Preparation for ABET Accreditation at an Indian University – An ABET Team Chair’s Perspective

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Introduction

ABET’s international accreditation efforts increased tremendously over last several years. In the past, ABET evaluated programs outside the U.S., by institutional request, to determine if they were “substantially equivalent” to ABET-accredited programs. “Substantial equivalency” means that a program is comparable in program content and educational experience, but may differ in format or method of delivery. It implies reasonable confidence that the program has prepared its graduates to begin professional practice at the entry level. While these evaluations followed policies and procedures similar to those used for accreditation, no accreditation action was taken, nor was there any assumption that a program undergoing accreditation would be accredited as a result of such review. Substantial equivalency is not binding on colleges, universities, employers, or licensing agencies. Most of the programs that were recognized as substantially equivalent have now been accredited. ABET will conduct an accreditation review outside the U.S. only with explicit permission from all applicable national education authorities in that program’s country or region. ABET accreditation process for programs located outside of the United States are identical to the accreditation process for programs within the United States. Although there are only a handful of Indian university’s engineering programs are currently accredited by ABET, interest in such accreditation is growing. The author was invited to give a seminar about ABET accreditation at an Indian University near Delhi and review of the program preparation status. Since ABET accreditation is primarily outcome base, the author reviewed with the faculty and administrator how course level assessment could be transformed to a program level outcome system.

Assessment as the Basis for Outcome Based Accreditation

Assessment is the process by which evidence for congruence between a program’s stated goals and objectives and the actual outcomes of its programs and activities is assembled and analyzed in order to improve teaching and learning. Although classroom teachers have been testing students on their mastery of subject matters for centuries, there is a growing concern that traditional classroom tests are frequently used as summative evaluations to only grade students and not as effective feedback tools. Assessment of students' learning is considered as both a means and an end. However, tests are effective ways to bound goals and objectives of the course. Research suggests that students concentrate on learning whatever they think will be on the test. As McKeachie and his colleagues observe whatever teachers' goals are and no matter how clearly they present them, students' goals are strongly influenced by tests that determine grades. No matter how clear the teacher is about the "big picture"; students are unlikely to share the view unless tests and other assessment measures point them toward it.

Assessment: A Learning Component in Indian Context

Assessment provides an environment for constant improvement. The essence of assessment is that it asks students to create something of meaning. A good assessment incorporates complex thinking and problem solving, addresses important disciplinary content, invokes authentic or real-world applications and uses tasks that are instructionally meaningful. Learning is not only a one-way transmission of information from teacher to students. Meaningful instruction engages students actively in their learning. Learning to be meaningful and effective it must have clear visions. Assessment is a key part of this vision. Good teachers constantly assess how
their students are performing, gather evidence of the progress and problems, and adjust their instructional plans accordingly. The students in the construction courses continuously participate in group assessment, giving the instructor an opportunity to adjust the goals and instruction methodology. For example, in one of the courses course, repeated references to lack of adequacy of the textbook promoted the instructor to provide additional handouts and increase frequency of short lectures and subsequently change the text in the following semester. So assessment in true sense is not only the evaluation of performance of the students, but the evaluations of the course as well as the instruction. Assessment is one component of the Teaching-Learning-Assessment- Improvement loop.

Definitions – As Articulated by the Indian University

Program Educational Objectives: Broad statements that described what graduates are expected to attain within a few years of graduation.
Student Outcomes: What students are expected to know and able to do by the time of graduation. These relate to knowledge, skills, and behaviors that students acquire as they progress through the program.
Evaluation: One or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.
Performance Criteria: Specific, measurable statements identifying the performance required to meet the outcome – confirmable through evidence.

Rubrics As Used by the Indian University

Rubrics are a way to explicitly stating the expectations for student performance. It provides exact characteristics for each level of performance. Rubrics generally contain three components – performance criteria (dimensions), level of performance (scales), descriptors. Level of performance scale could be discrete or continuous. For continuous scale usually a range is used instead of a single point for conversion to explicit level of performance. For example, if an outcome or part of an outcome is assessed in a quiz 70 to 84 score range could be classified as met the standard. Similarly, 60 to 69 range could be considered approaching the standard and score above 85 could be considered exceeded the standard.

Assessment Types Used by the Indian University

Direct – When assessments are done by direct measurements students’ performance. Examples, standardized examinations (usually at the end of the program), locally developed examinations, portfolios reviews, course embedded.
Indirect – when assessments are mainly done by opinion surveys.

Course Embedded Assessment as Used by the Indian University

This type of assessment is done during normal progression of a course. Usually through focused quizzes or by asking specific question in a test/examination. This type of assessment is easy to conduct for engineering/computer science/applied science/engineering technology faculty. It is considered by many experts robust and students’ motivation (or lack of it) for assessment test do not skew the results.
What Do They Measure?

