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Impact of IUCEE IGIP Engineering Educator's Certification Program on Teaching Performance of Participants

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Abstract: Mushrooming growth of engineering institutes in India has increased the demand for qualified and competent teachers in engineering education.Minimum eligibility for entry level Assistant Professor is post graduation in the concerned or equivalent engineering discipline. No formal education or training in the field of engineering education is mandatory. Comprehensive training program in engineering education was not available in India. Indo US Collaboration for Engineering Education (IUCEE), USA in collaboration with IGIP, Austria has recently launched a program that is fully customized for the engineering educators in India. First author of this paper has successfully completed this program. Student' feedback on the teaching performance of the author, before and after undergoing this program is compared. It is observed that teacher training program has improved the teaching performance of the authors.

Keywords: Teaching performance, course end survey, student centred classroom, OBE, NBA

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1. Introduction

Rapid growth of engineering institutes in India has resulted in acute shortage of qualified and competent faculty. Secondly National Board of Accreditation (NBA) has changed the model of accreditation from Input – Output to Outcomes based accreditation [1]. Therefore, it is imperative for the engineering institutes to implement OBE. India is permanent member to the Washington Accord. All the Universities / Institutes of the member countries of the Washington accord have implemented OBE. In order to make the degrees offered by Indian universities at par with degrees offered by the universities of other member countries of the Washington accord, Indian Universities have to implement OBE.

2. IUCEE IGIP Engineering Educator's Certification Program

IUCEE offered this training program during January to July 2015. Program was sponsored by Microsoft India.

2.1 Program objectives

This certification program brought together the expertise of two highly reputed engineering faculty training organizations - IUCEE (USA) & IGIP (Austria). Both these organizations have been involved in training engineering faculty for several years with extraordinary success. This collaboration brought to India the rich academic traditions and the

best of teaching-learning experience of engineering education in India, USA & Europe.

Following are the program objectives:

a) Provide a much needed formal, internationally recognized qualification in teaching technologies that is fully customized for engineering educators in India.

b) Provide a holistic program which not only sharpens the faculty member's teaching skills but also develops his/her professional acumen and confidence.

c) Provide a necessary theoretical and practical knowledge and skills for becoming an effective educator.

d) Provide insights about the changing learning needs of the 21st century learner and provide skills to modify teaching strategies to meet those needs.

e) Prepare the educators in using the state-of-the-art technological tools to enhance classroom instruction.

f) Provide an effective tool to the administration for evaluating faculty (for hiring, promotions etc.).

g) Provide an effective tool to the accrediting agencies in India. It is hoped that very soon, the value addition brought by this certification program will become evident and a requirement of having a minimum percentage of faculty certified by this program will become mandatory for each accredited engineering institution in India.

2.2 Program Curriculum and Delivery

The curriculum includes the key recommended components from IGIP curriculum but has been designed to address the specific academic, cultural and social realities faced by engineering educators in India.

PhaseI- Orientation Workshop (4 credits)

The program will start with a residential 4 day face-to-face orientation workshop. In addition to walking the trainees through the program design, curriculum and technology to be used, the orientation workshop will introduce the theoretical concepts which will be further developed in the six modules. The trainees will have an opportunity to bond with each other and share problems and best practices.

Phase II - (12 credits) this component will be delivered completely online over a period of 18 weeks.

The trainees will attend this phase while teaching at least one course and complete their practicum by implementing strategies learned in their respective classes, recording outcomes and preparing a personal teaching portfolio.The program will be taught by expert faculty from the USA and India and will comprise:

MODULE 1 - Fundamentals of Course Design

MODULE 2 - Creating a Dynamic Classroom

MODULE 3 - Effective Assessment

MODULE 4 - Collaborative Learning

MODULE 5 - Harnessing the Power of Technology in Teaching

MODULE6- Writing & Presenting Research

Phase III - Valedictory Workshop -(4 credits)

This will also be a 4 day residential program where trainees will present and peer evaluates teaching portfolios. They will make poster/research paper presentations prepared in Module 6 and create a one year plan of action for teaching/research and professional development.

2.3Program Coordination

The program is designed and coordinated by Prof. Veena Kumar.She is professor at the University of Maryland University College and was earlier professor and chair, education technology, New Delhi. An experienced education technologist and an active Board Member of IUCEE, she has vast experience in curriculum development; online instruction and teacher training in France, India and USA.

