Aligning Training of Teachers of Technical Institutions with Outcome Based Education

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Abstract. This study emphasis the need for changing design approach of training of teachers of technical institution for effective implementation of Outcome Based Education (OBE) in India and suggests student focus approach for designing teachers' training for assuring teachers support towards attainment of learning outcomes of student.

Keywords: Outcome Based Education · Four stage framework
Learning-teaching process

1 Introduction

Engineering education is undergoing through transformation from teacher-centric traditional education to learner-centric Outcome Based Education (OBE). Student engagement during instruction is a challenging task for the teachers as envisages in OBE. It is also expected that the technical institutions should be capable of producing graduate engineers with up- to- date technical knowledge and skills along with deep sense of quality, work ethics, motivation, interpersonal skills, team work skills, leadership, critical and creative thinking [1]. OBE demands learners' performance which is the product of ability multiplied by motivation, and ability is the product of aptitude multiplied by training and resources [1]. In the present context of knowledge-intensive and information-driven society, it becomes even more important for faculties to become facilitators of learning in diverse learning situations rather than merely perform teaching in a face-to face classroom situation [2]. Many instructors are unaware that alternatives exist to the traditional lecture based approach with which they were taught. Teachers believe that they are teaching appropriately but poor student performance and low ratings only reflect deficiencies in the students. Equipping engineering students with the skills needed for 21st century learners requires teaching and assessment methods not traditionally found in engineering education and unfamiliar to most engineering educators [3]. This is because, most engineering faculty members were never trained for developing those skills, but they need to create learning environment which will help their students in developing the same. Educational research already established that engineering faculty members who will be exposed to effective training with specific objectives, will be better prepared to conduct classroom teaching [3].

Most of the people learn best when they are actively involved in the learning process. Hence educators of today need to plan a thinking classroom and promote

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active learning. Group learning and collaborative exercises are exciting ways to improve classroom experience of students and thereby incorporating active learning into teaching process. OBE demands long-term, cross-curricular outcomes which are linked with learners' future life. This suggests steps have to be taken to hold great promises for reforming faculty preparatory programmes and to change of mind set and attitude amongst faculty community. Hence, there is a need for changing design approach of training of teachers of technical institutions for effective implementation of OBE in India.

2 Purpose

It is to be observed that, according to the information available with All India Council for Technical Education (AICTE), number of faculty members engaged in self-finance diploma level institute is nearly 1.3 lakhs and that in degree level institute is about 3.5 lakhs whereas nearly 65000 teachers are there in government financed institutes offering degree and diploma engineering programmes [4]. In-service training to the teachers of degree and diploma level technical institutions are primarily conducted by the four National Institute of Technical Teachers' Training & Research (NITTTR) in the country. In 2012–13, Ministry of Human Resource Development, Govt. of India, advised that the four NITTTR's to be ready to train approximately 80,000 polytechnic teachers within a period of six months [5], but up to the academic year 2013–2016, it is observed that only nearly 5% teachers are trained as per annual reports of NITTTRs [6–9].

Short Term Training programmes (STTPs) are presently designed by NITTTR, Kolkata for achieving three main goals viz. improvement of teachers' skills,

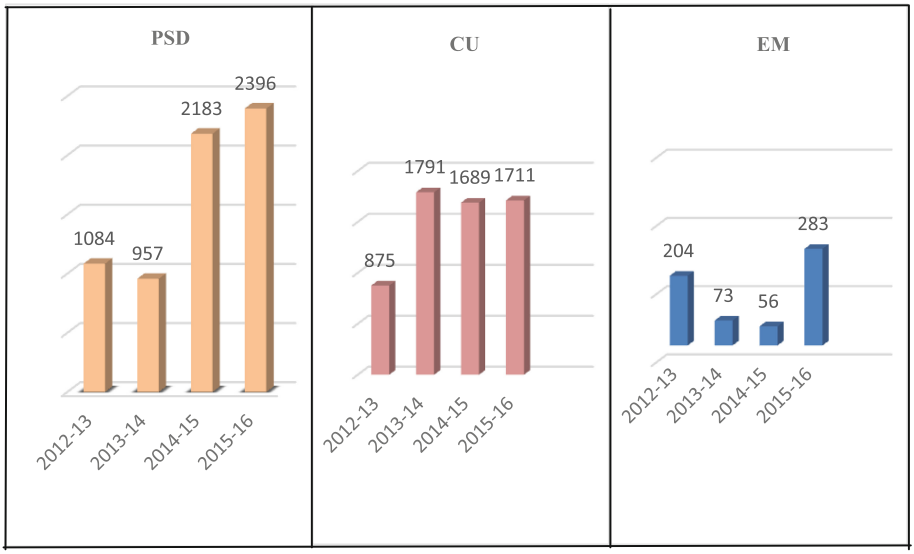

Fig. 1. Training data of NITTTR, Kolkata during 2012–2016

development of teachers' conceptions of teaching-learning and consequent changes in students' learning. These lead to categorise the training programmes into three major areas – (i) Professional Skill Development (PSD), (ii) Content Updating (CU) and (iii) Education Management (EM).

