

Outcomes of Implementing IUCEE Effective Teaching Methods in India: Can the IUCEE model be applied to Latin America and the Caribbean?

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ABSTRACT

The Indo-US Collaboration for Engineering Education (IUCEE) initiative is focused on preparing the next generation of engineering faculty in India and the United States, and dramatically increasing the number of collaborations in research and teaching to better prepare engineers for the global economy. After two years of planning, IUCEE implemented its first Faculty Leadership Institute in India for a six week period during the summer of 2008. Almost 600 Indian faculty participated in 23 week-long Train-the-Trainer workshops led by US faculty members and corporate representatives, generally taking a workshop on effective teaching techniques and another covering best practices teaching within their engineering disciplines; all agreed to give regional seminars on the subjects learned. This paper relates the experiences of one of the Indian faculty participants applying strategies learned in the IUCEE Faculty Leadership Institute to his own courses and to regional seminars to train other faculty. The results are positive and efforts are underway to adapt the IUCEE model to other countries, including Latin America and the Caribbean. The paper concludes by examining how the IUCEE model could be adapted for Latin America.

Keywords: Engineering Faculty Training, Higher Education Leadership, IUCEE, India, Latin America

1. INTRODUCTION

The Indo US Collaboration for Engineering Education (IUCEE) [1] initiative was started in 2007, with the assistance of American Society for Engineering Education (ASEE) and the International Federation of Engineering Education (IFEES). The IUCEE vision is to improve the quality and global relevance of Engineering Education in India and in the United States by fostering collaborations. IUCEE aims to identify, promote, catalyze, add value to assist in the scale up and multiplication of promising practices for collaboration in

- Research and Development
- Curriculum and Technology Enhanced Delivery
- Innovation and Entrepreneurship
- Quality and Accreditation Processes
- Industry Participation

With this purpose under the leadership of Dr. Krishna Vedula, a Faculty Leadership Institute was developed jointly by US and Indian academic leaders. The Institute consisted of 23 one week "Train-the-Trainer" workshops on effective teaching techniques, and discipline-based courses took place at the InfoSys Technologies' Global Education Center in Mysore, India. The workshops were led by US experts known for their pedagogical skills. The Indian participants typically enrolled in a teaching methodology workshop and a discipline-based workshop, and had agreed to lead regional workshop throughout India. IUCEE agreed to pair the Indian participants to US mentors.

The Indian participants had the following profile (IUCEE, 2008):

- 585 participants were selected from a pool of 1400 applicants for their potential to be trainers in their own colleges and regions;
- All participants had at least a Master of Technology or Master of Engineering Degree. 25% had PhDs;
- 75% has more than 10 years teaching experience;
- 25% were senior administrators or heads of colleges;
- 24% were female
- 15% from AP, 7% from Gujarat, 26% from Karnataka; 16% Maharashtra; 20% from Tamil Nadu; and 15% from other states in India.
- 175 colleges were represented

Table 1. 2008 Summer Faculty Leadership Institute Workshops, Presenters, and Participants

Week of	Lead Presenter and Affiliation	Title of Workshop	Number of Participants
May 26	1. Richard Felder and Rebecca Brent, North Carolina State University 2. Ashok Saxena, University of Arkansas	1. Effective Teaching 2. Quality and Accreditation	84
June 2	3. Jorge Velez-Arocho and Rosa Buxeda, University of Puerto Rico – Mayagüez, Lueny Morell, Hewlett Packard Co.	3. Curriculum Innovation and Quality Assurance	60
June 9	4. Joseph Tront, Virginia Tech University 5. James Kurose, University of Massachusetts 6. P. R. Kumar, Univ. of Illinois – Urbana 7. Veena Kumar, State Univ, of New Jersey	4. Computer Engineering 5. Computer Networks 6. Wireless Networks 7. Effective Course Design and Delivery	104
June 30	8. Sidney Burrus, Rice University 9. Richard Anderson, Univ. of Washington 10. Leon Osterweil and Lori Clarke, U. Mass. 11. Jack Davidson, University of Virginia 12. P. V. Krishnan, GIW Industries	8. Signal Processing 9. Algorithms and Data Structures 10. Software Engineering 11. Computer Security, and Modern Compilation 12. Principles of Effective Teaching and Learning	129
July 7	13. Andrew Mason, Michigan State Univ. 14. William Oakes, Purdue University 15. Vijay Kanabar, Boston University 16. Mani Venkata, University of Washington 17. World Bank and World Bank Institute 18. M. P. Ravindra, Infosys Technologies	13. VLSI 14. Engineering Design Projects in Community Service 15. Project Management: Security 16. Electric Energy and Power 17. Autonomy & Accountability in Engineering Education 18. Academic Systems & Processes and Leadership	161
July 14	19. Alice Agogino, U. of California – Berkeley 20. National Instruments 21. Xavier Fouger, Dassault Systems 22. Christopher Goh, Agilent Technologies 23. George Abraham, Autodesk	19. Project Based Learning & Sustainable Product Design 20. Hands-on Engineering using Labview 21. Product Life Management using CAD 22. Developing Leadership Skills 23. Engineering Drawing Using CAD	116