Over the past 28 years, Prof. Kumar has trained teachers from Japan, China and Brazil and has managed educational projects sponsored by

organizations like the World Bank, the European Union, the Ministry of Education, India, the Commonwealth of Learning, Canada and the British Council

3. Improvements in teaching

Following is the partial list of improvements made in teaching by author based on the knowledge and skills acquired in Engineering Educator's Certification program.

a) Teaching philosophy: it is a statement of teacher's personal ideology about what education (at the level where he/she is teaching) should be and what it should aim to achieve? Teaching Philosophy is personal but it must take into account the goals of the institution teacher is working for.

b) Distribution of the course description sheet on the first day of class

c) Micro and macro planning of course, defining the course outcomes

d) Designing teaching methods as per the different learning styles of the learners.

e) Effective use of office hours to solve the students' academic as well as personal problems

f) Effective teaching in large classes using in class exercises, think pair share etc.

g) Spread Quiz: Activity designed for large class, still evolving. Students do not respond in the class for variety of reasons i) No direct or tangible benefit to the students, if their performance in class is not considered in grading ii) communication problem iii) shyness iv) if they are not sure about the answer they avoid answering and making scene in front of other students. One of the solutions to this problem is to conduct a quiz and grade the students based on their performance in quiz. As it is not possible to grade all the students in large class, in a single quiz, a "Spread Quiz" which lasts entire semester is designed. A chart, for marking performance of the students is prepared for the course which is maintained during entire semester. Whenever students responds in a quiz a tick is marked against her/ his name. At the end of the semester based on number tick marks against the name of the students, In Semester Evaluation (ISE) marks are given.

h) Use of the open ended problem based on the knowledge gained in collaborative learning module of the Engineering educator's certification program.

i) While setting the question papers guidelines suggested by Prof. Richard M. Felder [2] are followed. Some of those guidelines are i) Test on what you teach: tests should always be based on the topics which have been taught. Difficulty level of the question should be same as dealt with in the class. ii) Consider handing out a study guide one to two weeks before each test: teaching is not a mystery religion. There should be no surprises on tests: nothing should appear that the students could not have anticipated, no skill tested that has not been explicitly taught and repeatedly practiced. iii) Minimize speed as a factor in performance on tests: students need time for thinking and solving quantitative problems. Sufficient time must be provided. Set up multiple-part problems so that the parts are independent: lengthy problems cad split into independent parts. iv) Don't deliberately design tests to make the average grade 60 or less.

j) Use of flipped class. "Flipping" the class reverses the traditional class setup: students acquire basic content outside of class, and then work together in class on application oriented activities.

k) Course website has been created. All the learning resources, course details like credits, and evaluation, course outcomes, syllabi, exam grades havebeen uploaded which students can browse and download..https://automationrobotics.wordpress.com/https://ritsupplychain.wordpress.com/

l) Collaborative techniques like STAD, Jigsaw has been implemented by authors during course delivery for few sessions.

All these efforts have resulted into the improvement in the teaching performance of the author and learning satisfaction of the students. A structured questionnaire is designed to collect the students' feedback. This process is explained in next section.

4. Data Collection

First author has taught Automation and Robotics course before going through the Engineering Educator's Certification program (academic year

2013-14) as well as during program (academic year 2014-15). This course is offered as a professional elective at eighth semester of B. Tech. (Mechanical) program. Students registered for this course during academic year 2013-14 is a control group (CG) and students registered for the course during academic year 2014-15 is a target group (TG). At the end of every semester, upon completion of the course students' feedback is collected on the performance of the course faculty.

A close ended, structured, multi choice questionnaire is designed for the collection of students' feedback. Questionnaire was designed before the introduction of the Engineering Educator's Certification program and hence there is no one to one and direction relation in between questions and modules of the program. In spite of this fact questionnaire covers all the aspects of the program. Following are the questions which were used to collect the students' feedback on the performance of the course faculty. Students were asked to register their ability/opinion to:

a) Define and classify manufacturing automation.

b) Recognize advanced automation functions

c) Define and differentiate process and discrete manufacturing industries.

d) Explain Transfer lines.

e) Explain automated assembly lines.

f) Recognize the meaning and need of robotics.

g) Explain robotic control system.

