, there is no mandatory registration required in NPTEL site a large pool of users could not be trapped for obtaining feedback. The causal effects of respondent's performance after accessing knowledge components from NPTEL portal need to be explored in a future study.

Originality/ Value – Very limited research has been done on NPTEL e-learning portals. This paper is unique in its exploration to the extent of knowledge transfer from the NPTEL portal to its regular viewers. The paper features SWOT analysis and SAP-LAP analysis on feedback received on the NPTEL portal and its outcome might serve as model for an e-learning portal. This paper encourages researchers, practitioners, policy makers, and citizens to consider knowledge portals with pools of educational lectures as the most viable supplement to regular classroom education. KM Implications for e-learning as well as issues for further research, are outlined.

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Introduction

E-learning through E-portal offers flexibility of knowledge transfer in Higher Education. With the application of technology it is now theoretically possible to take education to all from the most deprived (socially, economically and educationally), disadvantaged (geographically, physically, and gender-wise) to the working professional and disseminate it in anywhere, anytime, anyone (A3) paradigm in a more dynamic, interactive and interesting way (Dikshit, 2006).

Popularity of knowledge sharing concepts through E-learning portals has grown up many fold through out the world. There are many reasons behind its growing popularity and it is estimated that its popularity will grow further. Education through distance education mode requires technology support specially from ICT. There exist many research outcomes to validate this proposition. Technology offers innovative design and delivery of knowledge contents and also for sharing expertise among faculty in different parts of the world. Research suggests that academics have accepted the idea that information technology (IT) can be effectively used for teaching and learning (Gladstone, 2000; Reeder *et al.*, 2004; Weller, 2004). According to Roberts (2004), students increasingly expect the presence and use of IT in higher education (HE). Most of the student communities are now days IT literate and they always find use of IT is most useful in delivery of lecture and they prefer on-line distance education over traditional education. Frand (2000) pointed out that adult learners nowadays are more comfortable working on a keyboard, rather than writing in a notebook, they are happier reading from a computer screen rather than from paper in hands. As per Chaudhury *et al.* (2011), E-learning facilitates better time management and rich learning environment. Research further suggests that learning using IT can be enhanced in all sorts of ways, including hearing, seeing, as well as participating in activities such as a game or quiz (Goodfellow and Lea, 2007; Roberts, 2004). In order to learn more effectively, learning technologies must be fully embedded in a course and students must be provided with the adequate skills and support (Falconer, 2006; Turban *et al.*, 2000).

The implementation of e-learning into existing and new units at Higher Education Institutes is heavily influenced by the institution's ability to deliver knowledge based products. Developing Knowledge Transfer schemes with the aid of e-learning is expensive both in terms of time and money (Owens and McManus, 2004).

Knowledge Management (KM) is understood to be the organizations ability to identify, capture, and retain the tacit and explicit knowledge. KM can be used effectively in e-learning, and it can provide a learning grid to enable the learner to identify the right learning objects in an environment which is based on the learner's context and personal preferences (Lau and Tsui, 2009). NPTEL a web portal of Govt. of India, was initiated to develop web based technology courses catering to the need of students, faculty and working professionals. It utilizes educational technology tools for enhancement of teaching learning process. Faculty members of Indian Institute of Technologies and Indian Institute of Science are the main contributor in terms of developing its knowledge base. This portal is intended for knowledge transfer from the best technology institute in India to outside world and also to bridge the knowledge gap in technology education in India. The portal is a uniform platform of knowledge sharing.

The NPTEL project has two phases. In the first phase (between June 2003 and July 2007), Rs. 20.47 crore have been disbursed among the IITs, IISc and few other Engineering colleges for generating the knowledge pool. IT-enabled learning foster interaction and dialogue between the

learner(s) and the teacher (Goodfellow, 2005) i.e. it creates a better platform for mutual discussion. In the second phase of NPTEL project, MHRD has granted Rs. 200 crore where emphasis will be given for spreading practical knowledge through NPTEL knowledge portal. Almost 215 Engineering colleges are involved in the mammoth activity. The functional model of NPTEL is placed at **Figure 1**

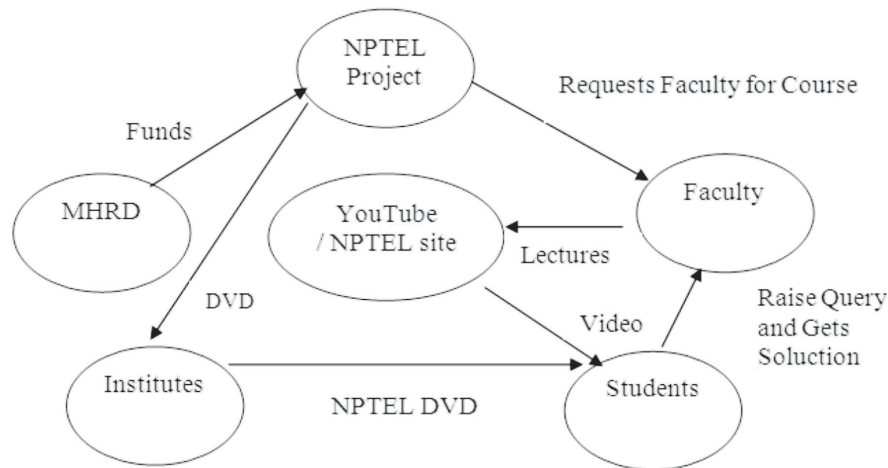


Figure 1: Functional Model of NPTEL

Various authors (Kalkota and Whinston, 1996; Owens, 2002; Owens and Floyd, 2007; Turban *et al.*, 2000) have identified that the internet offers unique opportunities in both teaching and learning applications. A recent survey (Student Expectations Study, 2007) reported that, many current and prospective students are comfortable with the learning technologies and the new generation of students like to see the concrete benefits of technology usage and implementation. Thus it can be seen that e-learning is moving rapidly from the margins to being a predominant form of post-secondary education in the USA. Similarly, a phenomenon growth of e-learning is visible in European Union. There exists no anomaly in Indian higher education too. Adoption of e-learning has increased many fold in India.

