Training of Technical Teachers through Integration of Information & Communication Technology in India

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Abstract

Technology has provided the platform for learning i.e anyone can learn anything, any where any time. The potential of technology was exploited to train technical teachers in order to enable them to understand the quality issues in technical education, plan and deliver instruction effectively, and also to evolve strategies for developing creativity and entrepreneurial competencies among students. About 4689 technical teachers have attended the programme from September 2012 to April, 2013. Four different modalities were used to conduct the programme namely live interaction through videoconferencing and google hang out& pre-recorded video lectures; pre-recorded videos and face- to- face interaction and pre-recorded video lectures only in the northern region of the country. Evaluation of the programme was done by seeking reactions of the participants on extent of achievement of objectives, extent to which their expectations were met, quality of various aspects, problems faced. Their suggestions were also sought to improve the quality of the programme. Majority of the participants have expressed their satisfaction with the programme and assigned ratings on various aspects between 4 and 5 on a five point rating scale. However, the quality of transmission in live interaction remained the major issue. Very little interest has been shown by participants in recorded videos.

Keywords: Technical Teachers Training Information & Communication Technology

1. Introduction

Since independence in 1947, Technical Education System has grown into a fairly large-sized system, offering opportunities for education and training in a wide variety of trades and disciplines at certificate, diploma, degree, postgraduate degree and doctoral levels in institutions located throughout the country. Technical education system in India comprises of 81 centrally funded institutes of National importance including Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), National Institutes of Technology(NITs), Indian Institutes of Information Technology (IIITs), Indian Institutes of Science and Research (IISERs) and National Institutes of Technical Teachers Training and Research (NITTTRs). There are 8536 degree level and 3524 diploma level technical institutions offering courses in Engineering and Technology, Applied Arts and Crafts, Architecture & Town Planning, Hotel Management and Catering Technology, Management, Master's in Computer Application, Pharmacy etc. The intake capacity of these institutions is 23 lakh and12 lakh respectively. Realizing the importance of technical education in the further development of the nation, the Government of India is keen on developing some more institutes on the lines of IITs, IIMs and IISCs.

However, quality of technical education is a major concern with stakeholders. Serious concerns have been expressed regarding the quality of curriculum, instructional processes, evaluation, technical graduates from these institutions, quality of linkages with world of work and feedback. The employability of the technical graduates is declining (McKinsey Global Institiute, 2005; Aspiring Minds, 2010 and Blom and Saike, 2011) and majority of the students are leaving their core branches of engineering and entering into IT and ITeS sector. It has been invariably expressed that graduates from technical institutions lack generic skills and higher order cognitive skills such as ability to analyze, evaluate and create as well as the practical skills. Blom and Saike (2011) and UK Commission for Employment and Skills (2008) advocated for bringing changes in curriculum and teaching learning and evaluation to enhance employability of graduates from technical institutions.

A series of panel discussions were organized by the institute to know the expectations of industry from technical graduates. Panelists included the industry personnel from a wide variety of industries such as automobile, infrastructure, pharmaceutical, biotechnology, electronics and manufacturing. Panelists opined that students lack fundamental knowledge of terminology, concepts, principles etc. in their own disciplines, lack knowledge of current developments in their disciplines and technology, lack practical skills, are unable to read engineering drawings, lack analytical ability, ability to work in teams, willingness to learn, communication skills, managerial skills and creativity, lack positive attitude and have become more materialistic, prefer to look for white collar jobs and prefer to work in IT or ITeS sector and do not continue in the core engineering branches. They suggested that changes should be introduced from time to time in the curricula for enhancing its relevance; industry personnel should be involved in curriculum design; instructional methods such as seminar, group discussion, brainstorming, collaborative project work, and case study should be used to develop higher order cognitive abilities teachers should acquire proficiency in handling practical work and should facilitate the acquisition of skills by the students; projects should be live problems from the industry or the society; structured industrial training should be provided to students;

teachers also need to be provided industrial exposure and training to enable them impart more practical knowledge to students and industry and academia should work in close collaboration Industry must support the institutions in providing training places for both students and teachers, contribute to R&D and establish or create laboratories at institution level (Tulsi and Poonia , 2013).

