Observations from Faculty Development Workshops in the Current Indian Context

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Abstract: More and more higher education administrators in India are recognizing the imperative need for new faculty development. Many 'fresher' engineering faculty are eager and motivated to teach using innovative teaching methods that are student-centred and experimenting in their classrooms. However very few of them have industry experience and most begin teaching right after their post-graduation. Given this scenario, what approaches can they take to create practical and relevant content for their classes? A hierarchical organization structure also constraints many young faculty initiatives. Then, there are curricular constraints resulting from the affiliated or autonomous status of the institutions. How can faculty and management address these constraints as well as student resistance to new approaches? In this context, as part of the IIEECP (IUCEE-IGIP International Engineering Educator Certification Programme), an attempt has been made by several institutional leaders and IUCEE to offer faculty development workshops in 3 phases. The scope of this paper is restricted to the experience of seven Phase 1 3-day workshops involving approximately 300 faculty members from various engineering institutions in India. The workshop sessions were highly interactive including group discussions and activities. The paper will share short summaries of participant survey data and facilitator observations from the workshops. As mentioned in many forums on higher education in India, a concerted and holistic approach involving leadership of forward thinking private higher educational institutions as well as academic and administrative bodies is long due to address issues regarding educational effectiveness at higher education institutions in India.

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1. Background and Context

The number of higher educational institutions offering accredited undergraduate engineering programmes in India was 1870 in 2016-2017 (AICTE Website Dashboard). The total number of undergraduate students enrolled in engineering and technology was estimated to be about 42.5lakhs (All India Survey of Higher Education 2015-2016). Taking an average student-faculty ratio of 21, the number of faculty at these institutions can be estimated at roughly 2 lakhs. The total number of Ph.D enrolment in engineering is 30,587 in 2015-2016 (All India Survey of Higher Education 2015 – 2016).When these Ph.D.s graduate the typical assumption by the hiring institutions is that they are qualified to teach. In other words, the training needs of this large a workforce has largely been neglected or given lip-service by most government and private institutions. The faculty begin and continue to teach with the ingrained illusion that 'no training is needed for teaching' in their minds. In some cases, a new faculty member who is inclined to teach using innovative methods is found questioning himself or herself because of this situation. Given this context, in many institutions, faculty quality and motivation suffer. However, in some institutions, a cohesive faculty community composed of a mix of young faculty and a few humble seniors are willing to experiment with and learn from their pedagogical experiments with the students in their classroom out of their own intrinsic motivation.One key ingredient in the success of such communities is a supportive and informed management.

2. The Faculty Experience – A Narrative

Let us follow a narrative of a faculty experience in order to illustrate the context better. This narrative resulted from a synthesis of observations of faculty and interactions with them during this workshop.

Mr. Suresh passed the GATE entrance exam and completed his M.E. in engineering recently. He was hired by ABC Engineering College. In the first year, Mr. Suresh taught a course already developed by Dr.Mahesh, a senior faculty member in his department. Dr.Mahesh addressed his occasional questions about teaching and got him off to a

good start but did not give him any suggestions on course delivery or student-centred learning. Mr. Suresh had so far not designed a course or written course learning objectives on his own. When Mr. Suresh asked Dr.Mahesh if he could attend a faculty development workshop being offered next month, Dr.Mahesh told him, "Do you think I attended any workshops on teaching? You will learn on the job. You will be fine. Don't worry! I will help you." After teaching the same course twice, Mr. Sureshfound the classroom experience a bit boring. Hetalked to a few other faculty members and researched online, and decided to do something to engage the students better the next year.

