

A Framework for Teaching evaluation

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Abstract— This research to practice full paper presents a framework for teaching evaluation. Teaching Evaluation is required for increased student learning, to measure the effectiveness of teaching, and to review courses and programs to effectively meet the needs of students. This evaluation must have a multidimensional approach to address various aspects of teaching and learning. Teaching evaluation can be done as a formative or summative evaluation, or a combination of both. Some combination of formative and summative evaluation about student learning can help in improving the teaching methodology to improve student learning. It is also known that evidence based instruction strategies improve the learning levels in the teaching learning process. This paper proposes a framework for teaching evaluation incorporating evaluation of evidence based teaching strategies.

Keywords— *Teaching & Learning Experiences in Engineering Education, Assessment and Evaluation Strategies/Approaches; Using Learning Theories in Education Research; Faculty Development; Engineering Education Research*

I. INTRODUCTION

Increasing the Employability levels of graduates by improving the quality of teaching in engineering institutions is a necessity. Institutions would be interested in evaluating teaching at their institute for any or all of these reasons: to improve the quality of teaching, or to assess the teachers, or for administrative purposes.

Evaluation of teaching in an institute is an exercise that needs to have a focused approach depending on the requirements. The primary focus of teaching evaluation should be the teacher's ability to create the conditions necessary to optimize student learning [3] [11].

There are many varied teaching evaluation approaches followed in various institutions. Teaching evaluation can be conducted using formative or summative assessments of teaching[17]. Formative assessments are focused on providing the information that can help the teacher to improve their teaching. Summative assessments are used to measure the overall performance of the teacher.

Some combination of formative and summative evaluation about student learning can help in improving the teaching methodology to improve

student learning. One of the most common teaching evaluation tools is the student feedback which is usually termed as Student Evaluation of Teaching (SET). Other practices for improving teaching include: Using Classroom assessment techniques, self-assessment or reflection, short discussions with colleagues and students about what is working and what is not [10]. The most complicated of all evaluations is the relationships between course evaluations and teaching effectiveness.

Linking effective teaching strategies (that are found to enhance student learning) to methods of assessing quality teaching in engineering is a research area that needs to be explored. Motivating the faculty to use evidence based teaching strategies is a necessity in engineering education. Also, the instructors using these strategies should get a proper evaluation of their learner-centered teaching strategies in terms of student learning. Some types of feedback are reported by teachers to be encouraging them to try out new teaching strategies. This paper proposes a framework for teaching evaluation incorporating feedback mechanisms for evidence based teaching strategies.

Current practices in Teaching Evaluation are presented in Section II. Factors associated with effective teaching evaluation are identified and presented in Section III. Section IV presents a gist of research based teaching strategies. Section V presents the Framework for Teaching Evaluation.

II. TEACHING EVALUATION - CURRENT PRACTICES

Teaching evaluation is traditionally carried out using certain well known practices like the end of the course evaluation, peer observations, evaluation of course materials, self-evaluation by the teachers, Student evaluation of Teaching (SET) [4]. The practices used vary depending on the context and culture.

The main sources of evidence for teaching evaluation include students – current students, graduating seniors, and alumni, graduate teaching assistants, department and other faculty colleagues. Herein after we refer to the educator/instructor/faculty as a 'teacher' in the paper.

A. SETs

Student Evaluation of Teaching is one of the most commonly used and one of the most effective practice for teaching evaluation. SETs are more reliable and valid and hence have received more empirical support than any other method of teaching assessment. But this should not be the only one for evaluation of teaching.

B. Classroom observation

This is one of the most common teaching evaluation practices being used after SETs. A peer educator or an administrator observes the class and notes the observations. These observations are later discussed with the teacher for improvement in teaching.

C. Evaluation of Classroom Materials

A Peer or a senior teacher does the evaluation of the classroom material prepared by the teacher to evaluate the preparedness and the quality of teaching planned by the teacher.

D. Student Mid-course evaluation

Student Mid-course evaluation is usually not a mandatory evaluation but taken up voluntarily by the teachers to evaluate their teaching and to improve their teaching further in the course.