Teachers are the backbone of the technical education system. Quality of instruction, to a large extent, depends upon the competence, commitment, and resourcefulness of teachers. Knowledge explosion leading to decline in the shelf values of degrees, rapidly changing technology, modern communication revolution and rapidly changing structures, processes and procedures in the world of work demand that teachers must update and upgrade their knowledge on a continuous basis. However, during the last two decades with proliferation of technical institutions, many fresh graduates have been inducted into the system and they though possess the subject matter knowledge but lack knowledge of pedagogy or andragogy. In addition to this, lack of industrial exposure is a serious concern to provide effective instruction and optimize learning to students.

Minister of Human Resource Development has announced National Mission on Teacher and Teaching during Twelfth Five Year Plan to improve quality of higher education in the country. During recent past, different approaches have been tried to train teachers in masses as per the mandate of the Ministry of Human Resource Development, Government of India. In this series, A-VIEW software has provided a rich interactive environment for e-learning. It has provided seamless connection among different colleges spread all over the country and the teachers at Indian Institute of Technology (IIT), Bombay. In fact, it was virtually a classroom with each remote centre functioning as a student entity. This facilitated each remote centre to follow the chat session with every other remote centre, thus providing a virtual class room spread over the entire country. Indian Institute of Technology, Bombay used both satellite (EDUSAT) and internet technology to reach out to a large number of college teachers through thirty remote centers. About 93% of the teachers were introduced first time to new teaching aids and technology (MOODLE and clicker). Survey findings indicated that 43% of the respondents said that the overall experience was excellent and 52% rated the experience as good. 90% of the teachers agreed that they would adopt the teaching material and methodology in their teaching (Kannan and Narayanan, 2010).

Capper (2000) reported the major findings of three case studies conducted with the support of World Bank Info Dev Programme intended to document various models of teacher training and technology. Armenia's The Three Pomegranite Network (3PN), a global online learning programme connected Armenian students and teachers through out the world by engaging them in collaborative project based learning. It led to the conclusion that this could be the cost effective approach to training teachers than face-to-face particularly when large number of teachers were involved. The two case studies in China focused on use of television as one of the delivery modes to provide in-service training to teachers. Both studies found that TV programmes were seldom used and teachers preferred direct review of the material due to pressure of passing an examination at the end of each year of coursework. It was found that teachers lived quite a distance from the study centres and did not have time to go to study centres.

Video tapes were expensive for teachers. National Institute of Education, Singapore was able to integrate the use of information technology in their pre-service teacher training programme due to availability of adequate resources and clear direction from the top.

2. National Institute of Technical Teachers Training and Research

National Institute of Technical Teachers Training and Research (NITTTR), Chandigarh, an ISO 9001-2008 certified institution, was set up in the year 1967 by MHRD, Government of India to bring qualitative improvement in technical education especially in the northern region of the country. The other three institutions catering to eastern, southern and western region of the country are at Kolkata, Chennai and Bhopal respectively. Recognizing the contribution made by the institute in improving quality of technical education, the institute was accorded the status of National Institute in the year 2003. The broad objectives of the institute are:

- To provide professional education and training for teachers of Engineering and Technology disciplines in technical institutions for advancement of learning towards promoting excellence in technical education and industry
- To strive for continuous improvement in instruction and research in engineering and technology and research in management of technical education
- To actively support the growth and quality improvement of technical education in the country through involvement in activities at national and state levels

The institute caters to the needs of education and training of faculty and staff, curriculum development, instructional material development, and research and development of technical institutions (both degree and diploma level) in the northern region and thus the clientele of the system consists of the following eight states and a union territory: Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand and Chandigarh . In addition, the institute is catering to the training needs of industry in the region.