Pilot studies on Indian distance learners revealed that it was preferred over face-to-face contact between the teachers and learners (Bansal and Rao, 2006).

A revolutionary development in computer assistant learning came with the availability of Internet in 1996 (Bates, 2008, Paul and Brindly, 2008). Developed countries such as England, Germany, the US and others have gradually integrated information technology (IT) into educational settings as well as corporate settings to support teaching and learning since the 1980s (Herman and Kirkup, 2008; Starr and Milheim, 1996). In developing countries, such as India, Taiwan, e-learning has gained public awareness in recent years through its recognition of educational resources for school teaching, learning and corporate training.

Methodology

Methodologically, the paper is based on evaluation of NPTEL portal in terms of its creation and delivery of knowledge with particular reference to the qualitative analysis of evaluative strengths, weakness, opportunities and threats (SWOT) and Situation, Actor, Process, Learning, Action and Performance (SAP-LAP).

Now a days, SWOT analysis is widely used as a managerial tool in strategic management. One of its basic advantages is that it is easily understandable by users (Sherman, *et al.*, 2006). The comments of the respondents were analyzed using processes such as data organization and reduction. In data reduction, the data material was simplified and categorized in order of importance.

The SAP-LAP methodology has two phases and it provides a basic framework that can be effectively applied to develop either generic or specific models of inquiry (Sushil 2000). SAP-LAP analysis could be an ongoing enquiry, where actors consistently evaluate situation then follow processes, take actions, learn from their performances and finally depending on the results of performances either modify the processes or follow the same processes (Majumder and Gupta 2001).

In this study, three instruments have been used for data collection, which are personal interviews with the academic administrators and NPTEL team members, structured questionnaire (with a large number of close ended responses and few open ended responses) and unstructured qualitative inputs based on personal interviews and focus group discussions.

To understand the usefulness of the NPTEL portal and to evaluate its effectiveness a survey was undertaken. A questionnaire was designed and circulated among 115 engineering colleges registered under NPTEL where students and faculty members were found viewing the sites regularly. The questionnaire is placed at **Appendex-1** for reference.

- A total of 2,323 users have given complete responses
- Process of Collecting the Feedback
 - Data is collected from NPTEL users from various locations in India
 - Users of NPTEL DVDs, were sent mailers through Btechguru.com a distribution partner of NPTEL.
 - Online Feedback form was posted on NPTEL Website
 - Publicized the feedback link on Social Networking portals (like facebook, etc.)

The breakdown of respondents is illustrated in **Table 1**.

Professions of the students accessed the NPTEL portal	Total numbers	Percentage (%)
Student	1537	66.2
Faculty	219	9.4
Working Professional	538	23.2
Others	29	1.2

Knowledge Management and E-learning

Peer-to-peer knowledge management tools provide the features for searching, using a workspace, file sharing, content distribution and synchronous communication. Learners can collaborate, exchange, share, distribute and disseminate knowledge with each other. These tools simulate the real learning environment of peer interaction, communication, learning material sharing and group work, so that learners can learn from each other and motivate other learners to learn in this peer-to-peer e-learning environment.

Based on learners' own preferences, learners can select, store, navigate and search the learning

content from their personal repository, so that search time is reduced. Through various collaboration tools, learners can seek other domain experts, or related knowledge, to help them with problem solving. Thus, personal knowledge management tools also assist learners to store and personalize the knowledge as well as to acquire new knowledge through knowledge externalization, internationalization, combination and personalization.

Delivery Mechanism

The course materials developed by the faculty members of IITs, IISc and IIMs are kept in the web-portal of NPTEL for free distribution and at the same time they are also displayed in the www.YouTube. Main technical hub of NPTEL is at IIT madras and they only uploads the courses and at the same time update the site. The site is technically managed by a group of 40 technical project staffs appointed at various nodal centers of different IITs. NPTEL course materials can be collected in three modes namely a) free download from NPTEL website b) can be seen in YouTube or c) it can be purchased from NPTEL office at a very minimal cost. However students can also view and download the knowledge contents directly from the NPTEL site free of cost.

Outcome of NPTEL Project

Under this program in the first phase about 125 web and 130 video knowledge contents have been designed and developed till date for various branches of engineering. Its contents are based on the All India council for Technical Education (AICTE) approved curricula and inputs from some state universities have also been taken. A powerful search engine to search content and keywords will be set up after indexing all video and web courses. Knowledge available around the country and internationally would be available as a usage packages. Encouraged by the tremendous success of NPTEL first phase where 125 web courses and 130 video courses have been developed, Govt. of India further decided to expand the program through the launch of second phase of NPTEL on 11th June 2010 (source : NPTEL website, www.iitm.ac.in/nptel). On successful implementation of second phase by the end of 2012 the portal will host around 900 different courses interestingly these includes subjects like Management science, Nano-Technology etc.

Operational Issues

Students and other knowledge seekers are allowed to raise their query on any topic they have learned. A collection of these reviewed queries along with its answers are posted in the form of Question-Answer Book of that specific topic. A student is allowed to search on a specific topic. This enables visitors a quick access on knowledge repository.

Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis

Strengths

- a) Best technical institutions of INDIA like IITs, IIMs and IISc are the partners of NPTEL.
- b) MHRD (Govt. of India) support in terms of grants.
- c) Flexibility of learning exists, since students can choose any topics of their choice at any given point of time, read them at their own pace and download any course at any given point of time.
- d) Structure of the site is totally user-friendly and the design of the website is such that it helps all the visitors to access any course at its own comfort level.
- e) Web hosting Support from Youtube for hosting NPTEL courses. As per Youtube statistics,

there are 65,73,058 channel viewers, with 94,690 subscribers which is one of the largest (as on 27th Jan 2012).