E. Exit Evaluation, Alumni Evaluation

Graduating students provide exit evaluation on the courses they studied and on the teaching they had undergone. Alumni evaluation is conducted to evaluate the program as a whole and to review the curriculum. These evaluations often help in long term assessment of the program.

F. Summative Evaluation

Overall evaluation at the end of the course is summative evaluation.

G. Faculty Self Evaluation

Reflection of faculty on their teaching regularly during the course can be a good source of formative evaluation that can help in the improvement of quality of teaching.

H. Other Evaluations of the Teacher

- One on One Discussions with the teacher
- How the teacher plans course delivery
- Assessment plan

These sources are expected to provide evidence for information related to the teacher's role in student learning, approaches to teaching, mentoring, material presented by the educator, level of student

engagement, and leadership on improving undergraduate education. The questionnaires are prepared by examining departmental policies.

The data collected from these evaluations may focus on a narrow range of teaching behaviors and may not cover cognitive and effective structures that construct partial image of teaching and learning [1].

It has been presented in a survey done recently [4], that certain types of assessments like Student end-of-course evaluation, and classroom observation by peers and non-peers are the most useful assessments. But they too have their share of disadvantages. SET cannot assess certain dimensions in teaching evaluation like the teacher's commitment to teaching, their decisions regarding the teaching plan, course delivery, teacher's rationale for decisions made in the classroom, and some other dimensions [1]. A 2003 national academy report on Evaluating and improving undergraduate teaching in STEM [10] cautioned against relying solely on SETs to gauge teaching effectiveness. It was also studied that Statistical knowledge from SETs does not prevent over-interpretation of student evaluation by the teachers. Classroom observation could be based on individual judgment if not standardized. Standardized forms or rubrics are required for classroom observation for making it specific and to remind the observer as to what needs to be assessed.

The current scenario considered is that of an institute where traditional teaching methods are followed by most of the faculty, and the teaching evaluation is also traditionally done through SETs, and classroom observations.

It has been observed that teaching evaluation is not a standardized practice. The evaluation varies based on the requirement. Also, the various kinds of evaluations need to be standardized in order to obtain unbiased evaluation.

III. IDENTIFYING FACTORS ASSOCIATED WITH EFFECTIVE TEACHING EVALUATION

SETs have certain disadvantages that they cannot assess the evaluation of teacher's commitment to teaching, teacher's decision regarding teaching plan and course delivery, and other contextual aspects. Evaluation of teaching by students must hence be supplemented by other methods such as peer observation, or review of course material. Some of the factors that affect effective teaching evaluation include the following.

A. Teaching methods

Teaching methods that would be used in engineering education may be the traditional methods or non-traditional methods like inductive methods of teaching and learning. These methods differ by their

focus on the instruction paradigm or the learning paradigm.

B. Context

The focus of the institution also matters for teaching evaluation. The institute might be a teaching institute or oriented towards research activities, or would like to concentrate on teaching but also focuses on faculty research to cater to accreditation requirements.

Factors like size of the class, course grade distribution, and whether the course is an elective or a core requirement, influence the student responses.

C. Motive of Evaluation

The motive of teaching evaluation is whether to assess the teacher for his/her promotion/administrative review, or to assess the effectiveness of teaching and the learning happening as a result of that teaching.

D. Role of Faculty

Faculty must play a strong role in developing policies and procedures for teaching evaluation in view of the departmental/institutional policies.

E. Evaluation Criteria

Evaluation Criteria must be clear, well known, and understood, scheduled regularly, and acceptable to all who will be involved with rendering or receiving evaluation [10].

F. Students Biases

There is possibility of discrimination such as students having gender bias, or negativity towards classes they perceive as overly challenging or taxing. Teachers who are perceived to be difficult or who teach difficult material may receive lower evaluations despite students having better success in later courses based on what they learnt from those teachers. Students often get confused during SETs on whether they are evaluating the course or the instructor.

IV. TEACHING STRATEGIES

Effective teaching and learning has been proven to be possible through Evidence Based Teaching Strategies. Multiple Research Based Instruction Strategies have been developed that have shown to improve student learning in engineering education [6]. Activities are required to be performed both by the teacher and student in this kind of teaching.

In order to implement these Research Based instruction strategies (presented in Table I) which improve student learning, the teacher should plan the activities to be performed by themselves as well as the students so that the teacher and the student together can create a better learning experience.