In the second year, Dr.Ashok, the Department Head informed Mr. Suresh that he needed to develop a new elective course for the department. Mr. Suresh was excited and diligently focussed on developing the new course on 'Artificial Intelligence'. He also consulted some other faculty colleagues on how to engage the students better. He had observed in his earlier class that students were mixing up definitions of some technical terms. Talking to a few faculty members and referring to a few articles online, he decided to use cross-words as that would increase student engagement in the classroom and would be interesting for him as well. He developed a few cross-words and used them successfully in his classes. He observed that students are engaged in his classes because of this activity. Of course, some students didn't care but that did not bother him. The next semester,after discussing with Dr. Gupta, an external resource person visiting his institution, Mr. Suresh set up a quiz competition among his student groups in the class. He found that the seating furniture needed to be rearrangedand enlisted a few enthusiastic students to help him with that. When he implemented the quiz the first time, it was poorly coordinated and the students did not like it. But Mr. Suresh persisted and tried it a second time. This time, the students liked the Quizbut it took him a lot of coordination effort to manage the quiz. He also found that student control was challenging in some circumstances but he learnt to let go of the 'illusion of control'. However, after doing two of these Quizzes, he decided to pause on the activities for a little while. In the three years of experimentation in his classes, he figured out that activities engage the students but disrupt the class. He also saw the need to refocus on effective student learning and not just student engagement. In one of his online searches, he came across a journal article that described how an engineering education research approach can improve teaching. He also learnt about outcomes-based-education (OBE) at a faculty development workshop organized by his institution...

This faculty development narrative can be continued in many ways but a few key elements are revealed in this:
1) Thinking about and brainstorming about how to teach is an important part of improving teaching.
2) Planning direct assessment of student learning helps one conduct effective educational research and publish.
3) Reading engineering education research journals periodically helps faculty find solutions to learning issues encountered during teaching.Therefore, it is important to provide these resources to faculty and create a culture of reading these articles periodically and discussing about them.
4) Every element of teaching from course design to setting up course learning objectives and creating activities require careful planning. While there is a substantial number of literature on engineering education, faculty may not find the time in the first few years to sort through and arrive at things to try. This indicates the importance of having a mentor, getting trained through webinars and workshops as well as networking with external and internal academics.
5) While experimenting with new approaches, faculty need to learn from their failures. For this process, one requires an understanding leadership that encourages corrective action and does not penalize the first few failures in implementing active learning methods in the classroom.
6) Faculty leadership also needs to understand the need for continuous and concurrent training and development of faculty.

A training intervention such as the workshop described in this paper works best in the second or third year of teaching. This is when the faculty member has had some significant experience of teaching and can identify the need to engage the student from his/ her own experience. After working on some activities in the classroom, the next step would be to refine these based on a deeper understanding through a learning assessment. All these steps indicate the need for a phased approach to faculty training. The IIEECP (IUCEE-IGIP International Engineering Educator Certification Programme) organized in 3 Phases was one such approach. More details about the full programme are available in Kavade et al. 2017. The impact of the workshop in improving teaching effectiveness is also discussed in this reference.

3. About the IIEECP Orientation Phase 1 Workshop

The objectives of the Phase 1 orientation workshop were limited to the following:

- To sensitize the faculty to the need for learner-centred teaching
- To begin to design or redesign a course and its elements
- To begin to develop effective teaching and active learning strategies for use in the classroom
- To begin to design formative and summative assessment tools and rubrics for outcomes assessment

The data and the observations presented in this paper coverseven workshops offered by the author as the facilitator in the years 2013 – 2016.Six of the workshops were offered as part of the IIEECP programme. One of the workshops was offered prior to the creation of the programme and is included in this paper.About 300 faculty from 10 engineering institutions participated in these workshops. 6 of the institutions were autonomous and 4 were affiliated to state Universities at the time of the workshop. The number of faculty at each of these workshops ranged between 35 and 45. The faculty were from the different engineering and technology disciplines (Computer Science and Engineering, Information Technology, Mechanical Engineering, Electronics and

Communication Engineering, Electrical and Electronics Engineering, Civil Engineering and Biotechnology). A few faculty from MBA and Basic Science and Humanities departments were represented as well.

The workshops were typically held ina seminar hall at one of the participant institutions where a discussion room type furniture arrangement was made available. However, two of the venues had a typical classroom style seating and a business conference room style seating. These arrangements did not offer optimal conditions for the workshop.While audio-visual equipment were available at most of these venues, collar-mike system and video recording equipment were typically not availablein many offerings of the workshop.