- f) Large pool of Engineering faculty members with sound intellectual notes contributed for the NPTEL knowledge repository.
- g) No Registration is required to view the video / text contents. It helps in knowledge capture.
- h) A growing middle class in India who gives importance to technical education. As per McKinsey report India's total middle class population comes to be around 150 million (source: http://en.wikipedia.org/wiki/Standard_of_living_in_India, last accessed 27th Jan 2012).
- i) Boom of Information and Communication Technology in India

Weaknesses

- a) One way traffic. Virtual classroom session with two way interaction (both side) can improve popularity of the site.
- b) Non-availability of laboratory training courses is a distinct drawback.
- c) Lack of collaborative learning scope
- d) Non-availability of discussion forum.
- e) Non availability of Glossary: It has been suggested that key terms and abbreviations should be fully explained.
- f) Internet penetration is still very low in rural India (as per Internet and Mobile Association of India report, The Indian internet users are only 5.4 million upto 2010, source : www.iamai.in). Hence reach of NPTEL course are still limited.
- g) Inefficient functioning of the knowledge delivery mechanism.
- h) Lack of personalized monitoring of knowledge gain by the individual visitors.
- i) Lack of bookmark style of navigation: Qualitative evaluation suggests that without appropriate guidelines or tracking of progress it becomes difficult for the students to keep a track of self learning. It was also suggested that at the end of each module there should be quiz questions. A small report may be sent to each visitor through email / SMS automatically on a weekly basis to enable him/her to monitor his of her individual progress.
- j) Lack of Full coverage of contents: Many students suggests that some topics should have been covered more elaborately. In many courses few topics have been kept untouched.
- k) Summary of problem faced by the visitors are summarized at **Table 17**.

Opportunities

- a) Availability of EduSAT the dedicated educational satellite to transmit educational information to mass w.e.f. 2004.
- b) Lowering of cost of hardware and bandwidth.
- c) There is not limit in age, time and place of learning.
- d) A large pool of young talents are eager to help NPTEL in providing support. The survey result states that 2150 respondent out to total 2323 (around 92.6%) are ready to participate in the NPTEL discussion forum to make the knowledge content of the web portal more enriched (**Ref. Table 7**).
- e) High growth of mobile connectivity (The wireless subscriber base was 811.59 million as on 31st March 2011 compared to 584.32 million as on 31st March 2010. It added 227.27

million subscribers in the financial year 2010-11 registering an annual growth rate of about 38.89% (source: www.trai.gov.in). NPTEL courses can be viewed from mobile also.

- f) It is impossible to take down everything that the professor says in class, so the NPTEL is the best supplement to formal education.

Threats

- a) Other countries like US, UK, Germany is giving high importance to knowledge creation through academic Portals. If India does not act at the hour of initiation, then in future we may lose the global share in education market.
- b) Overdependence on technology is a threat since E-learning portals are totally dependent on the ICT.
- c) Growing number of cyber crime is a potential threat for any E-portals. According to the recently released Norton Cyber Crime Report for 2011, 431 million adults worldwide were victims of cyber crime last year. The total cost of those crimes amounts to some \$114 billion (Source: <http://www.ewi.info/statistics-and-cyber-crime-epidemic>, last accessed on 4-Feb-2012).
- d) Risk of technological obsolescence.
- e) Regular students may start thinking that class room education is redundant. Hence students should know very clearly that NPTEL knowledge portal is only a supplement to classroom teaching and discussions and there is no replacement of class room education.

Analysis of NPTEL Portal under the SAP LAP Scanner

Prevailing Situation

Presently India has 544 universities (which consists of 261 state universities, 73 state private universities, 42 central universities, 130 deemed universities, 33 institutes of national importance, 5 institutes constituted under various state legislation). In addition there are 31,324 colleges including 3432 women colleges. and 9,050 ITIs (Source MHRD Annual Report 2010-11).

The size of Indian higher education is 20 Million (which consists of enrolment in universities and colleges is 17 million and 3 Million through distance education). Intake in technical education is around 3.1 Million (which consists of 1.4 Million in degree level, 1.2 Million at certificate level (i.e. ITI) and 0.5 at diploma level) (Source: University News).

India's gross enrolment ratio (GER) in higher education is about 12.6%. Other countries such as the USA (82%), china (23%), and brazil (75%) have much higher enrolment rates. GER in India increased from 5% in 1980 to 12% in 2007 while in the same period china's GER increased from 1% to 23%. India has taken a number of steps to augment higher education including technical education specially raising the Gross Enrollment Ratio (GER) is target to 30% by 2020 (Saleem and Gawali, 2011).

To realize net increase in GER, there has been significant increase in Govt. funding to the higher educational institutions- from mere Rs. 3,294 crore during the 10th plan period to Rs. 46,449 crores during the 11th plan period i.e. there is an increase of almost thirteen times in additional funding in comparison to that of the 10th plan period which is almost close to 1.0 per cent of the GDP from about 0.40 per cent during the 10th plan period (source: www.mhrd.gov.in)

In order to achieve the target of world's average GER of 23.2 per cent, India needs to expand extensively its intake capacity further by strengthening the existing infrastructure of the existing universities and colleges on a good scale besides establishing new institutions in large numbers.

According to a report by NASSCOM, only 15% to 20% engineering graduates in India are employable only 10 per cent of fresh graduates in India are employable (source: www.nasscom.org). Same is the case with management graduates, only 23 per cent of the MBA qualifiers are employable (Source: a study made by Merit Trac – an independent assessment company Ref. http://www.merittrac.com/MBA_talent_pool_report.pdf). Hence there is a need for supplementary support to the students of higher education in India.