h) There were sufficient practical examples to clarify concepts

i) Methodology to solve numerical problems was clear and easy to follow

j) There were sufficient opportunities to practice and apply important concepts

k) Teaching aids (E-learning resources / PPTs / Videos / animations / demonstration of cut section etc.) helped me in understanding complicated concepts in Engineering.

l) Industrial visits / field training helped for applications of theoretical knowledge in industry.

m) Discussionsand presentations were beneficial to me for experiencing group activity and developing soft skills.

n) Reference books / Journals / data books suggested by course teacher are helpful for continuous lifelong learning.

o) Course Practicals helped in understanding various concepts in Engineering.

p) Course Practicals were aligned with course content.

q) Expected course outcomes were clearly communicated

r) There was close agreement between stated course outcomes and what was actually covered.

s) Evaluation methods used in this course were fair and appropriate

t) The course material (Lecture notes, in class exercise) contributed to learning of the course content.

u) Prerequisite knowledge and skills were beneficial for mastering course content.

v) Faculty communicated recent topics of this course

w) I would like to read advanced topics related to this course.

Questions (a) through (g) are course outcomes whileother questions are related to classroom environment and overall teaching effectiveness. Upon completion of the course students' responses are collected through multi choice questions. Responses were collected from all the students registered for the course both from control group and target group.

Students are given five options to respond to the questions:

a) Strongly agree

b) Agree

c) Neutral

d) Disagree

e) Strongly disagree

Second author has taught Supply Chain Management course while going through the Engineering Educator's Certification program (academic year 2014-15) as well as in the next year (academic year 2015-16). This course is offered as a open elective at eighth semester of B. Tech. (Mechanical) program. At the end of every semester, upon completion of the course students' feedback is collected on the performance of the course faculty.

1. Develop understanding of role and key issues in the supply chain management.
2. Design the inventory system and level at various locations in supply chain.
3. Explore and recommend appropriate SC strategies under given situations.
4. Decide the distribution and transportation options
5. Develop appropriate strategic alliances for enhancing the performance of SC.
6. Use Information technology to improve SC performance.
7. There were sufficient practical examples to clarify concepts
8. Methodology to solve numerical problems was clear and easy to follow
9. There were sufficient opportunities to practice and apply important concepts
10. Teaching aids (E-learning resources / PPTs / Videos / animations / demonstration of cut section etc.) helped me in understanding complicated concepts in Engineering.
11. Industrial visits / field training helped for applications of theoretical knowledge in industry.
12. Discussionsand presentations were beneficial to me for experiencing group activity and developing soft skills.
13. Reference books / Journals / data books suggested by course teacher are helpful for continuous lifelong learning.
14. Expected course outcomes were clearly communicated
15. There was close agreement between stated course outcomes and what was actually covered.
16. Evaluation methods used in this course were fair and appropriate
17. The course material (Lecture notes, in class exercise) contributed to learning of the course content.
18. Prerequisite knowledge and skills were beneficial for mastering course content.
19. Faculty communicated recent topics of this course
20. I would like to read advanced topics related to this course.

Questions (1) through (6) are course outcomes while other questions are related to classroom environment and overall teaching effectiveness. Upon completion of the course students' responses are collected through multi choice questions. Responses were collected from all the students registered for the course both from academic year 2014-15and 2015-16.

Students are given five options to respond to the questions:

a) Excellent

b) Very Good

c) Good

d) Average

e) Poor

5. Evaluation of Students' Feedback

After collection of students' feedback, students' text responses were converted to numerical form for the purpose of analysis. The correlation between response and points is given below:

Based on the above relation, student's responses for

first author are converted to points. Average and standard deviation of the responses of all questions is given below:

Table1 Conversion of text responses into points

Response (First Author)	Response (Second Author)	Points
Strongly agree	Excellent	10
Agree	Very Good	7.5
Neutral	Good	5
Disagree	Average	2.5
Strongly disagree	Poor	0

For second author student responses are also converted to points. Average and standard deviation for the responses as mentioned below:

Question no.	Control group		Target group	
	Average	Std. Dev.	Average	Std. Dev.
a)	6.65	2.24	7.12	1.97
b)	6.6	2.01	7.17	1.72
c)	6.8	1.75	7.01	1.72
d)	7.05	2.12	7.72	1.81
e)	7.25	2.38	8.10	1.31
f)	7.7	1.66	7.99	1.36
g)	7.2	1.80	7.83	1.63
h)	7.25	2.33	7.17	2.39
i)	6.55	2.14	7.93	2.25
j)	6.85	2.19	7.23	2.06
k)	6.9	2.40	7.39	1.97
l)	6.7	2.50	6.85	2.38
m)	7.15	2.20	7.07	2.25
n)	7.15	1.89	7.34	1.62
o)	6.9	2.18	7.01	2.15
p)	7.5	1.68	7.45	1.71
q)	7.1	1.98	7.01	1.95
r)	7.4	1.67	7.39	1.66
s)	7.15	1.82	7.17	1.87
t)	6.95	2.16	7.01	2.15
u)	7.15	2.32	7.39	1.97
v)	7.55	1.78	8.26	1.48
w)	7	2.08	7.45	1.71
	7.06	2.05	7.44	1.88

Table 2: Responses to points for second course

Question no.	Academic Year 2014-15		Academic Year 2015-16	
	Average	Std.Dev.	Average	Std. Dev.
1	7.14	2.05	8.39	2.05
2	7.32	2.49	8.04	2.49
3	7.32	2.17	7.68	2.17
4	7.86	2.59	7.86	2.59
5	6.61	1.64	7.86	1.64
6	6.79	1.92	8.21	1.92
7	6.07	1.48	8.21	1.48
8	6.79	1.64	7.50	1.64
9	7.50	2.39	7.86	2.39
10	7.32	2.17	7.68	2.17
11	7.32	2.49	8.04	2.49
12	7.68	2.59	7.68	2.59
13	7.68	2.39	8.21	2.39
14	7.68	2.59	8.04	2.95
15	7.14	2.05	7.86	2.05
16	7.50	2.28	7.86	2.28
17	6.96	1.92	7.32	1.92
18	6.79	2.77	7.68	2.77
19	6.79	1.92	8.21	1.92
20	7.50	2.49	8.04	2.49

Target group was taught the course by first author while going through the Engineering Educator's Certificate program. Similarly, second author taught the course during engineering education program. Second author recorded the implications of the certification programme during the programme as well as in the next year. Both Authors implemented many student centred activities taught in the program. Data in the Table 1 clearly shows there is improvement in the average response from 7.06 for control group to 7.44 for target group. Standard deviation is reduced from 2.05 for the control group to 1.88 for target group. Table 2 shows that for second author also there is improvement in the average response from 7.20 of year 2014-15 to 7.91 for year 2015-16. Standard deviation is also reduced from 2.74 for year 2014-15 to 2.22 for year 2015-16.

Fig. 1a shows the average responses for first author, points on the scale of 10, plotted against

questions for the control group (CG) and target group (TG). Except for the question "h" and "q" there is improvement in students' response. Question h and q are related to practical examples and communication of course outcomes needs to be improved in next semester.Fig. 1b shows the average responses for second author, points on the scale of 10, plotted against questions for the year 2014-15 and 2015-16.

Fig. 2a and 2b shows standard deviations plotted against questions for first author and second author, respectively. It clearly shows reduction in variance of students' responses

Fig. 3 and 4 shows number of responses for question "a" for CG and TG respectively.Number of responses