The sessions in the workshop werelisted below.

- Introduction/ Ice-breaker
- Role of the Teacher
- Heartfulness Relaxation
- Revealing Misconceptions
- Elements of Effective Teaching[1]
- Course Design[1]
- Course Learning Objectives and Levels of Learning[2]
- Session Plan with Good Questions[1]
- Active Learning Methods
- Just-in-Time Teaching
- Collaborative Learning[2]
- Feedback and Assessment Rubrics[2]
- Project-Based Learning

[1]These topics were adapted from Felder, R.M. and Brent R., 2016.
[2]These topics were partly adapted from Felder, R.M. and Brent R., 2016.
Project-Based Learning was offered as a topic only in the initial workshops and was not offered in later ones.

Each workshop had a set of about 8 activities and accompanying worksheets on the topics. In most workshops, the faculty from related disciplines (for example, ECE and EEE) were seated in groups of 5. In some workshops, it was not feasible to form all faculty groups in related disciplines because of the small numbers in specific disciplines.

The topic on which the activity was done depended on the need either as indicated by the participants through a pre-workshop survey or as assessed by the facilitator during the workshop. The author facilitated the activities by probing the participants with questions and eliciting their written or oral responses. For example, the topic 'the role of the teacher' was conducted as a 'Think-Pair-Share' activity by forming pairs among the faculty. The participant responses were collected on a whiteboard and simultaneously collated into related groups and shared with all to convey the roles. The general approach of the workshop was to provide minimal content to introduce the topics and focus on generating a viable starting point for the IIEECP Phase 2 programme.

4. Pre-Workshop Survey

In order to prepare for the workshop, a pre-workshop survey was sent by email to all participants using Survey Monkey® and feedback solicited. The three main goals of the survey were: (1) to gauge the level of understanding of learning objectives, (2) to identify the activities that the participants were already doing in the classroom and (3) to introduce an element of 'just-in-time' teaching in the workshop.

5. Observations

In this section, observations of the facilitator are shared from the pre-workshop survey, activities of the participants during the workshop and the feedback survey.

Observations are reported here below with the subtopics listed in the order of appearance of the topics during the workshop.

A. Introduction/ Ice-breaker

The facilitator introduced his educational background and shared an unexpected event that occurred in the first day of his class. This was followed by the faculty sharing their stories of an unexpected event in the class. This was meant to be an ice-breaker to enable the facilitator and faculty to get to know each other. Certain interesting anecdotes emerged in these discussions revealing peculiar regional cultures and student issues in India.

B. Role of the Teacher

The goal of this section was to identify the role that teachersplay as facilitators in the context of today's students. A Think-Pair-Share activity was facilitated and the participant responses collected into three major groups. A summary of participant responses from all these workshopsand the facilitator's viewpoint resulted in a working definition of the role of the teacher today. This is presented below:

Today's engineering faculty

- **Motivates** and **inspires** students, moulds their behaviour as a **role model** enabling transformation of students into capable professionals.
- **Interacts** with students to uncover student misconceptions, **facilitates** internalization of learning and **improves** student's self-confidence.
- **Loves learning** and is eager to **advance** in **professional** skills and knowledge.
- **Infects students** with the **fire** to **master** skills and knowledge.

C. Heartfulness Relaxation

It was observed that faculty encountered various types of student issues and may themselves be stressed out or encounter students with a high degree of personal stress. In order to help address these issues, a brief 5-minute

Heartfulness relaxation technique was introduced to faculty. The script for this technique is available at the Heartfulness Relaxation Technique Web Link. The faculty appreciated the experience and found it to be an effective tool in relaxing their body and mind.Many faculty were interested in trying the relaxation technique in their classes. This technique has been introduced successfully in several schools, colleges and corporate organizations in India and other parts of the world. For more details on the benefits of students due to the practice or to organize an event or a programme at your institutionsee the Heartfulness Education Web link.