Significant follow up in the form of regional workshops conducted by the IUCEE participants are already taking place throughout India. Participants have been contacted several times to ensure they are practicing the techniques, are doing outcome based assessment, and are conducting seminars for other faculties in their colleges and regions. Over the next five years, IUCEE hopes to cover all the core courses in engineering and computer science and make the resources generated, easily accessible to faculty all over the world.

2. THE APPROACH

One of the authors was fortunate to be selected as one of the faculties to be part of the IUCEE Faculty Leadership Institute and participated in the Effective Teaching workshop. The second author is his US mentor, who participated in all the planning phases of the Institute, and traveled to India to help promote the Institute in the State of Gujarat. Immediately after completing the workshop, the IUCEE participant decided to try all the techniques learned in the next course he taught to see how the techniques worked prior to conducting the Regional

workshops to train other faculty. The course happened to be the second part of a two course sequence in a Master of Computer Application (MCA) program. He had taught all the students the previous semester, and now he would change his teaching methodologies adopting the IUCEE Effective Teaching strategies. This paper describes the process of implementing the effective teaching methods and accesses the outcomes of the process when applied to the MCA students and the students' reactions comparing the changes in teaching methodologies. In the next section, the Effective Teaching workshop is briefly described, followed by the impact of the workshop on the instructor, and the results of his applying the techniques learned in the Institutes in the second MCA course. A brief summary of outcomes and conclusions are then presented.

3. THE FELDER AND BECK WORKSHOP ON EFFECTIVE TEACHING

The "Effective Teaching Workshop" by Dr. Richard M. Felder and Dr. Rebecca Brent [2, 7, 9] was organized during 26-28 May 2008 in Infosys Training Campus, Mysore, India. The workshop was designed based on the following objectives [4].

- Identify critical characteristics of different student learning styles and specify instructional methods that address the needs of students with different styles.
- Define learning objectives, write and classify them in terms of Bloom's Taxonomy levels, and list pedagogical and curricular benefits of writing them for courses.
- Generate a set of handouts for the first day of a course (course syllabus, learning objectives, statement of policies and procedures) that provides the students with a full understanding of the course structure and ground rules.
- Devise preliminary course activities that capture interest and motivate learning.
- Identify characteristics of effective lectures and techniques for obtaining active participation from most or all students in attendance.
- Define inductive teaching and learning [5] and give examples of inductive teaching methods, and identify benefits of this instructional approach.
- Define and give examples of the higher-level (analytical, creative, critical) thinking skills of Bloom's Taxonomy, identify instructional conditions that induce students to develop and exercise these skills, and formulate exercises and problems that provide practice in the skills.
- Design tests that are both challenging and fair and a grading system that provides positive motivation for learning without lowering standards.
- Deal effectively with a variety of common classroom management and other student-related problems.
- Identify problems associated with the teaching profession having to do with time management, starting and maintaining research programs, and assessing and improving teaching, and formulate plans to overcome these problems.

The above objectives were covered in the workshop with suitable examples and demonstrations, which had long lasting effect on all of us who attended the workshop. Demonstrations and interactive examples made learning enjoyable and time speed by, most of us were surprised to find how quickly and joyously the time went by. More details of that workshop may be found by other sources, following is a quick run down.

1. On the first day the presenters covered the Learning Styles of students and shown how can one match his/her teaching styles to suit the need of all learning styles. Learning objectives and study guides were discussed.
2. On the second day how to kick start the learning process in the first week was discussed, Inductive teaching method was introduced, constructing less ambiguous and more student-friendly problems and assignments is shown. Active learning techniques [9] were discussed as well.
3. Third day was devoted to two important topics, first was outcomes based assessment and second was how to conduct effective teaching workshops.

There were few central ideas of the workshop. The first was to understand the learner and suit accordingly. Second was to be fair and legible at the time of assessment. Third was to step away from pure lecturing and innovatively engage students in some fruitful activities.