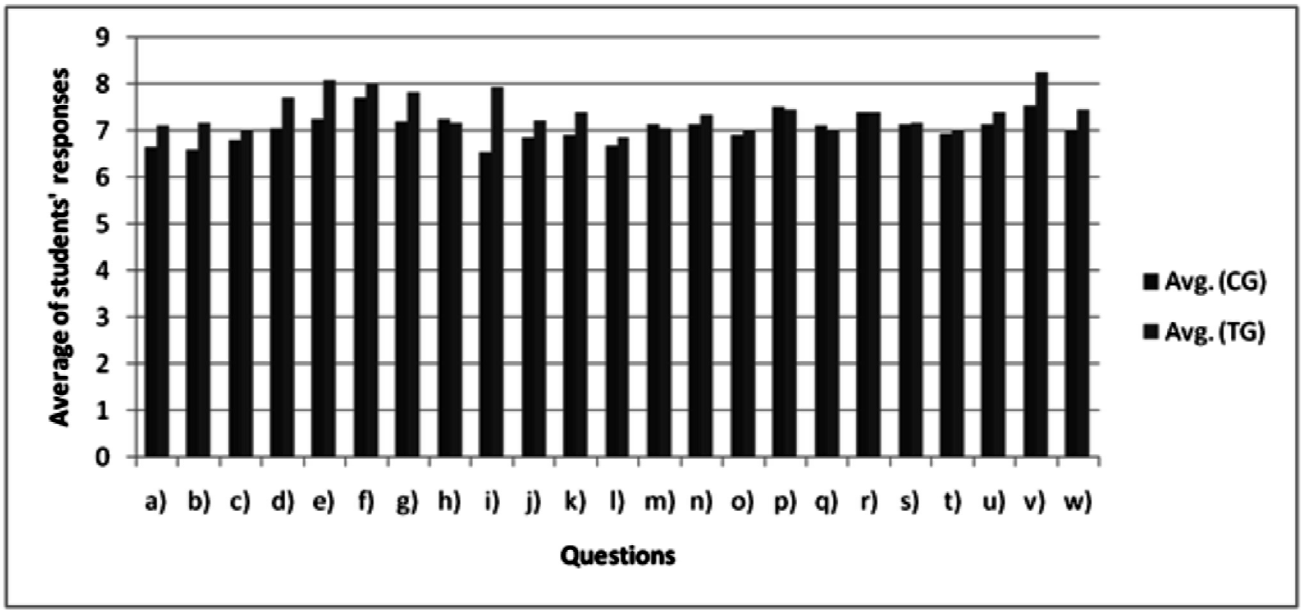

Fig. 1a Average students responses Vs questions for control group (CG) and target group (TG) for first author