D. Listing Common Misconceptions

In this exercise, faculty reported a list of common misconceptions or errors they noted in their interactions with students. The idea was to sensitize them to the need to document these as a way to experiment with ways to reduce the prevalence of the misconceptions or errors. As mentioned earlier in the paper, this topic was introduced as a group discussion activity. The faculty were formed in groups of 5 in their disciplines and a list of misconceptions was generated by each group in one or two classes of their choice through a small group discussion activity. Each group was asked to identify a recorder and a discussion facilitator. The list was recorded on a worksheet after group discussion by the 'recorder' in the group and two misconceptions from each group were shared on a whiteboard and discussed in detail with all participants. The participants were told that the recorder's role was to listen and record. The written notes from the recorder were passed on to another person for reading to all workshop participants. This was meant to ensure clarity in writing. The discussion facilitator's role was clarified by the participants themselves in an inquiry-based approach by the workshop facilitator.

Examples of the common misconceptions listed by the faculty participants in the workshop are listed in the table below.

Table 1. Sample List of Common Misconceptions

Misconception/ Error	Course
Difference between immunity and immune system	Immunology
Using Right Hand Rule when it should be Left Hand Rule	Electrical Machines
1kb = 1000 bits vs. 1024 bits	Programming
Solid resting on a corner vs. edge	Computer Graphics
Mixing omega for solid angle and frequency	Digital Signal Processing
Difference between algebraic sum and vector sum	Engineering Mathematics
Mixing decimal and octal systems	-
Velocity triangles and relative reference going from turbine inlet to outlet	Turbomachinery
Producer gas vs. biogas	-

While the lists generated above can be considered minor errors or mistakes in definitions, there were some serious misconceptions that surfaced during the discussions. All the generated 'common' misconceptions were distributed to the participant faculty in one form or the other. The original intent of the session was to have faculty bring copies of student exams with them and identify these from the student exams. However, since none of the faculty had access to the student exam copies, it was done as an exercise based on their memory. After the workshop, the participants were asked to use student exams and record the misconceptions in a more systematic manner. Some general observations can be made from this exercise. Many faculty realized the need to obtain audio visual materials for certain topics. Further, many of the errors were related to definitions and terminology. This was a recurrent theme in all the workshops and indicated that the connection between the name and its meaning was lost among many students as reported by the faculty. Further study needs to be done to understand this phenomenon to identify the root cause(s) and work towards possible solutions.

E. Elements of Effective Teaching

Introducing industry speakers in classes and involving them in course development are obvious ways to increase industry-relevance of courses. Such interactions also help faculty elevate their technical competence in subjects.

F. Writing Course Learning Objectives

While about 10 - 30%of the participant faculty were able to write clear, specific and measurable learning objectives, the majority had difficulty in writing clear learning objectives.

The exercise in the workshop involved an individual reflection by all faculty that resulted first in a list of their course learning objectives and then,a classification of the course learning objectives into the different levels of the cognitive domain of Bloom's taxonomy.

Between 30 - 50% of the engineering faculty attending the workshops lackedclear understanding of Bloom's taxonomy even though they had participated in prior workshops covering these topics. Assuming typical number of participants is 10% of the faculty at a workshop offering, the real percentage of prevailing misconceptions in this area at each institution may be much higher. Here below were a list of observations from the exercise.

1) There was a tendency to stick to the words used to describe Bloom's taxonomy classification itself and not understanding the higher intention behind it. For example, to explain a manufacturing process was identified as an 'Analysis' Bloom's cognitive level.

2) Another observation was that Outcome-Based-Education (OBE) was viewed as separate from Bloom's taxonomy instead of Bloom's taxonomy of classification being considered an integral part ofOBE.

3) The typical 'University' course objectives were vague and often at the 'Understand' level and the faculty were used to using these without consideration of the fact that understanding is not observable or measurable.