Teachers plan the class by selecting the instructional strategy according to the required outcomes to be attained. Teaching involves the teacher participating in activities like lecturing, asking the students, answering questions, and the students performing activities like discussions, explanations, brainstorming, questioning, reflection, computing and other activities that enables them to actively participate in the class for effective learning.

TABLE I. RESEARCH BASED INSTRUCTION STRATEGIES [6]

| RBIS |
|---|
| Active Learning [14] |
| Think-Pair-Share [2] |
| Concept Tests [2] |
| Thinking-Aloud Paired Problem Solving (TAPPS) [2] |
| Cooperative Learning [9] [14] |
| Collaborative Learning [8] |
| Problem-Based Learning (PBL) [15] |
| Case-Based Teaching [15] |
| Just-In-Time Teaching [12] |
| Peer Instruction [7] |
| Inquiry Learning [5] |
| Service Learning [13] |

V. FRAMEWORK FOR TEACHING EVALUATION

Evaluation of teaching needs to be done keeping in view certain guiding principles.

1) Focus of the Institute – Teaching / Research / Both

There would be various kinds of institutes with different focus. There could be institutes that focus only on teaching, or to some extent on research, or more on research. This aspect should be considered while designing teaching evaluation / teacher evaluation practices.

2) What to focus on : teacher / teaching

Institutes use teaching evaluation in two ways – for evaluating the *teacher* that could help for decisions made on promotions, increments, etc., or for evaluating the *teaching* for improving the quality of teaching.

3) Teaching methods used – Inductive teaching

Teaching methods used would have prominent influence on the outcomes and hence need to be considered while evaluating teaching.

This section presents a framework for teaching evaluation including evaluation of evidence based teaching strategies used. The rubrics and questionnaires shall vary between institutes depending on their policies and requirements. Sample rubrics and questionnaires that are being implemented in the author's institute are presented here. Each of the evaluation practices consists of a questionnaire that needs to be filled up by either the students/ peers/ administrators. The questionnaires vary depending on the guiding principles.

The framework is defined in such a way that the evaluation should be taken up either focusing on the teacher, or the teaching, mentioning clearly about what is expected. There shall be a different set of practices required to evaluate a teacher than those required to evaluate teaching. Both the evaluations are aimed at improving the quality in education. The first one focuses on the quality of the teacher which in turn indirectly affects the teaching quality.

Teachers shall be given a performance expectations rubric, and are evaluated based on that. An example rubric is provided in Table II. Number of times evaluation is done is also a factor that depends on whether it is teacher evaluation / teaching evaluation. If it is teacher evaluation then it is going to be stressful for the teacher when the number of evaluations are more. But teaching evaluation if done more than once in between the course, would be helpful in improving the teaching learning process.

Focus of the institute influences the choice of a formative or a summative evaluation. Summative evaluation would suffice for Institutes with focus on research rather than teaching.

A. Focus on Teacher

Evaluation of a teacher shall be done with the following evaluation practices.

a) SET – mid and end of the course evaluation

The questionnaire consists questions on teaching style, effective delivery of content, and preparedness of the teacher. A sample rubric for SET is presented in Table IV.

b) Classroom observation

Classroom observation shall have a well-defined rubric and a questionnaire to clearly observe what is expected from the teacher (Table V presents a questionnaire for classroom observation)

c) Evaluation of Material and level of preparation

This is done by a senior teacher or a peer faculty of the department who evaluate the quality of the teacher's preparation. A rubric is provided for this evaluation based on Bloom's taxonomy.

d) Faculty Reflective notes

Reflection is one of the best ways for improvement and hence this practice of writing reflective notes shall help the faculty in reflecting their teaching and thus for improving. This is not for external evaluation of the teacher but is a self-evaluation practice. Reflective Notes guidelines are provided in Table III.