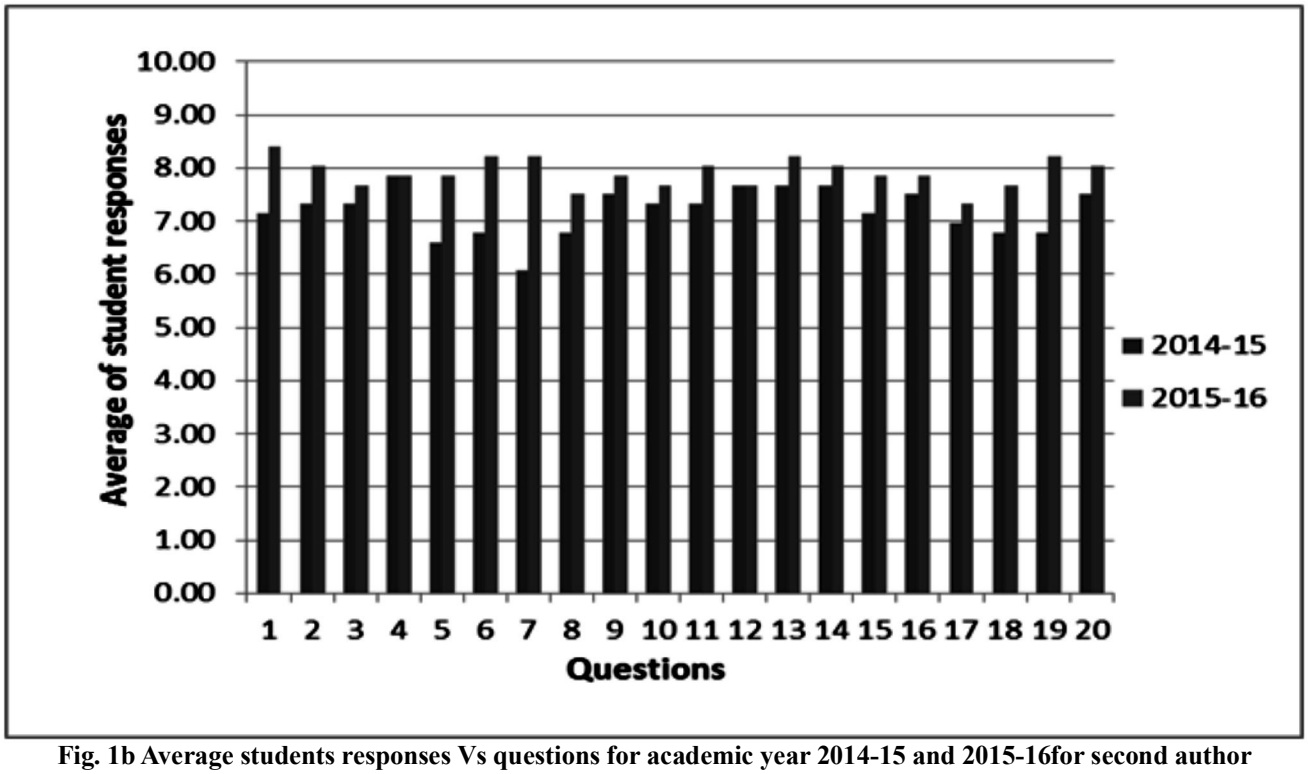

Fig. 1b Average students responses Vs questions for academic year 2014-15 and 2015-16for second author

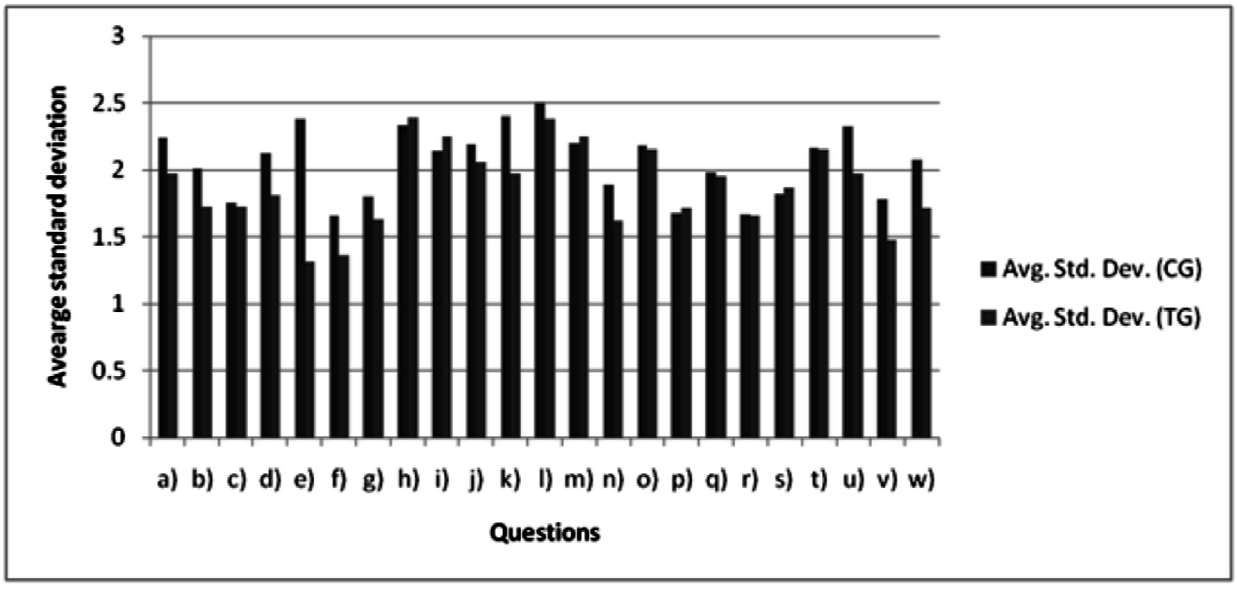

Fig. 2 aAverage standard deviation Vs questions for control group (CG) and target group (TG) for first author