From the training data represented in Fig. 1, it is observed that a high enhancement rate of participation in Professional Skill Development trainings whereas training in Content Updating shows no increment during previous three years and there is an observable enhancement in Education Management areas during the academic year 2015–16.

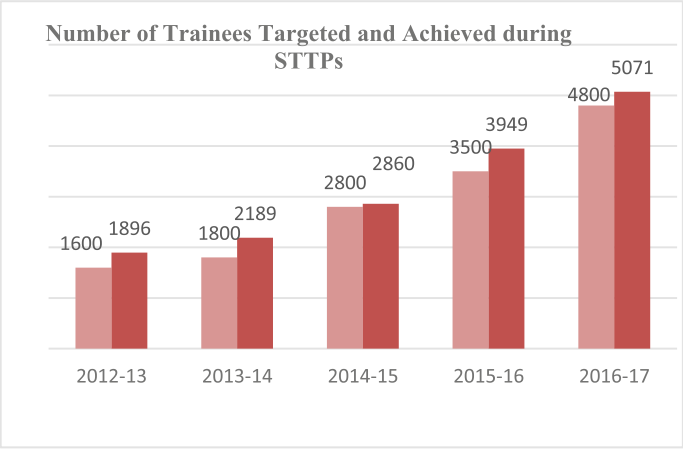

Fig. 2. Overall training data of NITTTR, Kolkata during 2012–2017

In the academic year 2015–16, NITTTR, Kolkata trained 5071 teachers in above mentioned areas. There is about 20% enhan-cement of overall training participation per year as revealed from the training data of last five years as represented in Fig. 2. Teachers experience during training collected through written and verbal feedback, provides a measure of trainees' reaction. It is observed that training programmes are much oriented towards developing specific knowledge of teachers in respective categories and less oriented towards improvement of student learning. This study establishes the need for integrating pedagogical aspects of teaching with content updating while designing STTPs for today's teachers.

3 Approach

In this paper, a four-stage framework as represented in Fig. 3, for designing a Model training programme for teachers of technical institutions has been proposed.

The pre-training stage (stage I) of four-stage framework is designed for baseline assessment of trainee teachers. In this stage, trainee's pre-requisite knowledge on specific content area related to the course along with their concept on why, what and how to teach a specific content is assessed by the trainer in a simulated classroom environment. The task of trainer at this stage is to ensure that the trainees must realise the importance of OBE and the features related to its implementation. Trainees must understand that the need for adapting the new instructional strategy, skill, or concept

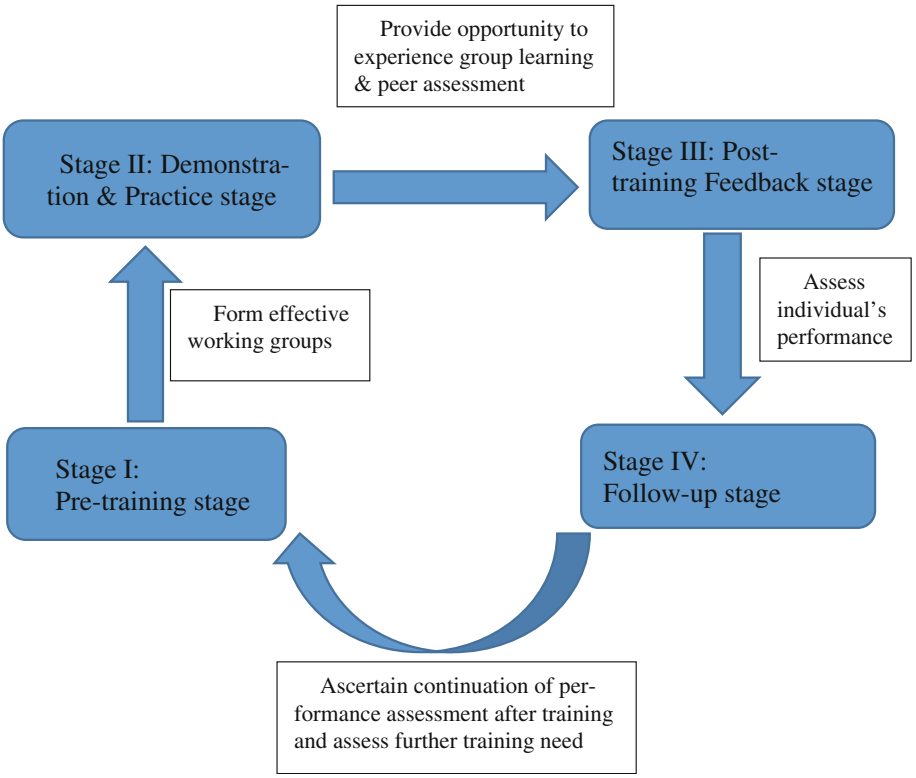

Fig. 3. Framework for model training programme for teachers of technical institutes