4. IMPACT OF ATTENDING THE WORKSHOP ON THE AUTHOR AND HIS TEACHING

As mentioned earlier, the first author was a participant in the Effective Teaching workshop. The impact is described in his own words as follows:

“Let me confess that now I realize mistakes that I have been making all these years. I was expecting students to do few things which are not reasonable (Like guessing what type of questions appear in the test, designing question papers, assignments, homework biased against few specific types of learners, not looking at outcomes for improvements etc.).

I had few burning questions like "is it not possible to increase the level of understanding of my students?" The problem of improving the underperforming student's grades was nailing me for years and I was frustrated not finding answers to those. I also was surprised about my abilities when I can see that others are able to learn faster than me. In fact over the years I have learned that my learning, though late, is far more holistic than others. I learned that I am a global learner from the workshop and relaxed to a large extent.

Not only have I received answers to most of my questions, I am able to see new avenues to improve the performance of my students and have also learned to share it.”

Following are common problems the first author has found teaching MCA students

1. They can not remain attentive after some time. They lose their concentration and cannot describe or write something explained in the later part of the session properly.
2. They are not able to retain information to a longer period, particularly something which is taught in the later part of the session or sometimes or when the lecture is scheduled in the later half of the day.
3. They are not able to interact and feel shy about communicating their doubts and problems to instructors
4. The result is usually poor and instructors have to usually scale up grades artificially.
5. Students are not able to work in a team and not able to express themselves

In trying to find out solutions to the above problems we have decided to adopt the following improvements in the teaching mechanism

1. **Inquiry and Problem Based Teaching** [6] was given additional stress. All three levels of questions; i.e. Knowledge, Application and Evaluation were asked and answers discussed in the class frequently. The Inquiry Based Teaching is usually augmented with **active learning methods** like group activities and analogy.
2. Concept of **learning objectives** and **study guide** was introduced.
3. The sessions were re-designed and re-worked to better suit inquiry based and active learning mechanisms
4. Following **active learning mechanisms** were applied
 - a. Minute paper at the end of every session were given to students and responses were considered in the next session coverage
 - b. Summarizing the contents of the previous lecture in the beginning by students after discussing that in a group
 - c. Brainstorming for different problems
 - d. Think individually and then pair discussion
 - e. Discussion using group of two or three
 - f. Students are given study guides one week or more before the exam.

A few other suggestions from the workshop were also implemented:

1. Reduced usage of PowerPoint slides
2. Designing papers, homework and assignments as suggested in workshop to make it more readable and understandable (and more reasonable as well)
3. Be more student-centric. Realize that what one teaches is not important but what student learn is important, so include lots of things to check what is learned -- results are surprising (and shocking sometimes)

All these methods were adopted from the Richard Felder and Rebecca Brent's Models which they discussed during IUCEE 2008 Leadership program held in Mysore India. In the next sections we show evidence that, not only the effective teaching methods are found to be useful and working, but all students unanimously suggested that all other faculties should also implement them!

5. IMPROVEMENT IN STUDENTS' PERFORMANCE

There are two different subjects taught with these mechanisms. All students are in the 5th Semester of the MCA Program at GLS Institute of Computer Technology. Total 47 respondents (students) participated in the process. At the end of first test, they are surveyed to test the effectiveness of these methods.

There was a massive impact on the student's performance after the application of effective teaching techniques in the class. The first author has taught the same batch of students a subject called Networking Technology 1 before attending the workshop. The subject basically deals with fundamentals of networking including the conventional models of networking and various layers and protocols in general. It starts at networking applications, physical, data link, network and transport layers and few applications. The subject also includes mechanisms for error handling, issues related to protocols of the network, encryption and other relevant topics. After attending the training the first author taught the subsequent subject called Networking Technology 2. This subject continues from the Networking Technology 1 and deals with TCP/IP protocol stack, working of Internet, right from addressing and IP and TCP layouts to applications like DNS, FTP, SMTP and burning issues like security.

As mentioned earlier, the second subject was taught to the same set of students after the workshop and the first author has found huge difference in following areas.