The institute undertakes the following six major activities to cater to the needs of clientele system:

- Education and Training Programmes
  - Long Term Programmes
  - Short term Programmes
- Curriculum Development
- Instructional Material Development
- Research and Development
- Extension Services
- Consultancy in Technical Education and Technology Areas

The institute offers long term programmes (ME/MTech) in six disciplines namely: Engineering Education, Computer Science and Engineering, Construction Technology and Management, Instrumentation and Control, Electronics and Communication Engineering and Manufacturing Technology. The programmes are offered through

regular contact mode and on modular basis. Fifty six students are pursuing PhD in various disciplines of engineering and technology. The institute offers short term courses of one to four weeks duration in a wide variety of areas. About 400 short term courses are organized in a year.

3. Training of Technical Teachers through Integration of Information and Communication Technologies

In the year 2012, MHRD, Govt. of India assigned a mandate of training 20,000 technical teachers in the region to the institute. The objectives of the programme are to enable the participating teachers to understand the quality issues in technical education, understand the process of planning and delivering effective instruction, evolve strategies for developing creativity and entrepreneurial skills among students and understand the process of generating video lectures and integration of those in teaching learning.

The institute has been training technical teachers through face-to-face contact mode since its inception. The institute has one of the largest set-up of Education Television Studio in northern region with latest equipment as shown in Fig.1. The department has all the facilities and resources (human and technical) to offer programmes through video conferencing. Thus, the institute decided to exploit the potential of technology to fulfill the mandate of training 20,000 technical teachers in the northern region.

Fig.1: Educational Television Studio, NITTTR

The minimum facilities and resources, which were required at the technical institutions in the region for networking with NITTTR, are given in Table 1.

Service Provider	Institution	NITTTR, Chandigarh	Google Hangout
▪ TCP ports to be opened Range 60000-64999 ▪ UDP ports to be opened Range 60000-64999 ▪ TCP 1720 to be opened ▪ H 239 to be enabled ▪ H 323 to be enabled	▪ Cabling from gate way(server) to the place (Seminar room) of training without having any router, switches and firewall or any securities in between. ▪ A LCD projector having HDMI input (in case of a normal LCD (vga) a converter is required). ▪ 1 mbps real IP based dedicated bandwidth during the period of the programme. The bandwidth should not be shared. ▪ Ampli speaker for the audience to listen and a good ▪ Seminar room with proper lighting facilities	▪ Video conferencing equipment.	For interaction through Google Hangout: ▪ A laptop with inbuilt web camera ▪ An external speaker (good quality) to listen ▪ An external mike to speak ▪ A good quality LCD projector (HDMI input) to see on big screen. ▪ A good seminar room with proper lighting facilities. ▪ Prefer to have a web cam with inbuilt mic properly installed in your desktop for a better interaction (This is in place of laptop) ▪ Dedicated bandwidth of 500 kbps for Google hangout

Table 1: Hardware Requirements for Video Conferencing & Google hangout

The only limitation of the adopted technology (video conferencing) is the requirement of dedicated 1mbps bandwidth as the transmission is in HD (High Definition-1920x1080P), which is bandwidth hungry technology. Hence, maintaining 1mbps bandwidth was a hard requirement of the network institutes. From September 2012 till April, 2013, 4689 technical teachers participated in the programme.

Since September 2012, the institute started offering programmes through four different modalities:

- live online interaction through video conferencing & pre-recorded video lectures
- live online interaction through use of Google Hang out & pre-recorded video lectures
- face- to- face interaction and pre-recorded video lectures
- use of pre-recorded video lectures only

Live lectures were delivered in the ETV studio of the institute and two to seven technical institutions acted as nodal centres for the various programmes. The potential of social media (Google hangout) has also been exploited to overcome the problems faced on account of limited availability of video conferencing facility and low bandwidth problem at network/nodal centres.

The contents covered in the programme included: Technical Education System: Challenges and Quality Issues, Curriculum Implementation, Teaching Effectiveness, Instructional Planning & Delivery, Instructional Methods-Brainstorming, Case Study and Role Play, e-content Generation and its distribution, Oral Communication, Creativity & Innovation, Entrepreneurship Development & Industry Institute Interaction, NVEQF, Schemes of Community Development through Polytechnics, Mainstreaming Persons with Disabilities in Technical Education, Accreditation Process, Writing Research Proposals and Papers, Sustainable Development and Management Skills. In addition, a panel discussion on the theme 'Expectations of Industry from Technical Graduates' formed a part of the programme.