India has 300 Million unemployed people who have no skill-sets whereas employers face huge shortage of skilled manpower (Om Vikas, 2011). India's total faculty strength is around 6.99 lakhs (1 lakh in universities and 5.99 lakhs in colleges.). Still there are acute shortage of manpower in higher education (around 45% posts of Professors, 51% posts of reader and 53% posts of lecturers are lying vacant. Source www.ugc.ac.in). Such a huge shortage of faculty is difficult to remove. A credible alternative may be the use of teachers and make them available to all using the capabilities of ICT and NPTEL is a platform for the said purpose.

There exists a huge gap in the quality standard of higher education as per NAAC standard and the present scenario. The key findings of the first NAAC assessment and its analysis are summarized in Table – 19. The assessment was conducted on 123 universities and 2956 colleges across India. 60% of these institutions were private, the rest are government run.

In the 1970s and early 1980s, close to 10% of engineering graduates came from the IITs; this has dropped to below 0.5% today (source : Prof. Kakodkar committee report, MHRD, Govt. of India, www.mhrd.gov.in) i.e. majority of engineering graduates are coming from Non-IIT system.

Women enrollment in higher education is only 18.45% in India (sources: University News). There is a problem for women to maintain continuity of formal education due to many social obligations. Here on-line education through knowledge portals plays a very important role in getting higher education for the women with ease.

In the year 2008-09 total enrollments in distance education were 16.5 lakhs and women enrollment were 38%. In the year 2009-10, distance education institutions recorded an enrollment of 21 lakh students out of which 43% of them are women (Source Annual Report of MHRD, Govt of India). Hence Indian women are taking the advantage of distance education in India to overcome the continuity of formal education. The proportion of our population, in the age group 18-24, that enters the world of higher education is around seven per cent.

Hence it is evident that in spite of huge investment by the Government in education India's GER is still much lower than world's GER. Employability and quality of education is very low. Distance education appears to be the most viable option to enhance GER.

Main Actor

Institutional Infrastructure: Most of the private engineering colleges in India does not have well equipped laboratories. Situation is very poor in private engineering colleges. Knowledge repository of NPTEL portal can be used by the institutes as a supplement to offer quality knowledge to its students. In the survey conducted, 1185 respondents (51%) stated that the audio / video quality of the course are "Very Clear or above", 652 respondents (28%) stated that the quality is "average" (Refer **Table 8**) i.e. the knowledge reach of NPTEL is quite high.

Govt. of India: The growth of Indian higher education system require adequate funds. Only 0.37% GDP are allocated by the Govt. to higher education which is much lower than USA (1.41%), UK (1.07%), Canada (1.88%), China (0.5%). This is insufficient for establishment of Knowledge Management (KM) infrastructure in Indian Universities (Source: www.nationmaster.com).

Faculty: Most of the private engineering colleges do not have sufficient faculty members. Moreover faculty members from reputed Indian Institutions fails to extend quality support to the industry due to lack of knowledge management (KM) infrastructure. NPTEL portal of Govt. of India helps in distributing quality knowledge of the experienced faculty members of IITs and IISc's to the mass and it may supplement inadequacy of quality faculty in Engineering education in India and abroad. (www.iitm.ac.in/nptel). With the help of ICT, a faculty member of NPTEL knowledge portal can address unlimited number of students. The survey result shows encouraging result. 46% respondents stated that the explanation provided by the faculty members in NPTEL site are "sufficient" or "More than sufficient" (Refer to **Table 6**). Total 1906 respondents (82.1%) stated that the subject depth in each topic covered are of high standard (Refer **Table 4**).

ICT : One of the policy decision of Distance Learning Division of the department of higher education, Ministry of Human Resources Development, Govt. of India is to exploiting the potential of Information and Communication Technology (ICT) in the teaching and learning process (Source : <http://education.nic.in/dl/PolicyDraft-DL.pdf>).

Open and Distance Education (ODE) institutions have been created under National Mission on Education through Information and Communication Technology. Its objectives are to build connectivity and knowledge network among and within institutions of higher learning in the country. The NPTEL survey results depicts that 713 respondents (30.7%) have already completed 30% of the course viewing, followed by 633 respondents (27.2%) who all stated that they have completed 50% of the course study, 490 respondents (21.1%) claimed that they finished 70% of the course. Finally 219 respondents (9.4%) claimed that they have completed 100% course study and looking for more such courses. The above statistics provides very encouraging figure of supplementary learning through E-learning portal of NPTEL.

Curriculum Design: A common curricula which caters to the syllabus of most of the Engineering colleges was a big challenge. The NPTEL survey depicts that 1720 respondents (74%) confirms that the NPTEL syllabus is nearly 80% or more near to its Engineering college syllabus.

Foreign Universities: A large number of foreign universities offers E-learning courses and many of them are very popular. Virtual university models supported and developed by Carnegie Mellon University (CMU), Pittsburgh, USA, MIT OCW, Commonwealth of Learning, British Open University, Australian Open Universities and Digital Library initiatives etc. are most popular Web-enabled course. Unless the NPTEL initiative of Govt. of India becomes very popular and captures a large market, there is a chance of threat of losing a large market share of E-learning. NPTEL statistics states that viewers other than India (80%) are mainly from USA (14.66%). Rest viewer countries (4.71%) are UAE, Saudi Arabia, Singapore, Australia, Canada etc (source. www.iitm.ac.in/nptel).

KM Infrastructure of National Mission on education through ICT: It has established a strong communication network between institutions of Higher learning. The major components of connectivity are:

- I. Communication and storage servers at 100 institutions
- II. EduSAT teaching hub at each of the 100 Central institutions with Satellite interactive terminal at each of 18000 institutions to be connected.
- III. 2000 nodes for 1 Gbps connectivity at each of the 100 central institutions to be connected through BSNL, Internet, VPN etc.
- IV. Six uplinking hubs for 6 national beam transponders of TeuSAT Plan

- V. Provision of 1000 DTH channels for Eklavya and other video based programmes including IPTV for e-learning
- VI. Provision of 100 PC in 18000 institutions of Higher learning @ 1 per faculty member on 50:50 cost sharing basis.