1. Student's interaction with professor, and level of thinking: Students have become so interactive that sometimes the professor found difficult to control them. In case of NT-1 the professor used to follow conventional "Any Queries" approach at the end of the session usually followed by a stony silence. Here in NT-2 the professor followed active learning where he used to divide students in groups before and then give them time to answer. Sometimes professor tells them to think individually and then compare their results with their friends (Think-Pair-Share Method). The professor gets suggestions and answers which make him amazed sometimes. For example, the professor received a query of why HTTP only should have controls like "only download when updated otherwise refrain from doing so" and why not other protocols? Professor was unable to find the answer immediately! He occasionally get queries that surprise him; like once one student asked what will happen if we remove the network layer while working in broadcasting LAN? The professor has to think before answering that question.
2. Students' approach to study: Earlier students were interested in just passing the test and getting more marks. Now they are more interested in the subject itself. We have quoted two examples earlier. One of the students was so interested in learning Wireshark (it is open source software with GUI to help study network operations by sniffing the network traffic passing by) that he helped the first author conduct a workshop on "Network Monitoring and Security" by preparing and delivering a session on Wireshark. Quite a few of them are showing their desire to work in the field of networking and security. They have also started enjoying the

lecture more. The first author also has conducted the survey on students he taught about all these. Following section describes the responses of these students and the outcomes of the survey [2, 3].

3. Their own understanding about the subject: - They seem to understand the subject much more than in the previous course. The survey outcome speaks for itself.

6. BACKGROUND

First author (Bhushan Trivedi) is working as a professor in GLS institute of Computer Technology in India. He is teaching these students and is responsible for carrying out this experiment in GLS. The other author (Maria Petrie) is responsible for providing higher level guidance for all these experiments and measurements. As mentioned earlier, all these experiments are based on the IUCEE Summer 2008 Faculty Leadership Institute workshop by Richard Felder and Rebecca Brent on Effective Teaching and subsequent communications with the workshop facilitators.

The methods we worked on are described in brief next

The first method is the Minute Paper. After every session, students are told to report back by a single chit with two points. The first point describes the most understood point of the lecture and second is the muddiest part of the session. Only points are to be written. This gives an idea to the presenter how well the lecture went. This exercise is for one minute usually and the chit that the students submit is, that is why, known as minute paper.

The second method is to start with summarizing by students themselves. In the beginning of the class, students are told to flip through the previous lectures notes for few minutes. Then random student is picked up (not volunteers) to point out topic not mentioned before. This makes students refresh the previous lecture's contents. This method is found useful for retention as well as better understanding of current session.

Third method is to give both active and reflective learners something to do by using group discussion and think-pair-share. It is important (and difficult sometimes) to think of question to ask or problem to give. This method is part of Active Learning Process and problem based and inquiry based education must be used along with this. To convert a regular session into problem and inquiry based session sometimes need the entire session to be reworked.

The next method involved using Learning objectives for the subjects under consideration. They were designed and provided to students as guidelines for the exams. The student's response to that is overwhelming. They demanded study guides to be given to them much earlier next time and they took live interest when study guide related discussion was going on.

7. APPROACH

All respondents are students of MCA semester V at GLS Institute of technology. One of the authors taught the same class just before attending the Mysore Richard Felder and Rebecca Brent workshop. When the author is assigned the responsibility of teaching the same class again after attending the said workshop, he decided to experiment on these students. He taught them Networking Technology 1 subject in 4th semester of their MCA course before the workshop. After attending the workshop, In the 5th semester, he taught two subjects, first was networking technology 2 and second was Artificial Intelligence. Above mentioned techniques were applied to classes of both the subjects without any difference.

Students were informed clearly about the experiment beforehand. Details about experiments ex. what is active learning, advantages of group activities etc are clearly discussed. Possible problems like slow coverage of the syllabus also were discussed. They were encouraged to participate in group activities. The group activities were varied in nature. Sometimes only pairs are allowed to discuss (better for reflective learners) and sometimes a group of three or four is allowed (better active learners). Sometimes individual is allowed to think and write down points for a while and then allowed to communicate to group members.

Inquiry based instruction is also stressed a lot. A question in the beginning is usually asked in the class which demands the knowledge of need of the topic that is about to be discussed. Ex. Following question is asked to the audience and answers are sought after discussion in the groups before teaching them alternate methods for knowledge representation methods in AI. They already studied the knowledge representation mechanism using predicate logic representation. The question asked was something like this. "What do you think problems with statements like "It is very clean", "if you are very rich you can afford this" and "if it is fever a doctor thinks of having 70% chance of malaria". Students discussed and answered about requirements of representing these statements. Concepts like non monotonic reasoning, fuzzy logic representation and requirement of alternative to probability based representation were emerged during discussion.

Whenever a lecture begins, students are advised to take one minute and write down all topics that they remember of last lecture. Then they are allowed to discuss in a group and write all missing points that other group members have considered. Then the audience is randomly probed to listen to each point one after another. This was a novice experiment to recap the previous lecture. Periodically (but not following any regular pattern of any sort) forming small groups and doing some small exercises (not longer then two to three minutes) was a common feature. The activities include summarizing something, or try to find out answer to something or guessing what will be next or something similar.