Programme evaluation proforma was designed and it included various aspects of programme namely: extent of achievement of objectives, extent to which expectations met, experience of participating in the programme, relevance of the contents covered, clarity of objectives, arousal of interest, use of examples, communication skills of presenters, involvement of participants, opportunities to clarify doubts, use of questions, quality of presentation, quality of audio, video, & power point presentations, learning and over all rating. The participating teachers at the end of the programme did programme evaluation. In total, 2000 evaluation proforma complete in all respect were analysed for this purpose.

4. Major Findings

Major findings related to various aspects of the programme are summarised below under the
following headings:

- Extent of achievement of objectives
- Extent to which expectations met
- Quality of various aspects
- Overall rating & Experience of participating in the programme
- Problems faced
- Suggestions provided by the participants

- **Extent of achievement of objectives**

On the basis of analysis of evaluation performa received from the participants, it was found that 35% of the participants felt that 80-100% programme objectives were achieved and 53% were of the opinion that 60-80% of the objectives were achieved. However, 11% and 1% of the participants felt that the extent of achievement of objectives was between 40-60% and 20-40% respectively as shown in Fig.2.

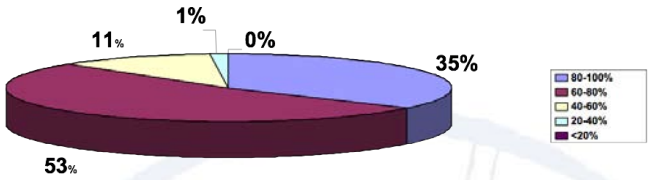

Figure 2: Achievement of Programme Objectives

Extent to which expectations met

84% of the participants opined that programme met more than 60% of their expectations (Fig. 3). Participants felt that greater emphasis could be on teaching and learning.

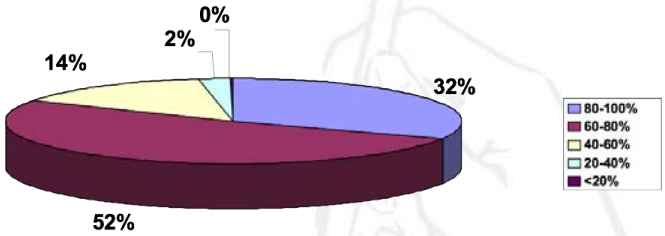

Figure3: Extent to which Expectations Met

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Quality of various aspects of the programme

The quality of various aspects of the programme -relevance of the contents covered, clarity of objectives, arousal of interest, use of examples, communication skills of presenters, involvement of participants, opportunities to clarify doubts, use of questions, quality of presentation, quality of audio, video & power point presentations and learning was rated on a five point scale namely: Excellent(5), Very Good(4), Good(3), Satisfactory(2) and Poor(1). The ratings to various aspects of the programme ranged between 3.69 (quality of video) and 4.31(communication skills of presenters). On eight of the fourteen aspects namely relevance of contents, clarity of objectives, adequacy of explanation, use of examples, communication skills, clarification of doubts, quality of presentation, and learning, the average rating was between 4 and 5 (Fig.4).