Process of Knowledge Creation through NPTEL Portal

Knowledge creation through NPTEL knowledge portal: The knowledge portal of NPTEL have created a impact on the technical education system in India in terms of acceptability among the students and academic community. The contents are freely available to all. The contents once prepared are continuously being enriched due to contribution from all its stake holders namely student, faculty, working professionals etc.. Till date more than 1260 courses of 40 hours each (260 in Phase-I and 1000+ in phase – II) are available on-line covering most popular disciplines of technology and management (Source : <http://nptel.iitm.ac.in>, last accessed 14-2-2012). The number of viewers to this website has been seeing a steady increase on a daily basis and the trend is only likely to continue.

Knowledge conversion from Tacit to Explicit: Faculty members shares its life long learning on a specific subject or topics through its 40 hours lecture which are permanently stored in the NPTEL portal. Thus the tacit knowledge of an expert faculty member gets converted into its explicit form. E-learning is a valid approach to turning tacit knowledge into explicit knowledge and sharing it (Camison *et al.* 2009). Lectures delivered by experienced faculty members on a specific topic are captured here. Both the video, text interaction with students through question answer session modes offers sufficient opportunity to convert the tacit knowledge of a faculty into its implicit form. A faculty member of IIT Delhi stated “I have kept my life long learning at NPTEL portal”.

Knowledge sharing: Computer as a learning tool promotes interactivity in teaching-learning. ... Internet combines various media technologies and creates a new virtual world. It has now emerged as the most successful education tool because it offers a global open platform for information storage display and communication (Chaudhury *et al.* 2011). Knowledge sharing can bring about enhanced effectiveness (Gupta & Govindarajan, 2000). Ideas breed new ideas and shared knowledge stays with the giver while it enriches the receiver (Davenport and Prusak, 1998). The survey results depicts that around 66% of NPTEL viewers are students, followed by 23% of working professionals, and 9.4% faculty members (Refer **Table 13**). The **Table 12** shows that its 85.4% visitors views the portal at least once in a week. Based on Youtube statistics, till date total channel views are 66,63,379 and total subscribers are 96,807 (Source: <http://nptel.iitm.ac.in>, last accessed 14-2-2012).

Knowledge retentions: The comments and answers to the queries raised by the viewers are permanently available in the site and thereby it enhances the knowledge scope. Permanent availability of more then 1200 video courses along with comments of users provides a solid case of knowledge retentions.

Knowledge mentoring: A growing number of corporations and businesses are discovering that e-mentoring are a cost-effective way to improve the effectiveness of distance training and education even while cutting training staff and training budgets (Jossi, 1997). Students who are raising any query on a NPTEL course are answered by the mentors / author. The mentoring process helps the student in knowledge gain and the interactions between them are recorded in the portal which can be used by the next person visiting the same course.

Knowledge Transfer: Research indicates that E-Learning is perceived as a key enabler to

knowledge transfer within the Higher Education sector (Hannon and D'Netto, 2007; Owens, 2002, 2006; Macfadyen, 2005; Wang and Ahmed, 2003). Popularity of NPTEL site among the students community has enhanced many fold. Refer to **Table 9** of the survey result, which depicts that 57.7% students have already completed 50% or above of NPTEL courses relevant in their areas.

Learning Issues

There is a continuous demand for inclusion of new courses in the portal. E-learning attracts people from all works of life. **Table 15** provides complete distribute of students perception on the purpose of viewing the NPTEL website. Viewers of NPTEL have diverse interest for which they view the portal for technical knowledge gain. **Table 3** illustrates that 64.39% people visits the NPTEL mainly due to have interest in the subject followed by 53.5% for academic interest. 36.89% are preparing for competitive examination and lastly 19.41% are preparing for interview.

Survey results proves that NPTEL is a highly knowledge rich portal with 82% of its viewers grading it high standard or above, 36% says it is very high standard and 46% rates it as high standard (Refer to **Table 4**). Only 15% have ranked them as average.

NPTEL course outline matches with the technical syllabus followed in most of the Engineering colleges (Refer to **Table 5**). Interestingly the similarity of syllabus can be further established with other countries as well for example, 61% people in US stated that 80% NPTEL syllabus matches with US university syllabus, 83% Pakistan citizens stated that 80% NPTEL syllabus has similarity with their university syllabus.

The responses of NPTEL viewers on the quality of explanation provided by the faculty members are mixed. 46% viewers are with the view point that quality of explanation is sufficient. 19% stated that concepts are 50% understood (refer **Table 6**). Around 92% viewers agreed to contribute for the growth of NPTEL portal by the way of participating in the discussion forum (refer **Table 7**) which signifies the interest generated among the users community to make the NPTEL as a successful e-learning portal. 97% viewers are with the opinion that audio/ video quality of the NPTEL portal are clear or better (refer **Table 8**) which helps in smooth transfer of knowledge.

Suggested Actions

Comments of 1293 respondents have been further analyzed on the problem faced by the NPTEL viewers. For these 1293 cases online submit timestamp have been received out of total 2323 responses. All of them appreciated the effort of Govt. of India for creating the knowledge pool but they also provided many suggestions for improvement. The problems identified by the users group have been classified in nine distinct groups and its summary is placed at **Table 16**. Some distinct comments received from survey are furnished below:

- (a) NPTEL courses are in high demand and more and more courses on diverse field should be added. Around 313 respondents suggested that NPTEL should add more number of courses.
- (b) More and more web courses should be made available in its PDF and DOC format.
- (c) Video courses may be broken down into smaller duration courses for better flexibility and accessibility.
- (d) There is a demand to add more number of laboratory courses.
- (e) NPTEL should emphasis to have quality courses on Numerical Analysis.
- (f) A large number of respondents have complained about low downloading speed and if possible

download through torrent software be allowed.