The questions or whatever work given to students periodically served two different purposes. They become aware of the problem and may find a solution to that problem. Thus they learn the concept in a far better, unforgettable way. The other case is that they could not get answer; they understand that the problem is difficult and pays more attention when the solution is provided.

8. HOW IT WORKED: -ASSESSMENT AND COMPARISON TO CONVENTIONAL APPROACH

All of above worked almost as expected with some exceptions. The experiments are continued till the first test (Which is taken after nearly 70 days) and then the survey is conducted after the test¹. The result of survey is summarized in the following.

There are 47 respondents to this experiment. The survey is divided into four parts. The first part contains direct questions. The answers to these questions have rating from 1 to 5. 1 indicates lowest while 5 is highest. There are 12 direct questions where they have to answer. Ex. One direct question was if they find my teaching improved. In this case 27 replied that my teaching is improved substantially (4) and 18 thinks that it is improved beyond substantial (5). While 5 gave the grade as 3 and 1 gave the grade as 2. The detail summary of all direct questions is given in appendix1. The next part contains a question to check the effectiveness of the review activity before each lecture. That checks to see if the reviewing by students (which are hand picked by the instructor and not volunteers) of the previous session is useful or not. If it is useful only in learning or also in improving the retention period is also checked. It is found that only 1 student found it not useful. 14 found it improving their learning and 37 found the method also improves their retention. The effectiveness of asking questions to the students about all three levels (knowledge, application and evaluation) is the focus of next section. There were four options from which students have to choose. The options include the questions are 1. Intimidating 2. Interesting but not important 3. Important 4. Extremely important. The results says that respectively 19,20 and 21 respondents feel all three levels are extremely important. Likewise 15,12 and 13 thinks that these questions were

¹ All the experiments are found to be very fruitful so we have continued with them even after the survey completed. Few modifications are made looking at the results of the survey but otherwise the practice is continued without much difference.

important. 5,8, and 9 found it interesting respectively for all these three types of questions. Next section was based on to check the effectiveness of group activities. Four facets are checked. The first was whether the communication skills improvement. Second was for checking if they feel more like team members then before, third was for being more comfortable in putting forward their views to the professor or others and forth is related to contributing in a group. They were to give grades between 1 to 5, 1 being lowest and 5 highest. The results clearly show that the group activities have been very useful to the respondents. The average grades given to all four questions (3.90, 3.94,4.07 and 4.27) indicates that respondents feel all this expectations are met with success. Overall improvement rating is asked next. The answer is to be between 0 and 100. The average comes out to be 75.93. Again this clearly indicates the success of all these methods. There are some additional questions in the survey to cross check if the student is filling the form randomly and not with purpose.

9. ANALYZING ABOVE RESULTS

The result analysis of all these experiments is really interesting. Most of the experiments return positive results. Some of the students have replied that they are not able to improve to their liking but otherwise they feel that their learning and my teaching is improved in the process. The experiment they like the most is to allow discussion in the group before answering the questions. This helps reflective and intuitive learners and also help the respondents feeling that the question asked is interesting and they can answer that (albeit wrong quite a few times, but stress is not on the correctness of the answer, the stress is on the participation and advantage of communicating in a group. That was clearly visible to the instructor and also is reflected in their replies in the survey (average 4.6 with maximum 5)). One more important fact is that they have started enjoying the lecture more (4.25). Mine is usually the last session, the most difficult to get attention of. Also, most of them agree that their attention to the lecture is improved (4.52 average from max 5). Most of them also believed that their learning is improved to a large extent (4.10).

The student's responses showed clearly the advantages of the effective teaching methods. The success of group activities and students enthusiasm to work in group propels us to work further in that area. We are planning to work more on collaborative activities which include division of work in a group, responsibility assignments and reporting infrastructure. We are also planning to device a strategy to rework the sessions to fit the need of different types of learners; particularly for post graduate engineering and MCA students. One of the authors has conducted two workshops on effective teaching already and based on his experience, we are planning to work on an extensive survey to get more accurate measurements of effective teaching methods. So far, our conclusion is that the methods that we have used are extremely effective in teaching at masters and we highly recommend implementation of these methods at that level.

10. COMPARISON OF STUDENT RESULTS: -

More interesting statistics relate to the student's results. This is the focus of this paper. We have compared results of the first test of both the subjects. We could instead have compared either the second test results or final results but first test results reflect better for following reasons.