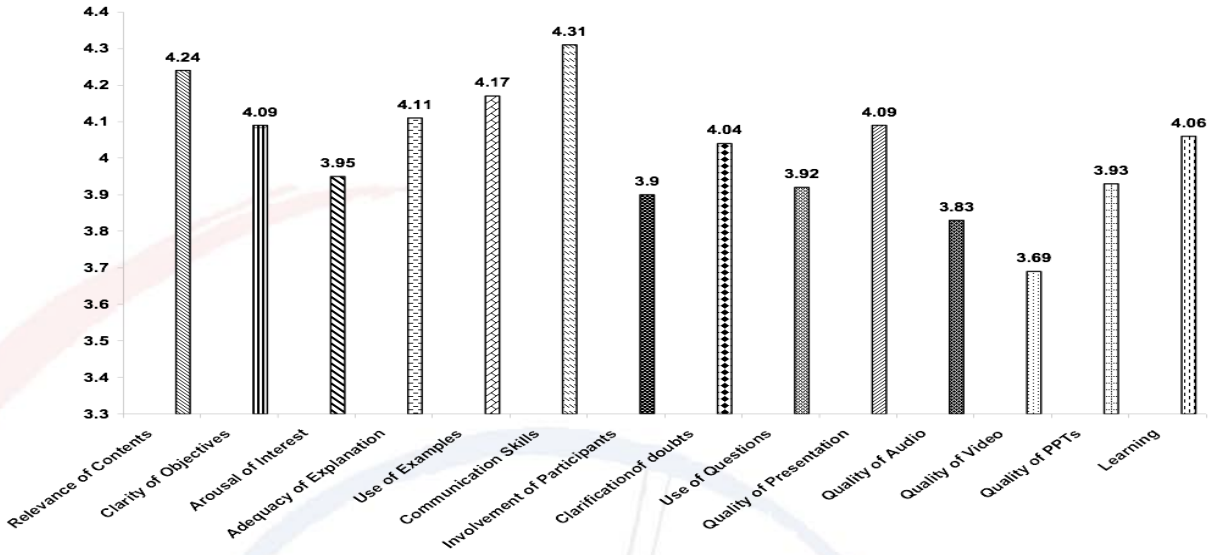


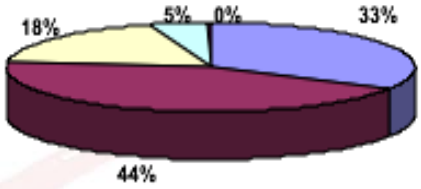
Figure 4: Quality of Various Aspects of the Programme

The problem in the quality of video faced by the participants was mainly due to low bandwidth available at the network centers in the region. At times, the participants were not able to hear audio, see the power points and suggested that quality of power points should be improved and greater involvement of participants should be ensured during sessions.

Participants opined that video conferencing facility helped them in interacting with experts and other technical teachers at different nodal centres. They found the programme informative, interactive and interesting.

Overall rating and experience of participating in the programme

95% of the participants rated their experience of participating in the programme between good to excellent with an overall rating of 4.08 on a five point scale (Fig. 5)..Participants assigned an overall rating of 4.04 to the training programme (Fig.6).



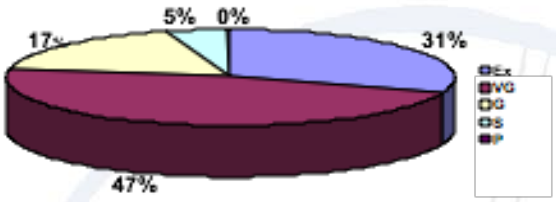


Figure 5: Rating to Overall Experience **Figure 6: Overall Rating to Programme**

Some remarks of the participants

- 'A great learning experience--------'
- 'It was a wonderful experience and will help us to improve teaching'
- 'It was a nice experience . I learnt so many good things that will help me as a teacher'
- 'The programme was well designed and delivered.-----'.
- 'It was one of the best experiences of my life. I have learnt many important aspects of teaching and life'.
- 'Such type of courses must be organized on a regular basis'
- 'Such programmes should be organized in future because it was really very novel and enriching event altogether'.
- 'Overall programme was good. We would like to attend such programmes periodically'.
- 'Looking forward to more programmes to enhance teaching learning process'.
- 'Such programmes are very informative and useful in enhancing knowledge and skills'.
- 'Commendable endeavour-very beneficial'.
- 'Faculty members from remote areas can gain insight and are able to share their views with esteemed experts/ faculty -----and with their colleagues'.
- 'I really felt great after attending the Induction Programme through ICT. I came to know of three pillar strategy of ICT namely transformation, innovativeness and connectivity'
- 'In A class cities and metros, resource persons are available where as in B &C class cities, they are not available. As such, technology is required to share experiences and great ideas with resource persons and implement

logistics in our daily life and take our country on the path of good governance and prosperity'.