that will be presented during training are capable of enhancing student learning. The recorded observation is used for formation of effective working groups.

Stage II focuses on illustration of designing thinking classroom through collaborative exercises. It provides the trainees an opportunity to observe a model of what is being taught. The trainer demonstrates the opening action, explanation and closure of a technical content with specific Intended Learning Outcomes (ILOs) using experiential strategy. This demonstration may also be provided through a video recorded in real classroom situation. After each demonstration, the task of trainer is to illustrate the stages of instruction along with the selection of appropriate strategy. Hence this stage demonstrates mapping of sequence of instructional design to phases of learning viz. motivation, apprehension/acquisition, retention/recall and feedback/evaluation. The demonstration and illustration is followed by practice where each group is assigned with some pre-defined outcomes of the course preferably those require higher order thinking skills and asked to prepare instructional plan for active learning indicating teaching strategy, method, tools needed and estimated time. Each group then be asked to demonstrate active learning in simulated environment. Peer assessment is used for identifying strength and weaknesses of each participant groups. The trainer must then provide each trainee teacher with feedback on how well the groups and the group

members have prepared and delivered plan and taken part in peer assessment. It has to be seen that the all the groups and also each group member have got sufficient time to complete the assigned task.

The stage III ensures that each trainee is able to decide course outcomes and corresponding intended learning outcomes, also able to design and deliver concerned content under the specific course and experience self-assessment. In this stage, each trainee is assigned a technical content and asked to select suitable teaching strategy and technique for promoting higher order thinking. Individual trainee's performance in the simulated classroom is video recorded which is further analysed by respective trainee for self-assessment. This helps the trainee to internalise what is being learned through group activity, observation, peer and self- assessment and trainer feedback.

In this stage training feedback is also collected on individual basis and is shared for trainees' understanding towards designing classroom teaching. The trainer need to use appropriate scoring sheet or rubric for effective training evaluation.

Stage IV deals with designing follow up activities leading to effective implementation of training in content updating. Follow up includes mainly discussion after training programme regarding issues related to implementation and need for additional training related to what is being learned. After attending the training, teachers return to their respective workplaces. They are advised to prepare instructional plan and select strategy to model for his/her class. They are advised to invite their colleague as a mentor preferably an expert in the same domain area. The mentor observes the instruction and give constructive feedback for improvement. The mentor need to be suggested to consult the trainee's video recorded during training. The feedback collected over a period of at least one month may be shared with other colleagues. For any difficulty in implementation or unpredicted outcome, trainees are advised to contact trainer for suggestion and future action.

4 Experimental Observation and Outcomes

The four-stage framework proposed for designing a Model training programme for teachers of technical institutions has been experimented on trial basis. A short term training programme on Simulation and Analysis of Nonlinear and Adaptive Control Systems, conducted during academic year 2016–17.

In regard to content of the training programme, control theory is an interdisciplinary branch of engineering which is concerned with the behavior of dynamical systems. It deals systems with inputs which can be controlled such that desired output can be obtained using appropriate feedback. It can be noted that as linear system obeys the principle of superposition, it can be broken down into parts and each part can be solved separately. It allows us to simplify complex problems by using several suitable mathematical tools. But in nature many things do not act in this way. Most of the systems that we observe in everyday life are nonlinear in nature and the principle of superposition fails in those cases [10]. As a result most nonlinear systems are impossible to be solved analytically using conventional mathematical tools available for linear system analysis. In addition to nonlinear control part, the content also extended to adaptive control which provide a systematic approach for automation in

real time in order to maintain desired performance of the dynamic systems for unknown and/or very complex system parameters. When engineers analyze and design nonlinear dynamical systems in electrical circuits, mechanical systems, control systems, and other engineering disciplines, they need to be able to use a wide range of nonlinear analysis tools. Moreover there is increasing demands for further development of nonlinear and adaptive control theory to facilitate research activities related to study and experimentation of complex control problems [11]. This leads the engineers to formulate, analyse and design control algorithms. Thus the study of nonlinear and adaptive control systems has become important in modern – technical society and so the curriculum of electrical and electrical engineering related programmes at graduate and post graduate levels includes this as an essential course.