1. The first test is usually a strict test with an aim to awaken those who are complacent. Thus results are poor then second test where the aim is to see that students get fair internal marks. This, most of the times the second test requires being lenient while examining and require to elevate the result to some extent. Comparing such results may not give exact outcome of the effective teaching methods. There are no such constraints in the first test.
2. The students who does well in the first test, tend to be little lethargic in the second test as the best of the two tests are considered. This again may skew the results and hence not preferred.

Following are outcomes of the comparison of NT-1 and NT-2 subjects.

There are total 53 students who appeared in both the tests; the first test after implementing the effective teaching techniques (of subject NT-2) and the first test before the workshop (of Subject NT-1). Marks of 37 students increased while 16 students have their marks reduced. This show most of the students have learned the subject better and also learned to attempt the exam in a better way.

Total marks obtained by students in the NT-1 case was 223 (it was a 25 marks test) while the case of NT 2 is whopping 468, a difference of 245! Those who have their marks increased, the increment is 292, while those who have reduced their marks, the figure comes out to be 47. This shows that the students have not only get their marks increased, they get is done by a large margin! Those who have it reduced, most of their marks are reduced by a small margin only.

There is one more parameter which shows the effectiveness of the effective teaching methods. The average marks on the first case were meager 4.21 and in the next case it is 8.8! More then 100 percent increase! Table 2 lists above information in tabular form.

Table 2. Survey Outcomes and Conclusions

	NT 1	NT 2
Total Marks obtained by all the students	223	468
Average marks	4.21	8.81
Students whose marks are decreased	16	
Students whose marks are increased	37	
Total marks increased (for students with increased marks)	292	
Total Marks decreased (For students with decreased marks)	47	
Total marks increased (For all)	245 (110%)	

The students after getting above result are surveyed for their reaction for increment or decrement of marks and what do they feel about the role of effective teaching methods on them. Those who have their marks increased are asked to choose one particular reason for their success and rate the effective teaching techniques in order of their contribution in their success. Those who have their marks decreased are asked to give one reason for their failure to have more marks and see if the effective teaching methods are still useful for them, they have to rank these techniques using their preference. The choice include an option for not useful to extremely useful. All the students are also asked if they prefer these techniques to be deployed by other faculties as well. Total 30 respondents whose marks are increased are available for survey and total 7 whose marks are increased are available for the survey. Few of the students are detained as they could not clear the subsequent external exam. Most of them are those whose marks are decreased. They were not available for survey and few others could not be contacted.

11. STUDENT ASSESSMENT OF EFFECTIVE TEACHING TECHNIQUES

The ranking of effective teaching methods by both the groups of students (those who have their marks improved and those who have them reduced) is almost identical. The unanimous first choice is *Active Learning*. Second choice is *Summary in the Beginning of a Lecture*. Third is the *Inquiry Based Approach* where they have to work to find answers to queries and problems in the class. *Study Guides* is fourth for those who have their marks increased and minute paper is forth for those who have their marks decreased. At the fifth position it is *Minute Paper* for the increased marks group and study guide for the decreased marks group.

The most important reason for increment in marks is though the combination of *Inquiry Based Approach* and the *Active Learning* as the most important reason for increment in marks.

The most important reason for decrement in marks is shared by three different reasons. The first one is student's own *Inability to Study*, second being *Inability to Talk to Others* and third being *Complacency*. It is important to state that *NONE blames any effective teaching methods for their decrement*.

All students, whether their marks are increased or decreased, unanimously agreed that the effective teaching techniques are useful to them and more importantly, the techniques are to be deployed by other teachers as well.

We think the above result is the most important one.

12. THE FACULTY RESPONSE TO THE EFFECTIVE TEACHING WORKSHOPS

The first workshop in LD college of Engineering: -

The first workshop was conducted on 20th September 2008. This is the only workshop I have conducted with one more facilitator; Dr Rajul Gajjar from LD college of engineering. I have conducted other workshops as sole facilitator. There were total 49 participants, 40 were from LD College itself and 9 from other engineering colleges. The Topics covered included 1) learning styles of different learners and adjusting teaching styles considering all learners, 2) inquiry based and problem based approach with active learning and 3) learning objectives, bloom's taxonomy and study guides. 4) Active learning and 5) Group activities

The workshop was for a single day from 9:30 Morning to 5:00 Evening. Table 3 summarized as follows.