4) A related question raised by faculty is 'How can students apply without understanding?' So we need to have an 'understand' level in the learning objective.
5) Another related mindset prevalent among most faculty is that 'theory' needs to be taught before 'application'. However, a deeper inquiry may show that, in many cases, application examples can be brought in after introduction of a few theoretical concepts. A spiral modelmay be appropriate in course design.
6) The core of any assessment of learning involves a set of clear, specific and measurable descriptors that begin with the words, 'After the completion of the course, the students should be able to …' A typical stumbler in the earlier workshops was the difference in the use of the words 'objectives' or 'outcomes' by the different institutions. Considering the imperative need to implement Outcome-Based-Education, institutions or organizations may simply pick one option. Scientists and engineers can relate this process to picking a sign convention. In this context, it is relevant to note that the word 'Course Outcome' is used for this descriptor by NBA.

One final note regarding this exercise is that the emphasis is placed on the use of 'skill-based' descriptors and creating some 'higher' level learning objectives. A stifling constraint to autonomous institutions is the insistence on the course structure being 70% - 75% unchangeable and the allowance for 30% - 25% of the course to change. Instead since the Universities have representations at the Board of Studies and there is an approval process for this, one should consider relaxing this norm. One possibility is to allow the Board of Studies to discuss and make the determination on the extent of variation allowed in a course and more importantly what variations are being considered with proper justification including current industry-relevance, future trends reported etc. In fact, the faculty or faculty teams submitting the changes to the course, can write out a justification for changes to the course and defend it with the Board of Studies.

Note: The range of variation reported among participants indicated the variation between the different workshops. The participants were already pre-selected by the management for the workshop and typically represented the top 20 – 25% of the faculty in the departments. This sampling bias needs to be taken into account when considering these numbers. These observations hold true for the remaining sub-sections of this section.

G. Session Plan and Planning Good Questions

Most faculty members had a session plan that typically had only the topics and did not have any details about how to deliver. The typical misunderstanding here was that the objective of the session plan was simply to pick the topics to be covered for each session and sections in the textbook. So the session plan did not really have details on course delivery.In general, the session on planning good questions was well-received by the faculty and most faculty welcomed the challenge of creating good questions and participated fully. The list of good questions was listed on the whiteboard and challenged for their 'goodness' by participant polling and modified.

H. Active Learning Methods

While more than 30% of the responses in the pre-workshop survey included group discussion, many of the responses included asking questions, quizzes, crosswords etc. These responses indicate a misunderstanding of the term, 'active learning' versus 'interactive teaching'. This provided the starting point for the discussion on active learning in the workshop.

Another point made was that active learning methods are most effective for achievement for higher level learning objectives.

The list of active learning methodsand effective teaching practices demonstrated during the workshop with the faculty as active participants is presented below:

- Think-Pair-Share
- Individual Reflection
- Small Group Discussion
- Interactive Worksheets
- Just-in-Time Teaching Warmup Quizzes
- Minute Paper
- Mid-Term Survey

In this session, the participants created an activity plan for a difficult topic or a topic with listed common misconceptions that they had identified earlier. One common mind-set that preventedimplementation of activities in the classroom was the faculty perception that there is insufficient time to cover the syllabus. This is consistent with the reported faculty perception from around the world in various publications. Considerable effort is undertaken in the workshop to address this mind-set and convince faculty about the need for implementing activities in the classes through a discussion of the different student learning styles and the reported efficacy of these. Most participants liked the simplicity of 'Think-Pair-Share' and agreed from their own experience of the activity in the workshop that it takes the least amount of time to implement and that it engages all the students actively. Therefore, it was no surprise that in the feedback survey a large fraction of the participants reported they will do this activity in their classes. One key element of 'Think-Pair-Share' is the need to inform the students that the faculty will pick on one student to share with the class their responses. Without this prior information, some students may not feel the need to participate. This element will improve the effectiveness of the activity.

Some of the faculty understood the need to have a facilitated discussion among students on certain topics. However, when asked to enact the activity, the participants generally neglected the details of the process and jumped into performing the activity. The structure of the group discussion activity was shared with all the participants. The need to have one student identified as the recorder and one student as the facilitator prior to the discussion was

indicated as a key element to conduct an effective facilitated discussion among the students.