B. Focus on Teaching

Apart from the above evaluations of a teacher, the following are required to evaluate teaching.

a) Student mid course evaluations

Students are given questions on delivery modes, learning effectiveness, and any other aspects that need improvement. This is taken during the course so that the teacher can improve their teaching style based on these observations. This is a formative assessment

b) Students End of the course evaluation

End of course evaluation is a summative assessment that gives information about how much the students have learned in the course which is the actual requirement of the course.

c) Outcomes assessments

Unit wise outcomes assessment can benefit both the teacher as well as the student in assessing whether the desired learning outcomes are being met, and remedial measures can be planned at each of those levels both from the student's as well as the teacher's perspective. i.e., in learning as well as teaching methods followed.

d) Alumni Evaluation

This is not typically used to evaluate educator, but to evaluate the program as a whole.

C. Evaluation of Teaching based on Evidence based Instructional Strategies

Section IV presented a comprehensive list of Research based Instruction Strategies that were found to improve the quality of teaching and learning. Evaluation of teaching shall have to be varied when these instruction strategies are implemented. Apart from the above evaluations, there needs to be evaluations at both the ends: teacher and the student.

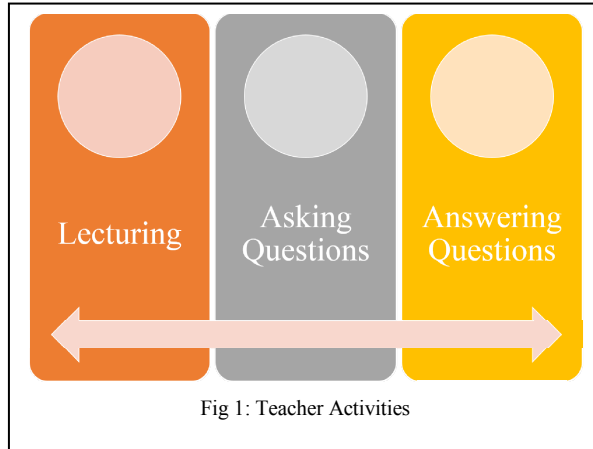
For using any modern, evidence based instruction strategy, the teacher does the following.

- the teacher first prepares a lesson plan,
- lists the learning outcomes for the topics to be covered,
- chooses the teaching strategy/ active learning techniques to be used in class.

The activities of the teacher in the class include lecturing, asking questions, and answering questions. (Fig.1)

The student on the other hand, will participate in discussions, explains, or questions, or reflects, or computes, or participates in some activity and thus learns (Fig. 1). The student will have to be made aware of the teaching strategy being planned to be used [16]. Evaluation of this kind of teaching learning

process should involve participation of teacher as well as the student.



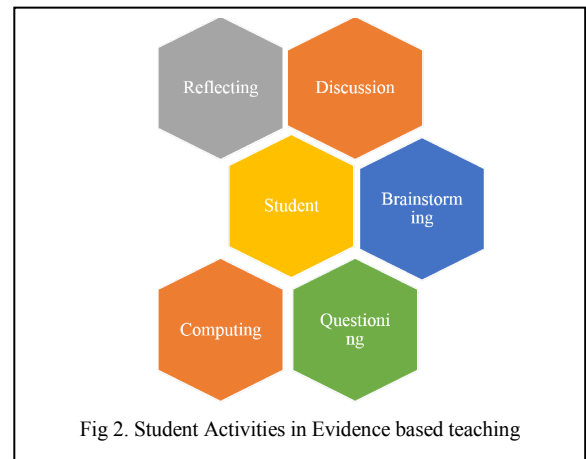
Teaching evaluation of Evidence based Teaching Strategies should involve the following.

a) Lesson plan by the Teacher including the learning outcomes planned to be achieved along with the instructional strategies planned to be used that shall undergo a peer review.

- The peer reviewer shall be a peer teacher or an administrator of the department. Review is communicated through a one-on-one discussion with the teacher.
- This evaluation shall be done before the class as a formative assessment.
- The planned outcomes and the active learning techniques used are reviewed

b) The students provide evaluation of teaching by responding to

- What was the teaching method used
- What kind of activity they participated in during the class (Fig. 2)
- Whether the Learning outcome is achieved



These two evaluations shall be compared to check the attainment levels of the planned learning outcomes. If the outcome attainment is satisfactory, it can be deduced that the teaching strategy was appropriately implemented. If not, either the teaching strategy, or the delivery process needs a change.

It can be intrinsically deduced that the teacher shall also get motivated in the process of outcome assessment to use more of evidence based teaching strategies for teaching.