Table 3. Summary of Student Opinions from First Training Workshop [2]

No.	Opinion on	Rating				
		Poor	Fair	Average	Good	Excellent
1	Workshop Content	0	0	6	20	23
2	Visuals	0	0	6	26	17
3	Presenters	0	1	2	23	23
4	Overall Workshop	0	0	2	27	20

This clearly indicated the success of the workshop. As it was the first workshop, we had some negatives as well. The first one was the numbers in average is not insignificant and we need to improve on that. Following table indicates what thought about the workshop. Number of people remained neutral, though less, not insignificant. One of the reasons of that was the coverage. I thought we have tried to cover lots of things in a single day and the content was bit too heavy. Anyway, when most of them considered the workshop worth recommending to others (41 out of 49), we could easily see the workshop was as worth as we found it ourselves when we attended the Richard Brent and Rebecca Brent workshop.

Table 4. Summary of Student Satisfaction from First Training Workshop [2]

No.	Opinion	Response		
		Disagree Strongly	Neutral	Agree Strongly
1	Workshop met my Objectives	0	12	37
2	Workshop was enjoyable	0	13	36
3	I would recommend it to others	0	8	41

The Second Workshop at Charotar College of Engineering, Changa

This workshop was held at Chnaga, around 80 kilometers from Ahmedabad from 10:00 AM to 4:00 AM on 14th November 2008. All the participants were faculties of the same college from different engineering disciplines. Topics covered included 1) learning styles of different learners and adjusting teaching styles considering all learners, 2) inquiry based and problem based approach with active learning and 3) learning objectives, bloom's taxonomy and study guides. I have decided to reduce the coverage to go little deeper and give participants more

chance to absorb the material presented, demonstrated and made them to work on. The results are far better than the previous workshop. It is difficult to find exact reasons but one of the feedbacks helped me. It was about reducing the pace of the content presentation. I have reduced the pace as well as elaboration which resulted into less coverage than the first workshop but far better understanding of the participants.

The workshop was attended by 51 participants. The ratings given to the workshop is as follows.

One good sign was the improvement in the last column, the Excellent Column; particularly the Presenter row.

Table 5. Student Opinion Survey Results from Second Training Workshop

No.	Opinion on	Rating				
		Poor	Fair	Average	Good	Excellent
1	Workshop Content	0	0	0	21	30
2	Visuals	0	0	7	18	26
3	Presenter	0	0	0	10	41

Table 6. Student Satisfaction Survey Results from Second Training Workshop

No.	Opinion	Response		
		Disagree Strongly	Neutral	Agree Strongly
1	Workshop met my Objectives	0	12	39
2	Workshop was enjoyable	0	7	44
3	I would recommend it to others	0	5	46

The third workshop in Computer Society of India, Ahmedabad Chapter

The workshop on the same lines as of 2nd workshop is conducted in CSI Ahmedabad Chapter office. Total 14 participants from MCA, BCA and BE collages attended the workshop. It was the first time I had a small but heterogeneous group of teachers. The results clearly indicate that nobody thought the workshop to be poor, fair or average and almost half felt it to be excellent and other half thought it to be good. The most heartening part is the recommending the workshop to others. Only two of them remained neutral, other 12 thought they would recommend this workshop to others.

Table 7. Student Opinion Survey Results from Third Training Workshop

No.	Opinion on	Rating				
		Poor	Fair	Average	Good	Excellent
1	Workshop Content	0	0	0	7	6
2	Visuals	0	0	0	7	6
3	Presenter	0	0	0	5	8
4	Overall workshop	0	0	0	4	9

Table 8. Student Satisfaction Survey Results from Third Training Workshop

No.	Opinion	Response		
		Disagree Strongly	Neutral	Agree Strongly
1	Workshop met my Objectives	0	2	11
2	Workshop was enjoyable	0	5	8
3	I would recommend it to others	0	1	12

13. SOME OF THE CONCERNS SHOWN BY THE FACULTIES WHO ATTENDED THE WORKSHOP AND THEIR ANSWERS

Coverage of Syllabus: -

Most of the faculties have shown their concern over the coverage of syllabus. They think that when we spend time in active learning techniques and the like, the time available for rest of the content becomes less than usual and that creates a problem. The answer to that was also given to participants in the Felder and Brent workshop which the first author explained same to them drawing examples from his own experience. The answer is something like this. The first thing is that merely covering syllabus does not mean students learn that. It is done merely for teachers satisfaction that he/she has done is job. The focus should be on student's learning. The outcome based assessment process stresses on students learning rather than teacher's coverage of syllabus. The second issue is that it is possible and useful to list everything to be covered in a subject in form of learning objectives. Once the coverage is clearly transformed into set of learning objectives, it is easier to find out first level learning objectives from the coverage. It is advisable to skip them while teaching them and let the student read them from a lucid written version that a teacher should prepare. The first author's own experience suggests that the level 1 content is worth 10 to 20 percent. Once we skip that part, the time saved can be utilized in active learning methods. A teacher must learn to balance, but the effort is worth having.