- (g) There is a demand for “Discussion Forum”, where viewers should be allowed to interact with the faculty members and its course mentors.
- (h) Few users have observed that pace of delivery of lectures by the faculty members is a problem. Few says they are very fast but many of them says they are slow in delivery.
- (i) For better knowledge delivery following are some suggestions :
 - (i) Each video course should have a table of contents.
 - (ii) Search option should be inbuilt in the system.
 - (iii) Each course should have a predefined syllabus and brief note on each course should be available. In addition to above each video course should also provide a list of questions and answers and reference course materials.
 - (iv) Add more and more examples, diagram and animations for better clarity.
 - (v) Faculty should refrain from using PPT while delivering a lecture.
 - (vi) Few courses are backdated.
 - (vii) Transcript of each video courses be provided for better clarity and understanding.

Expected Performance

Growth of NPTEL viewers: Viewers of NPTEL has increased manifold over the years. Survey result depicts that there is a growing demand for more and more NPTEL courses. There has been significant increase in number of technology courses and its growth in diversified fields has created exponential demand for more web based courses. The overall growth of NPTEL is summarized at **Table 18**. Users of NPTEL are growing everyday.

Overall improvement in quality of Knowledge Transfer in technology education through distance mode: The survey result of NPTEL viewers shows that its visitors are happy with the various quality aspect of NPTEL portal. **Table 2** indicates that 60.8% visitors views more than 3-5 courses at a time. Visitors views the portal for all kind of purposes like preparation for examinations, for academic interest, for interest in the subject or for interview preparation purpose (refer **Table 3**). 82% of its viewers rates that the knowledge standard of the portal are “High standard” or above (refer **Table 4**). 74% of its visitors indicates that NPTEL portal follows almost 80% of its university syllabus (refer **Table 5**). 46% of its viewers indicates that quality of explanation provided by its faculty members are sufficient (Ref. **Table 6**). 51% of its users are happy with quality of Audio/ video (Ref. **Table 8**). 68% viewers feels that the pace of delivery of lectures are average or above (Ref. **Table 10**). The above statistics indicates the high level of quality of knowledge transfer through NPTEL portal.

Enhancement of ranking of IIT system globally: NPTEL is a brain child of IIT and IISc Bangalore. NPTEL has contributed substantially in the enhancement of knowledge among its viewers and the huge success of NPTEL has helped in the development of brand image of IIT system.

This is expected that NPTEL will be one of the major intervention in enhancing the Gross Enrolment Ratio (GER) of Indian Higher Education by 5 percentage during the XI Five Year Plan period.

Development of knowledge modules having the right content to take care of the aspirations of academic community and to address to the personalized needs of the learners;

Standardization and quality assurance of e-contents in technology education to make them

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world class and finally making its e-knowledge contents available free of cost and finally providing support for the creation of Virtual Technological University.

Developing and maintaining the database with the profiles of our human resources.

The peer group assisted content development would utilize the Wikipedia kind of collaborative platform and to create an Interactivity and problem solving platform through "Talk to a Teacher"

It would also promote open source culture and provide platform for sharing of ideas, techniques and pooling of knowledge resources. Vocational education would be strengthened through ICT and class room teaching would be supplemented.

Quality enhancement of teaching through digital empowerment of teachers would bridge the digital divide and there would be on-line availability of experts and teachers to remove doubts of students.

Table 2: Number of NPTEL Courses Accessed

Total number of Courses accessed.	Total numbers	Percentage (%)
1 Course	445	19.2
More than 1 less than 3 courses	465	20.0
Between 3 and 5 courses	591	25.4
Between 5 and 10 courses	400	17.2
More than 10 courses	422	18.2

Table 3: Purpose of Viewing NPTEL Site

Purpose of viewing NPTEL web portal	Total numbers	Percentage (%) out of 2323
Academic Interest	1245	53.50%
Competitive Examination	857	36.89%
Interview Preparation	451	19.41%
Interest in the subject	1496	64.39%

Table 4: Perception of NPTEL Viewers on Level of Subject Depth

Subject depth	Total numbers	Percentage (%)
Very low standard	24	1.0
low standard	30	1.3
Average	363	15.6
High standard	1070	46.1
very high standard	836	36.0

Table 5: Similarly of NPTEL Syllabus with other University Syllabus

Level of syllabus having similarity with NPTEL courses	Total numbers	Percentage (%)
Nothing common	66	2.8
not much in common	90	3.9
about 50% in common	422	18.2
close to about 80% in common	1201	51.7
more or less the same syllabus	519	22.3

Table 6: Quality of Explanation Provided in the NPTEL Portal

Quality of explanation provided	Total numbers	Percentage (%)
more than sufficient	562	24.2
sufficient	506	21.8
50% understood	446	19.2
few problems left	519	22.3
still have problems understanding the concepts	290	12.5

Table 7: Expression of Interest to Participate in the NPTEL Discussion Forum

Interested to participate in the NPTEL discussion forum	Total numbers	Percentage (%)
YES	2150	92.6
NO	169	7.3

Table 8: Quality of NPTEL Audio / Video

Audio / Video quality parameter	Total numbers	Percentage (%)
not clear	60	2.6
Clear	414	17.8
Average	652	28.1
very clear	666	28.7
excellent quality	519	22.3

Table 9: Percentage of Courses Finished by the Visitors

Percentage of courses finished by the visitors	Total numbers	Percentage (%)
yet to get started	258	11.1
about 30%	713	30.7
about 50%	633	27.2
more than 70%	490	21.1
finished what i have taken and planning to get more	219	9.4

Table 10: Pace at which the NPTEL Portal has can be Accessed

The Pace of Accessing NPTEL portal	Total numbers	Percentage (%)
very slow paced	66	2.8
slow paced	677	29.1
Average	938	40.4
fast paced	523	22.5
very fast paced	118	5.1

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Table 11: Number of Times the NPTEL Portal has been Visited