One observation from the workshop is that some faculty tend to focus on generating energy and interest among the students too much that there is the danger of faculty emphasizing the 'activity' and forgetting the 'learning'. Since student interactions were generally reported as the most enjoyable part of teaching by faculty, this tendency to have student interactions that both faculty and students enjoy creates a pseudo win-win scenario that does not result in student learning.

I. Collaborative Learning and Project-Enhanced Learning

A few elements from these two sessions were offered based on the need as well as the time available during the workshop. This included creating an awareness about CATME (www.catme.org) and Project-Enhanced Learning (mini-projects parallel to the course). Since many curricular constraints did not allow for mini-projects, implementation was solely based on individual faculty motivation and student interest. Further, the faculty were warned not to challenge themselves with too many changes to the course in the context of the project. Instead they were asked to make small changes to the course and introduce the changes in a cumulative phased manner. Some of the later Phase 1 workshops did not include the topic of Project-Enhanced Learning due to lower priority assigned to these by faculty. It was decided to cover this topic in a separate workshop.

J. Feedback and Assessment

This session introduced the participants to the idea of providing balanced feedback on assignments. The need to encourage sincere students who do the assignments was emphasized. As faculty were accustomed to giving critical and usually negative feedback, a certain awareness was created on the need for positive feedback through a Think-Pair-Share activity. All feedback comments typically given to students were collected from the participants and shared on the whiteboard. Typically the comments were distinctly skewed towards the negative in the beginning of the activity. Towards the middle of the activity, the faculty themselves realize the need for positive feedback comments. Finally, the need for assessment rubrics was emphasized and templates were shared with the faculty to customize for their use.

A holistic approach to OBE will need to necessarily consider higher level learning objectives in conjunction with teaching methods/ course delivery suitable for these objectives, appropriate formative evaluation methods to convey the learnings to the students as well as summative assessment methods and rubrics to demonstrate the attainment of these objectives.

K. Minute Paper

The formative evaluation technique similar to the one described in Felder, R.M. and Brent R., 2016 was implemented in the workshop at the end of the first and second days of the workshop, with the following questions:

Take two minutes and write down the response to the following questions on a sheet of paper, and leave it on the desk when you leave:

- What was the best part of the sessions so far?
- What was the least clear part of the sessions so far?
- What topic would you like to be covered in more detail?

Every workshop had different topics come up under the three different headings above. The topics on revealing misconceptions, relaxation, learning objectives, Bloom's taxonomy and good questions were reported as best in the different workshop offerings. Bloom's taxonomy and learning objectives were reported as least clear in many workshop offerings. These least clear topics were addressed in some detail in the beginning of the next day and the ones that needed more detail were typically those that were to be addressed in Phase 2.

L. Participant Feedback Survey

A printed feedback form was shared with the participants and the data collected in 3 of the 7 workshops. This section summarizes the results from this survey which was completed by 98 participants.

1) *Participants' Perception ofAttainment of Workshop Learning Objectives:*

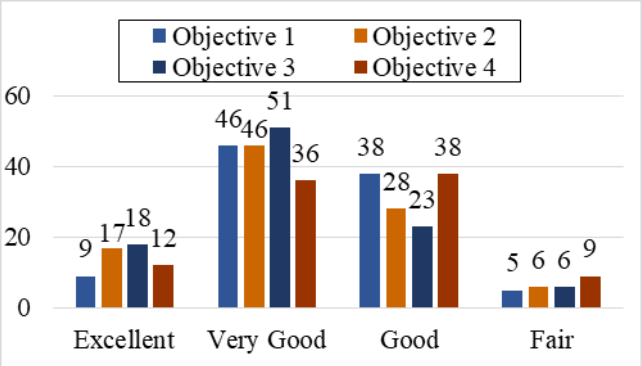

Fig. 1Workshop Learning Objectives – Participants' Perception

Figure 1 shows the participants' perception of the attainment of learning objectives for the workshop. The overall perception was positive in this regard though the last objective was rated the lowest. The reason for this was that there was insufficient time to cover these topics. Later workshops reduced the time spent on project-enhanced learning and increased the time spent on the topic of assessment and evaluation.