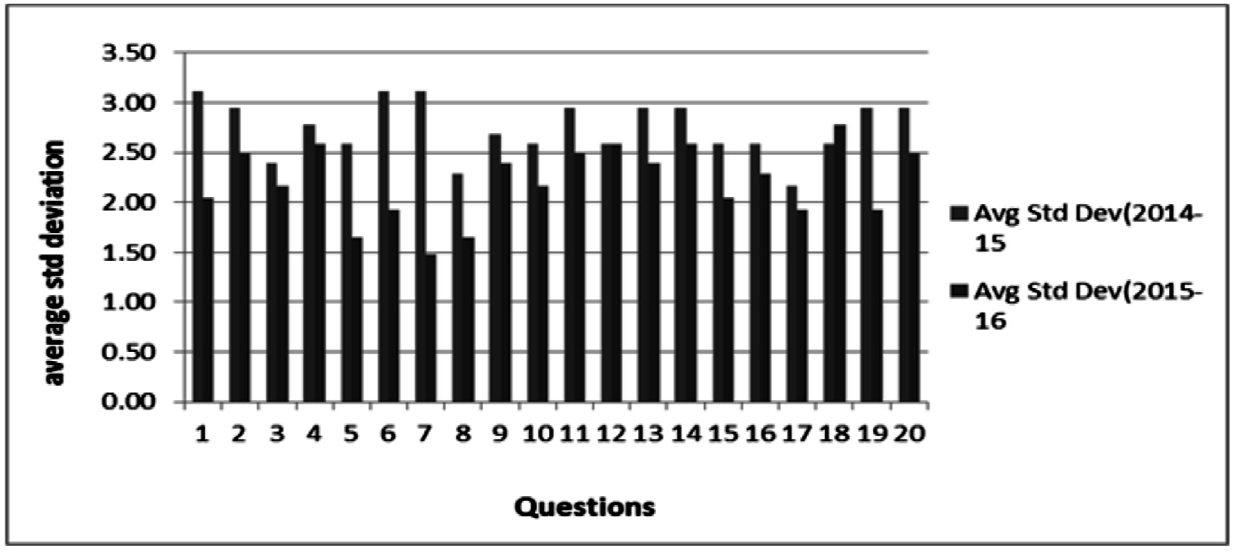

Fig. 2bAverage standard deviation Vs questions for academic year 2014-15 and 2015-16 for second author.

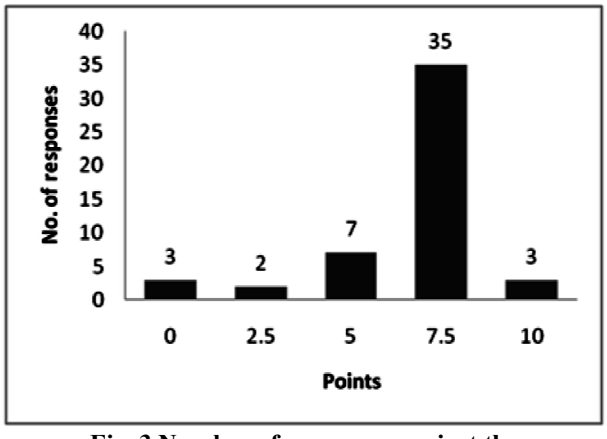

Fig. 3 Number of responses against the points for CG for question a

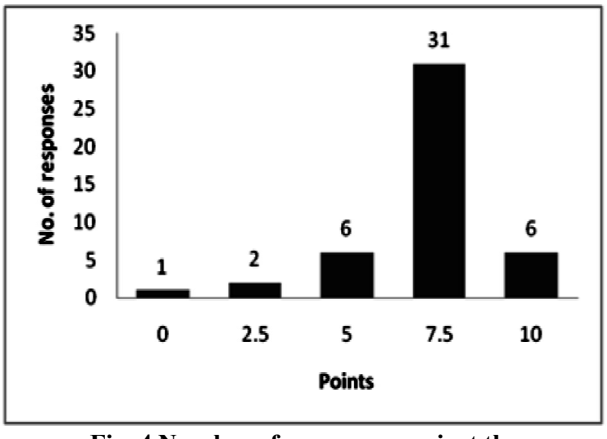

Fig. 4 Number of responses against the points for TG for question a

for maximum points 10 (Strongly agree) has been increased. This shows improvement in teacher's performance. Similar graphs can be plotted for other questions as well but those are not reproduced in this paper. Second author has also recorded similar observation for his course.

6. Conclusions

Rapid growth of engineering institutions in India has resulted in acute shortage of qualified and competent faculty. IUCEE – IGIP Engineering Educator's Certification Program has provided an opportunity to improve their teaching skills. Author has participated in first pilot of this program during January to July 2015. Feedback of the students, before and after the program, on teaching performance of the author shows improvement in performance after program.

References

[1] IUCEE-IGIP Engineering Educator's Cetification Program brochure

[2] NBA manuals on Accreditation of Engineering Programs.

[3] Richard M. Felder, Designing Tests to Maximize Learning, J. Prof. Issues in Engr. Education & Practice, 128 (1), 1–3 (2002).

[4] Course material provided by faculty of all the modules of Engineering educator's Certification Program.