How many times the NPTEL portal were visited	Frequency	Percentage (%)
atleast once a day	694	29.9
about 3 times a week	650	28.0
once a week	638	27.5
atleast twice a month	337	14.5

Table 12: Demographic Analysis on the Profession of the Visitors

Profession	Percentage	Total numbers
Student	66	1537
Faculty	9.4	219
Working Professional	23.15	538
Others	1.24	29
Total		2323

Table 13: Students Feedback on Total Number of Courses Accessed by them

Total number of courses accessed	Total numbers
1 Course	445
More than 1 less than 3 courses	465
Between 3 and 5 courses	591
Between 5 and 10 courses	400
More than 10 courses	422
Total	2323

Table 14: Students Perception on their Purpose of Viewing/ Visiting NPTEL Portal

Purpose of viewing NPTEL portal	Total numbers
Purpose of NPTEL portal viewing.	Total Nos
academic interest(1)	383
academic interest(1), interest in the subject(4)	320
academic interest(1), interview preparation(3)	19
academic interest(1), interview preparation(3), interest in the subject(4)	36
academic interest(1), competitive examinations(2)	103
academic interest(1), competitive examinations(2), interest in the subject(4)	154
academic interest(1), competitive examinations(2), interview preparation(3)	20
academic interest(1), competitive examinations(2), interview preparation(3), interest in the subject(4)	210
competitive examinations(2),	181
competitive examinations(2), interest in the subject(4)	98
competitive examinations(2), interview preparation(3)	25
competitive examinations(2), interview preparation(3), interest in the subject(4)	66
interview preparation(3)	23
interview preparation(3), interest in the subject(4)	52
interest in the subject(4)	560
Purpose of academic interest (1)	1245
Purpose of competitive examinations (2)	857
Purpose of interview preparation (3)	451
Purpose of interest in the subject (4)	1496

Table 15: Descriptive Statistics

	Mean	Std. Deviation
Depth of knowledge	4.17	.805
Syllabus covered	2.97	.753
Whether concepts cleared	2.85	1.372
Percentage covered	2.85	2.263
Pace of lectures	3.35	.808
How many times refer?	1.97	.977
Quality of Video	3.90	.989
Course Accessed	4.52	.500

Data Analysis and Discussions

India is the third largest higher education system in the world after US and China but the quality of higher education is in question since it can not attract even 1% of total global foreign students going abroad (USA, UK, Germany, France and Australia takes the maximum share of foreign students with 25%, 11%, 10%, 9% and 8% respectively).

There exists a large gap in the quality of education imparted in Indian higher education as per the assessment made by NAAC in the year 2007 (Refer to **Table 19**).

The Govt. of India and UGC set an ambitious target for themselves by taking the GER to 15% by the end of the XI plan i.e. 31st March, 2012 from its 10% at the beginning of the XI five year plan i.e. 1st April, 2007. The Govt. of India has set another ambitious target of taking the GER to 20% by the end of the XII five year plan i.e. 31st March, 2017 and to 30% by 2020. Thus about 42 million students will have to be additionally enrolled by 2020 to achieve the target of 30% GER of the increased population.

With the help of formal education system alone it is impossible for the Indian Government to achieve the stiff target set by them. Education through distance mode seems to be the most viable alternative to meet the target. There has been a significant growth in the enrollment in higher education through distance education mode.

NPTEL is probably the best alternative created by Govt. of India to meet the growing demand of technical education which is supplementary to the formal class room education. Analysis of the result of the survey conducted reveals very positive results which are summarized below.

- (i) Based on the data provided in **Table 16** it is observed that the visitors ranked the depth of knowledge provided in NPTEL site as very high with mean value 4.17 in the range of five scales (with 5 as very high standard). Similarly the mean value of the attribute “pace of lectures delivered by the NPTEL faculty” is 3.35 in the scale of five (with 5 as Fast paced and 1 as Slow paced) justifies that knowledge transfer was smooth. The parameter “Quality of Video” with mean value 3.9 (with 5 as Very Clear) also validates smooth knowledge transfer through the portal.
- (ii) 79% respondents says clarity of Audio/ Video are average or above (Refer to **Table 8**). 74% respondents feels that the NPTEL syllabus has similarity with their university syllabus (**Table-5**).
- (iii) 82% of respondents considers depth of knowledge provided by the NPTEL site are “High standard” or above. 46% respondents consider quality of explanation provided by the faculty

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members of NPTEL are “Sufficient” or “More than sufficient” (Refer **Table 4** and **6**). 68% viewers feels that the pace of delivery of lectures by the faculty members are average or above (Ref. **Table 10**).

An analysis of the NPTEL survey on the problem faced by the viewers generated few constructive suggestions like (Refer **Table 17**):

- (i) Request to add more courses, PPTs, PDF, examples etc.
- (ii) Availability of search option with table of content.
- (iii) Reducing the size of large video courses into smaller duration video courses.
- (iv) Improvement of quality of diagram/ video/ audio etc.
- (v) Availability of “Discussion Forum” for direct interaction with the faculty members.
- (vi) Availability of “Question-Answers” along with reference book name will give added advantage to the visitors of NPTEL portal.

Table 16: NPTEL Problem / Suggestions Analysis

Problem Classification	Number of Respondents	Sub-category of problems / suggestions
Knowledge Access	44	Non availability of PDF (30), Non availability of Search option (8)
Knowledge Content	359	Add Course (313), Add lab Courses (12), Add Numerical Courses (7)
Knowledge delivery	6	Pace of delivery is not uniform (6)
Knowledge Index	15	Provide Syllabus, Provide Table of contents, Provide topic wise index, Please add synopsis etc.
Knowledge Sharing	17	Please provide Discussion Forum Contact details of the faculty be provided
Knowledge Supplement	24	Add question answers and Add reference materials.
Knowledge Transfer	67	Add more examples, Add PPTs, animations and diagrams. Add Transcript, Many found lectures boring Many found video size is too large and it is suggested that lectures length should be small.
Methodology	22	Many found syllabus as backdated, Many proposed that faculty should not teach through PPTs.
Technical	256	Many Diagrams are not visible, Many found the problems of download (57) Poor audio/ video quality (140), server problem, text background etc.