The effect of these evaluations on the instructors' motivation to try out new learner-centric techniques is yet to be studied.

CONCLUSION

A framework for teaching evaluation is proposed to cater to various kinds of requirements in institutions incorporating evaluation of evidence based teaching strategies. Sample Rubrics and questionnaires for some of the teaching evaluations are presented.

TABLE II. FACULTY CLASSROOM PERFORMANCE EXPECTATIONS

| | Performance level → | Needs to improve | Meets expectations | Outstanding |
|--|---------------------|--|--|---|
| Classroom Activities ↓ | | | | |
| Preparation and organization (time management, syllabus completion), punctuality to class | | Complies 90% of the time | Shows 100% of the time | Always returns assignments/papers on time, completes and revises syllabus, makes arrangement even when emergency situations arise or in the face of unexpected situations |
| Knowledge of subject, willingness to learn/accept mistakes | | Some topics not well understood or not willing to find out and respond after class | Sound subject knowledge and answers all questions either at that time or after class | Expert level knowledge. Encourages questions that expand the students' and own knowledge |
| Clarity and loudness of speech and board/PPT usage | | Handwriting small or not neat. Asks for mike if not clear. | writing visible to all students and voice audible and commanding | Makes exceptionally clear pictures or neat writing. Voice has properly modulated to keep students alert |
| Use of active methods to teach majority of students | | is able to use 75% of the time | Use 90% of time | Is able to keep all students involved in class in all classes |
| Evaluation and assessment of students | | Unstructured, not useful to students | Timely, constructive | proactive feedback to students on their task performance |
| Social environment in class, Discipline, flexibility, interaction with students | | Occasional chaos in class or not able to manage discipline. Adheres too strictly to rules, unable to make exceptions | Well managed class and good personal rapport with students | Can motivate students through flexibility and at the same time manage proper behavior |
| Innovative methods | | Uses in at least 10 classes in the semester. Gives feedback on students' response | Uses at least in 30 classes in the semester. Gives feedback about students' response | Uses in at least 40 classes in the semester. Or explores more innovative methods by self and uses them. Gives feedback on response and self assessment. |
| Support outside class | | Does not take initiative unless students meet | Regularly meets students or discusses their concerns | Has a regular schedule to meet students after class and ensures that every student is seen at least 3-4 times a semester (one on one) |
| Projects/assignments / lab experiments beyond normal expectations (may be for high achievers) | | Does 2-3 items beyond syllabus. | Gives additional challenging tasks to high achievers | Consistently gives graded questions such that all levels of learners are able to do something challenging (differentiated teaching) |

TABLE III. GUIDELINES FOR WRITING REFLECTIVE NOTES

| Reflective Notes for Theory Courses | Reflective Notes for Lab Courses |
|---|---|
| Some of the following points may be mentioned | Some of the following points may be mentioned |
| <ul style="list-style-type: none"> Whether the Objectives of the class were met Informal Student feedback Whether any new/innovative method was used in the class What went well in the class What needs to be improved in the class Any discussion with colleagues on the topic/method of teaching Any interesting doubts from the students and how do you plan to clarify them | <ul style="list-style-type: none"> Problems faced by the students-were they solved Did any student get any variations in the expected results - was any discussion held on this Extended any experiment/have done new experiment |