2) *Facilitator Rating Questions*

The facilitator was rated using the survey questions below:

Rate the Resource Person on a scale of 1 to 5

(Scale of 1 to 5: 1, Strongly disagree, 2 – Disagree, 3-Neutral, 4 – Agree, 5 - Strongly Agree)

The Resource Person for the Workshop:
Fa1 - Prepared sufficiently for the workshop
Fa2 - Engaged the participants in activities
Fa3 - Provided sufficient feedback during activities
Fa4 - Communicated clearly
Fa5 - Was energetic & enthusiastic during the workshop
Fa6 - Was focussed sufficiently during the workshop

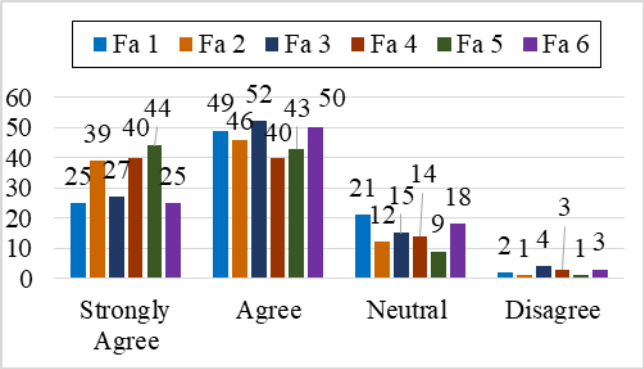

Fig. 2Facilitator Rating

While 74/ 98 faculty rated the facilitator preparation highly, 21/ 98 faculty rated the facilitator preparation as neutral while 2/ 98 as poor. The facilitator's approach was an inquiry-based approach which required the faculty to think of and create contextual examples in their respective disciplines. The neutral and poor rating may be attributed to this mismatch of expectations. Further, some of the faculty explicitly stated that they needed discipline-specific examples, while the facilitator's approach was to help them create these examples during activities.

A further effect to note was that not all faculty participants could be covered by one facilitator in view of the limited time for the workshop. An alternate approach would be to limit the number of topics and have a more focussed approach. However, since each workshop was slightly different in terms of the faculty prior preparation and skills, this was not entirely feasible. Further, faculty from some departments such as MBA had real difficulty during the discussion sessions.

3) *Faculty Self Rating Questions*

The faculty also rated themselves using the survey questions below:
Rate yourself on a scale of 1 to 5
(Scale of 1 to 5: 1, Strongly disagree, 2 – Disagree, 3-Neutral, 4 – Agree, 5- Strongly Agree)
During this workshop I:
S1 - Prepared sufficiently for the workshop
S2 - Engaged in activities sufficiently
S3 - Asked relevant questions during activities
S4 - Communicated clearly
S5 - Was energetic and enthusiastic during the workshop
S6 - Was focussed sufficiently during the workshop

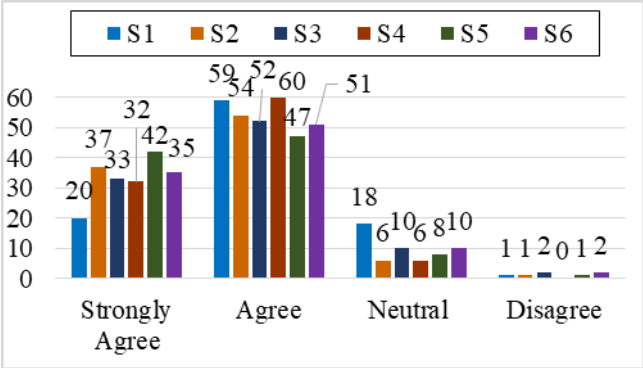

Fig. 3Self Rating

Roughly the same patterns were seen for the self-rating with the exception that the faculty rated themselves slightly better than the facilitator. One observation to note was that while the majority of the faculty rated themselves high, a few of them (19/28) felt that they were not prepared well for the workshop and a smaller number (12/98) felt that they were neutral or ineffective in asking questions.