Table 17: Growth of NPTEL Viewers

Details of Viewers	As on 15th Sept 2009	As on 5th Dec 2011
Video's uploaded	3,965	5,675
Number of Courses	112	154
Channel Views	14,16,203	63,64,357
Users	21,76,021	44,39,866
Subscribers	23,743	87,966

Table 18: Quality GAP in Indian Higher Education (In Universities and Colleges)

University / Colleges	Quality Parameters	Average in universities / colleges	Bench marks (as in A-grade universities / colleges)	Quality gap
In Universities	Departments per universities	29	34	5
	Sanctioned faculty per universities	287	432	145
	Filled-up faculty position per university	220	329	109
	Faculty members with Ph.D.	158	432	274
	No. of teachers per department per university	8	10	2
	No. of books in library	2,88,913	3,52,886	63,937
In Colleges	Student teacher ratio	27	20	7
	Teachers per college	33	30	3
	Permanent teachers per college	39	54	15
	Ad-hoc teachers per college	9	25	16
	Books per college	11966	15215	3249
	Journals per college	13	22	9
	Students per computer	229	145	84

Source: The results of the first-ever official assessment of the higher education system, conducted by UGC's Bangalore-based national assessment and accreditation council (NAAC), had been presented to Prime Minister Manmohan Singh by former HRD minister Arjun Singh. The assessment was conducted on 123 universities and 2956 colleges across India an estimated 60% of these institutions were private, the rest government run.

Conclusion

Based on the overall assessment and feedback received on the NPTEL portal, following are concluded.

NPTEL is a Indian government sponsored knowledge portal which offers E-learning with flexibility and smoothness. NPTEL helps in creation, sharing and transfer of knowledge. NPTEL portal can help the Government in enhancement of Gross Enrollment Ratio (GER) without substantial increase of allocation of GDP for higher education.

NPTEL brings efficiency in knowledge delivery. The core processes of the portal have been designed in such a way that selecting a specific course becomes easy through its advanced search options. Those institutes which have allowed its students and faculty members to access the NPTEL portal regularly have been benefited in many fold like improvement in knowledge access and academic process. It acts as a supplement to regular education incurred in universities and engineering colleges.

It avoids knowledge loss: Academic knowledge of faculty members from institutes of national importance can be retained in NPTEL portal. Thus retirement or resignation of faculty members will not lead to severe knowledge loss for the institute. Moreover a video lecture is a permanent asset here which is enriched every time.

NPTEL which harness ICT and open educational resources has moved towards a true 'boundary-less' in respect of geography, languages and disciplines; a new education through a new framework.

The result of survey reveals that the level of awareness, usage and rating of e-content of the NPTEL portal are very high. The result is uniform irrespective of its diverse users like engineering students, faculty members of various Institutions and working professionals irrespective of its gender, discipline and geographic location.

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The portal can be made more powerful with addition of “discussion – forum” where a student and teacher can discuss and clarify doubts through face-to-face talk. In addition to above NPTEL should also try to add more and more courses on “laboratory courses”. There is a growing demand for such courses and many of the engineering colleges lacks sophisticated equipments and knowledgeable faculty members to operate them.

Overall rating of the NPTEL portal is very high in terms of quality, faculty, curriculum and presentation. It looks at e-learning and information technology (IT) as tools are near to give one the flavor of the traditional class room learning experience. But from a traditional perspective for the time beings it appears this mode of learning will act only in a supportive capacity to the traditional teaching and learning approach at Higher education. In future, NPTEL may become a standalone programme of study offered by a Virtual University for imparting technical knowledge. This will not be an easy process and it will take some time. It appears that we are standing on the doorstep of revolutionary change and we need to push the door wide open.

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Appendix-1

Questionnaire on NPTEL Knowledge Portal

Respondents background (please tick(-) on the correct column)									
1.	Name :								
2.	Email :								
3.	Phone No. :								
4.	State :								
5.	Country :								
6.	Profession :	Student	Faculty	Working Professional	Others				
7.	Educational Qualification :	BE	BTech	ME	MTech	MCA	BSC	BCA	other
1.	How many courses have you accessed?								
	1 Course								
	More than 1 less than 3 courses								
	Between 3 and 5 courses								
	Between 5 and 10 courses								
	More than 10 courses								
2.	Please give us the list of courses you have accessed.								
3.	How did you come to know about NPTEL courses?								
	Online (google, youtube.com)								
	Through friends								
	Through College								
	Brochures and other print material								
	Workshops and NPTEL stalls								
	Other								
4.	What is the purpose for which you are using NPTEL courses?								
	Academic examinations								
	Competitive Exams								
	Interview preparation								
	Interest in the subject								
	Other								
5.	Was the syllabus taught in the course close to your academic syllabus?								
	Not much in common								
	About 50% in common								
	Close to about 80% in common								
	More less the same syllabus								
	Other								
6.	Would you be interested to participate in Online NPTEL Discussion forums?								
7.	What percentage of the NPTEL courses have you finished?								
	Yet to get started								
	About 30%								
	About 50%								
	More than 70%								
	Finished what I have taken and planning to get more								
	Other								
8.	Did you face any specific problem with NPTEL courses? If so please mention below- suggestions are also welcome.								
9.	How often do you refer to NPTEL website or course?								
	Atleast once a day								
	About 3 times a week								
	Once a week								
	Atleast twice a month								
	Other								
	On a scale of 5 please rate the depth of the subject taught in the courses		1	2	3	4	5		
1.	Was the explanation sufficient to understand the concepts?								
2.	Was the audio, video and text/diagram quality good?								
3.	On a scale of 5, how do you rate the pace at which the subjects are taught in the courses?								