This is not applicable in my case: -

Rather strange argument that the first author heard often is that whatever discussed is ok but this is not applicable in their own case. This is difficult to address explicitly as it is impossible to understand the level and type of one's own position, one's own subject, one's own set of students. The first author tried to discuss and find what actual problems behind this statement are. Some of the cases point to the management which demands completing the syllabus literally. Some other cases point to the resistance of the head and others in implementing. Such participants are advised to find out methods which suits in their own environment and apply them. (Ex. Study guide is something which can be applied almost all cases, minute paper is also possible to be applied as it does not have any impact on anything else, similarly setting up questions which are more readable also can be done without any problems) Once they are successfully implementing them they can attempt other methods if they feel like. In fact, the first author has seen some of the participant working in similar conditions producing some results and thus think that it is also a problem of resistance from the participants itself.

We do not have any control on the exams

Most of our participants belong to institutions affiliated to some Universities. Under the affiliation norms, the final exam is conducted by the University and the teachers have absolutely no control over that exam. In most of the cases though, there is small portion of internal marks that is in teacher's hand. Sometimes the policies of the organization demands additional restriction on teacher's giving out internals (like conducting two written tests and two practical tests and give best of both as internal etc). When some of the participants reported that they do not have much control over the exam they are right most of the times. They are advised that they can apply whatever they have learned in this workshop to a smaller portion they have control over and forget about the rest. The engineering and MCA colleges of Gujrat are soon to become part of (GTU) Gujarat Technical University. In fact first year engineering has become part of GTU. When working with a mass of students, the GTU might probably decide to adopt standards adopted all over the world, and then whatever discussed and learned in the workshop becomes much more relevant. Thus they were advised to learn and implement the concepts of learning objectives and study guides in their own subjects.

14. REFLECTION ON RESULTS OF TRAINING WORKSHOPS

All students unanimously agreed that the new teaching strategies learned by the instructor at the IUCEE Faculty Leadership Institute were very effective and recommended that other teachers should also implement the same. The instructor felt that he needed to work on techniques learned to improve performance of students who did not fully engage in the strategies. Some of the students that failed to engage in interactive techniques cited reasons such as: their discomfort mingling with others, their own inability, and complacency as the main factors that kept them from fully engaging. This problem requires other solutions other than making teaching more effective, perhaps addressing lack of socialization and lack of motivation. The IUCEE Institute participant found that his experiences implementing the strategies learned in his own classroom, on a two part course, where the first part of the course was given prior to taking the IUCEE Institute and the second part utilizing the strategies learned in the Institute, have yielded results that have proven that the teaching strategies taught at the IUCEE Engineering Faculty Leadership Institutions are very effective and work in his own classroom. Collaboration and interaction with the US mentor have resulted in pedagogical publications in international conferences [2], and further technical research collaboration and publications are planned. Regional Centers support Regional Workshops with materials that were generated during the 2008 Institute. It would be more beneficial if the materials were available outside of the centers.

IUCEE plans a Second Indo US Engineering Faculty Leadership Institute to be held Summer of 2009 from June 22 to July 10, 2009 at the Global Education Center of Infosys Technologies at Mysore, India, with the objective of building on the success of the First Summer Leadership Institute held in 2008 and the follow up work being done by the Regional Centers. This Second Institute will admit, in addition to the Indian faculty participants, a limited number of participants from other regions, such as Latin America and Africa, where the IUCEE model is being studied for replication. More detail can be found at the IUCEE web site [1].

15. CONCLUSION

This paper presented the format of the IUCEE 2008 Summer Faculty Leadership Institute and the experiences of one Indian faculty member who was trained in the Effective Teaching Methods presented by Richard Felder and Rebecca Brent. The faculty member had very successful results in improving student performance and satisfaction in using the techniques. Results of applying the discipline based workshops have not been published as of this date. The International Federation of Engineering Education Societies (IFEES) is considering how to expand the Faculty Leadership Institutes to other countries. IUCEE is collaborating making the materials (videos and PowerPoint slides) available to IFEES and IFEES members to help in the adaptation of the Institutes to other areas. Dr. Krishna Vedula will give a 3 hour seminar in the IFEES 2009 Global Engineering Education Summit in St. Petersburg, Russia on the basis of the model. IUCEE is inviting academic leaders from Latin America and the Caribbean to attend its 2009 Institute to have first hand experience of the courses and think of adapting the IUCEE model. LACCEI is actively participating in this effort and invites others interested to join the taskforce.

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