The pre-requisites needed for this course are knowledge of mathematics like differential equations, matrices for representing dynamic systems, signals and systems, linear control systems theory, engineering analysis and problem solving skills and social skills like work in team in handling multidisciplinary problems.

It has been observed that working groups can be identified using effective tools for baseline assessment. Pre-training activity sheet was prepared for checking of pre-requisite learning outcomes. Assessment criteria prepared for identifying 'highly prepared', 'prepared' and 'not sufficiently prepared' for the training being offered. Five groups of trainees were formed with each group consisting of 4–5 members and equally distributed category of baseline identification. The whole process was explained by the trainer so that trainees can also be able to design baseline assessment tools for their own students on related content.

Through demonstration by the trainer and then followed by collaborative exercises conducted during stage II, they understood the process of deciding students' learning outcomes based on Blooms Taxonomy table [12]. Each group designed the instruction for developing higher order thinking skills related to course content using suitable teaching strategy and method. Assignments planned in such a way that it had included all essential ILOs and it was found that sharing of working groups' thinking while designing assigned instruction had made every individual member to clear several doubts.

It was observed that practicing the whole process by individual member during stage III, many innovative ideas generated which could be implemented in conventional classroom situation but would create the learning environment active through collaborative involvement of learners. It was also found that many of the issues raised during stage II was resolved in this stage. Each trainee also prepared a self-assessment report based on their performance as recorded and shared at this stage. Feedback collected during this stage was also shared by the trainer at the time of training valediction.

Training follow-up started with evaluation of training feedback and it was found that there was appreciable enhancement in content knowledge of each individual teacher. It also gave an evidence of enhancement of teachers' self-confidence in instructional delivery and the desire to take the challenge to teach the course.

5 Conclusions

The suggested student focus approach in designing training programmes for teachers of technical institutes will assure attainment of learning outcomes of students with teacher as facilitator and thereby support transformation of existing teaching-learning system to a self-assessed, self-monitored learning-teaching system needed for Outcome Based Education in India.

It has been observed from the trial test of proposed framework for designing STTPs that the teachers were motivated to think independently, confident enough to take the challenge of teaching a course like Nonlinear and Adaptive Control System and also able to design innovative classroom instruction for promoting active learning.

All trainings are planned and offered by NITTTRs based on assessment of training need which is collected from teachers of the technical institutes of their respective region. But there is no systematic mechanism to ascertain continuation of performance assessment of teachers after training. NITTTR, Kolkata is now actively involved to device a system of continuous follow-up to imbibe the concept of Outcome Based Education in the country.

References

1. Spady, W.G.: Outcome-Based Education: Critical Issues and Answers. American Association of School Administrators, 1801 North Moore Street, Arlington, VA 22209 (Stock No. 21-00488; $18.95 plus postage) (1994)
2. Kirkpatrick, D.L., Kirkpatrick, J.D.: Evaluating Training Programs, 3rd edn. Berret Koehler Publishers, San Fransisco (2006)
3. Felder, R.M., Brent, R.: Designing and teaching courses to satisfy the ABET engineering criteria. J. Eng. Educ. **92**, 7–25 (2003)
4. http://www.aicte-india.org/dashboard/pages/approvedinstitutes.php
5. F. No. 23-4/2012-TS.IV Government of India: Ministry of Human Resource Development Department of Higher Education
6. NITTTR, Annual Reports 2013–14, 2014–15 and 2015–16. Bhopal: National Institute of Technical Teachers Training and Research (2014, 2015, 2016)
7. NITTTR, Annual Reports 2013–14, 2014–15 and 2015–16. Chandigarh: National Institute of Technical Teachers Training and Research (2014, 2015, 2016)
8. NITTTR, Annual Reports 2013–14, 2014–15 and 2015–16. Chennai: National Institute of Technical Teachers Training and Research (2014, 2015, 2016)
9. NITTTR, Annual Reports 2013–14, 2014–15 and 2015–16. Kolkata: National Institute of Technical Teachers Training and Research (2014, 2015, 2016)
10. Lyshevski, S.E.: Control Systems Theory with Engineering Applications. Springer Science & Business Media, New York (2012)
11. Sastry, S., Bodson, M.: Adaptive Control: Stability, Convergence, and Robustness. Prentice Hall Information and System Sciences Series (1989). ISBN 0-13-004326
12. Anderson, L.W., Krathwohl, D.R. (eds.): A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Allyn and Bacon (2001). ISBN 978-0-8013-1903-7