4) *Workshop Rating Questions*

The participants rated the workshop through the questions below:

Rate the Workshop on a scale of 1 to 5:
(Scale of 1 to 5: 1, Strongly disagree, 2 – Disagree, 3-Neutral, 4 – Agree, 5- Strongly Agree)
W1 - Overall, I found this workshop was very useful for my teaching career.
W2 - I would recommend this workshop to others.

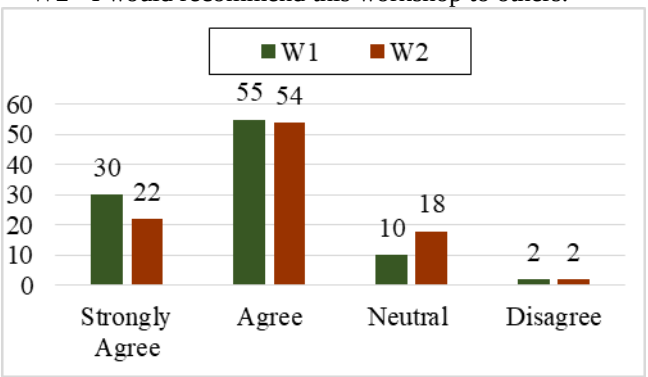

Fig. 4Workshop Rating

A large majority (85/ 98) agreed or strongly agreed that it was useful to their teaching career. However, 12 of them were neutral or disagreed with this statement. Further, 76/98 participants said they would recommend this workshop to other colleagues. The remaining were neutral or disagreed that they would recommend the workshop to other colleagues. This observation follows the other observations in the previous sub-sections of this topic.

5) *Open comments*

The participants shared their open comments in a separate section. Some of these comments were addressed to evolve best practices for the workshops.

M. Some Workshop Best Practices

Some best practices for faculty development workshops were identified as below:
1) Use of Pre-workshop Surveys helps identify and address potential stumbling blocks early and introduces an element of 'just-in-time' teaching in the workshop.
2) A checklist can be provided to participants on what to bring to the workshop.
3) Multiple trainers with different domain expertise can enhance the effectiveness of such workshops
4) Several Indian and regional contexts were different so at least one faculty from the participant institution needs to participate in customizing and co-developing the workshop.
5) Use of Minute Papers at the end of Days 1 and 2 of the workshop and addressing these prior to session start of the next day.
6) Feedback from Participants with self-assessment and open comments sections.

Some of the above suggestions came from the participants and were addressed in subsequent workshops when possible.

One other comment is related to the need to stick to the time schedule for the workshop. Even though the time schedule for each session was given ahead of time, many coordinators and participant faculty could not keep the starting time of the workshop. This was addressed in later workshops by prior communication with the coordinators.

Conclusions

Faculty and management best practices were identified from a faculty development workshop experience. The major ones from these are listed below:

1) Administration and Faculty leadership:

- Administration and faculty leadership need to allow for mistakes made by the faculty while experimenting with new approaches and support and encourage such experimentation.
- Administration needs to be aware of the need for continuous, timely and holistic development of faculty through multiple approaches.
- The Board of Studies structure at autonomous institutions needs to allow for greater flexibility perhaps in a phased manner to allow institutions to create modified courses while monitoring quality.

2) Faculty:

- Thinking about and brainstorming about how to teach is an important part of improving teaching.
- Heartfulness relaxation is an effective tool that can help create a positive learning environment in the classroom.
- Simple methods of active learning can be implemented to improve teaching effectiveness without loss of class time.
- Planning direct assessment of student learning helps faculty conduct effective educational research and publish.
- Reading engineering education research journals periodically helps faculty find solutions to learning issues encountered during teaching.
- Feedback on student assignments need to focus on positive elements to encourage sincere students who do the assignments.

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