TABLE IV. RUBRIC FOR STUDENT EVALUATION OF TEACHER

| | 4 | 3 | 2 | 1 |
|---|--|--|---|---|
| Punctuality | Always on time | Most of the times | Sometimes | Never |
| Class Organisation | Begins the class with a proper introduction, clearly explains the topic and ends the class with a proper conclusion | No proper introduction is given but clearly explains the topic and also ends with a proper conclusion | Explains the topic but neither an introduction at the beginning nor a conclusion at the end of the class is given | No proper explanation and class is not organized well |
| Willingness to learn/accept mistakes | Always | Most of the times | Sometimes | Never |
| Clarity of Speech and Board/PPT usage | Excellent | Good | Average | Poor |
| Evaluation and Assessment Process | The faculty provides prompt and clear feedback about me every time a class test/assignment/quiz etc .. is conducted and suggests the ways to improve | Results of Exams/Assignments/Tests etc. are given promptly without any feedback, but gives feedback if asked for | Results of Exams/Assignments/Tests etc. are given but without any feedback | Only marks are displayed but the corrected scripts of exams/ assignments/tests etc are never shown to me. |
| Discipline | Highly Disciplined | Is able to manage the class with occasional chaos | Frequently Chaotic class | Totally Chaotic and disoriented class |
| Interaction with Students in Class | Always makes class very interactive by posing interesting questions and also welcomes queries from the students. | Most of the times. | Sometimes | Never |
| Support Outside the Class (Clarifying doubts etc.) | Readily available to provide support | Available Most of the times upon request | Sometimes agrees to provide support | Doesn't bother |
| Projects/ Assignments/ Lab Exercises beyond normal expectations | Interesting and motivating enough to make me learn beyond the syllabus which increases the interest in the subject | Good assignments are given which are confined to the syllabus. Helpful only to pass my university exams. | Very simple and straightforward questions which are not very helpful | No such activities are done |
| Encouragement in other activities | Always | Most of the times | Sometimes | Doesn't bother |

TABLE V. CLASSROOM OBSERVATION FEEDBACK OF FACULTY

| Classroom Observation Feedback of Faculty | |
|---|---|
| Faculty Name: _____ | Designation: _____ Department: _____ |
| 1. | Preparation and punctuality to class. a) Punctual, prepares beyond the specific topic and ready to clarify any doubts of students b) Punctual, well prepared for the class and clarifies the doubts c) Punctual, but lack of preparation to clarify the doubts d) No proper preparation and no punctuality. |
| 2. | Class room organization by faculty – (Recall → Introduction → Objectives → Main coverage of topic → Conclusion). a) Excellent – All aspects are well covered b) Well organized – but one of the above is lacking. c) Satisfactory –but order of the above components are missing. d) Not organized properly – missing many of the above components. |
| 3. | Time Management – (for entire 50 minutes of the class). a) Well planned class – covered the topic and gives assignments b) Effective utilization of time for topic c) Class started on time but no backup plan for certain resources/ aids d) Resources are not arranged earlier and no backup plan, panic in the class |
| 4. | Subject Knowledge, willingness to learn/ update and giving latest information to sensitize the students. a) Excellent knowledge, gives best examples and willing to learn and update b) Good subject knowledge, clarifies the queries of students in the classroom. c) Average subject knowledge, lack of update on subject and very few local examples d) Lack of clarity on subject – no examples and no update on topic. |
| 5. | Clarity of voice a) Clear, commanding modulated. b) Properly modulated voice. c) Voice audible. d) Voice not audible. |
| 6. | Use of teaching aids (models, charts, demos, animations etc.) a) Relevant and well used. b) Not used effectively. c) Not well designed / relevant. d) No teaching aids. |
| 7. | Clarity of writing – drawing pictures and graphs for clarification and PPTs. a) Excellent handwriting draws relevant pictures/graphs for explanation. b) Good handwriting – less use of relevant pictures / graphs for explanation. c) Handwriting small but not using relevant pictures/ graphs for explanation. d) Very poor handwriting – No pictures / graphs for explanation are used. |
| 8. | Body language – eye contact/ Gestures and Postures in the class room. a) Excellent- capturing attention of all students with good gestures and postures. b) Confident- Keep eye contact on all the students with good gestures and postures. c) Less confident – no eye contact on all the class and students. d) No confidence –no eye contact on the class and students. |
| 9. | Class room environment degree of flexibility, discipline, control and social interaction with students. a) Well managed class in all aspects b) Good environment for learning c) Faculty is able but lack flexibility and control d) Often class room turns into chaos and not able to manage class room discipline. |
| 10. | Use of Innovative methods in classroom teaching. a) Regularly uses, interesting for students and other faculty members. b) Uses once or twice in a semester. Interesting for students. c) Rarely used in a semester. d) Not used at all. |
| 11. | Feedback on students and interaction with class representative. a) Regularly gives feedback and interacts with class representative for improvement of presentation. b) Regularly gives feedback and lack of interaction with class representative for Improvement of presentation. c) Gives feedback and interacts with class representative (once in a semester) d) Irregular in giving feedback and not interested to interact with class representative. |

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