Problems Faced

During the conduct of the programme through integration of information technologies, the following problems were faced:

Network Centres

- Availability of low bandwidth of internet
- Frequent breaking up of link during the initial programmes
- Poor quality of audio and video reception
- Power failure at times leading to missing a part of the programme by participants
- Acoustics problem at nodal centres
- Lack of AC in seminar halls
- Lack of eye contact with speaker
- Certain presentations were allocated inadequate time
- Participants at centers connected through Google Hangout were not clearly visible due to fixed position of camera as in built camera of the laptop was used.

Centres where only pre-recorded video lectures were used

- Difficulty faced by participating teachers to view pre-recorded video lectures continuously for six hours a day
- Inability to clarify doubts due to non- availability of experts

Suggestions provided by the participants

Some of the significant suggestions put forth by the participants of various courses include the following:

- Such type of courses should be mandatory for all technical teachers
- Duration of pre recorded videos should be short
- More examples should be integrated in the presentations
- Interaction with industry experts/personnel should be increased
- Involvement of participants should be ensured in all sessions. More time should be allocated for question answer session and discussion. Participants' questions should be adequately dealt with to generate satisfaction among them.
- A copy of DVDs or the course material should be provided to the participants.
- In case of teachers from engineering colleges, more emphasis should be laid on research and development
- Participants were of the opinion that they had a novel experience but also pointed out that face- to- face interaction cannot be replaced. They enjoyed live interaction with experts and not the screening of pre-recorded lectures except a few and thus suggested that face to face interaction or live interaction

with the experts should be preferred over screening of pre-recorded video lectures. If DVD is used, presenter should be available to take on questions from the participants.

- Courses in technical subjects may also be conducted through videoconferencing
- Practical components for sessions like generation of e-content and media tools should also be included in the programme.
- The experts for the convenience of the participants may use mixed language.
- Video conferencing facility should be set up in institutions
- States should be requested to formulate training policies to ensure continuous professional development of teachers.

Conclusions

The feedback has been quite encouraging. On the fourteen aspects of the programme, eight have been rated between 4 and 5 on a five- point scale. It has helped the institute to widen the reach of its programmes and train a large number of teachers in northern region and bring some attitudinal change among teachers regarding integration of technology in teaching learning. Technology has the potential to break geographical and time barriers and allows seamless integration of resources without physical movement of the same. The initiative taken by the institute to offer training programmes through ICT is a step in the right direction as the Ministry of Human Resource Development, Govt. of India has launched a Mission on Teacher and Teaching during the twelfth five year plan and the target is to train teachers through ICT. Technical institutions must take the advantage of National Mission on Teacher and Teaching, National Mission on Education through ICT and National Programme on Technology Enhanced Learning and create networking facilities and share resources and expertise for improving quality of technical education in the country.

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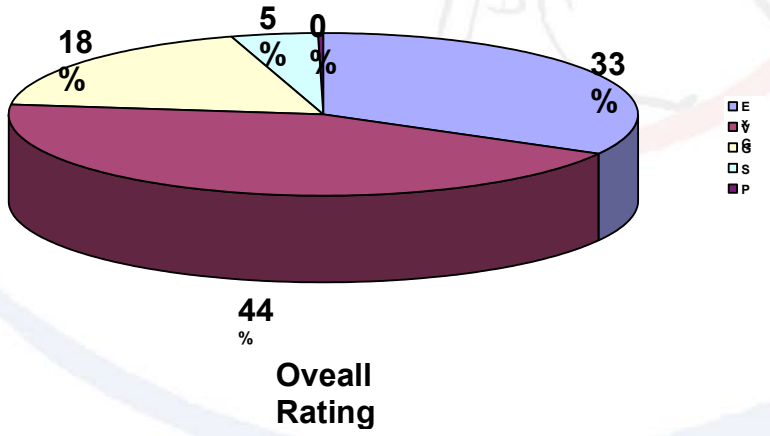

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