They actually do not measure students’ outcomes directly. What they measure for a particular outcome is performance criteria related to that outcome. Degree of attainment based on students’ level of performance on performance criteria.

When Do They Measure?

All or most courses should be mapped with the students’ outcomes. Also, most outcomes need to be measured at multiple points or at multiple embedded courses. Most of these points of measurement should be at the upper level courses, when students would have enough time to master the outcome. If there are sequences of courses on a subfield, the embedded assessment should be done at the terminal course. For that reason many of the outcomes could be assessed at a capstone course.

How Often Do They Measure

The frequency of measurements depends on what we try to measure. It depends on how critical this particular outcome is for the continuous improvement of the program. Once it is decided how often an outcome should be measured, keeping that cycle constant is the most important factor for the process.

Use of Rubrics in Assessment at the Indian University

Current emphasis on assessment came mainly from “education” discipline. Much of the subject matter in education and liberal arts are assessed subjectively. So, use of discrete assessment rubrics with statements of achievement standards makes sense. However in Science, Technology, Engineering, and Mathematics (STEM) and other problem solving disciplines assessment “rubrics” could be continuous. So, rather than using discrete statement for level of achievements one could use traditional scoring matrix in place of rubrics. The appendix includes an example of program level assessment based on course embedded assessment in a construction management program, where traditional scoring system is used for course level assessment.

Assessment as the Basis for Continuous Improvement

Program assessment is all about program continuous improvement. ABET criterion (all commissions) states: The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for continuous improvement of the program. Other available information may also be used to assist in continuous improvement of the program.

An Example of Evaluation Process (Appendix)

Based on the premises discussed above, an example of the evaluation process is included in the appendix as used by the university. This system of assessment is adopted for the civil engineering Program. Due to faculty apathy elaborate assessment process was not implemented for this program for a number of years. At the same time, a short but effective assessment system had to be adopted to satisfy mainly upcoming ABET evaluation. Due to shortness of time there was no time to develop local assessment test or looking for an appropriate terminal
assessment instrument. So, the program used course embedded assessment to minimize additional efforts. The assessment forms were adopted from previously implemented university wide assessment for general education and departmental assessment. The program assessed all the ABET General Criteria student outcomes (a thru k) and all the Program Criteria outcomes by using course embedded assessment. Each of the outcome then assessed based on the cumulative success or failure rate in all the courses that covered a particular outcome. It was found out that in a few of outcomes the program needed immediate improvement to meet the standard. These improvements were carried out and re-assessment of the outcomes was satisfactory. The course embedded assessments have been accepted by the program faculty. The cover sheets list the intended outcomes, the methods of assessments, and expected outcomes. The following pages show the actual data collection from individual courses based on various performance indicators and sources of those data (such as quiz 1 or test 2 etc.)

Conclusion

A key to learning is a well-designed assessment process. The assessment, however, has no value without student’s actual learning of the subject area. So a well-designed lesson plan and a well-developed series of problems is actually the foundation of the assessment. Assignments must be supplemented by short and focused lectures. The assignment must be designed so that the students must spend some time outside the class working in teams. The other main component is individual student’s preparation before coming to the class. The syllabus given at the beginning of the course must contain the relevant reading assignment for the students. One of the purposes of this non-traditional approach is to make the student more responsible for their learning.
PROGRAM LEVEL ASSESSMENT REPORT
COVER SHEET

Civil Engineering  B.Tech.  
(Instructional Degree Program / Prof. Area) (Degree Level)

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October 2013  Academic Year 2012-13
(Submitted By and Date)  (Assessment Period Covered)

Intended Outcomes and Associated College Goals:

1. **Intended Outcome:**
   Students will be able to apply current knowledge, techniques, skills and modern tools learned in the discipline and by adapting emerging application of mathematics, science, engineering, and technology to identify, analyze and solve technical problems. (ETAC/ABET criteria 3a, 3b, and 3f)

   **College Goal(s) Supported:**
   Goal number 1. To foster teaching and learning in a supportive environment
   Goal number 5. To involve students in solving problems of importance to local industries, government, and community organizations

2. **Intended Outcome:**
   Students will be able to conduct, analyze and interpret experiments and apply experimental results to improve processes related to the discipline. (ETAC/ABET criteria 3c)

   **College Goal(s) Supported:**
   Goal number 1. To foster teaching and learning in a supportive environment
   Goal number 5. To involve students in solving problems of importance to local industries, government, and community organizations

3. **Intended Outcome:**
   Students will be able to apply creativity in the design of systems and components related to the discipline. (ETAC/ABET criteria 3d)
College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment
Goal number 5. To involve students in solving problems of importance to local industries, government, and community organizations

4. Intended Outcome:
Students will be able to function effectively on teams. (ETAC/ABET criteria 3e)

College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment

5. Intended Outcome:
Students will be able to communicate effectively in writing, orally, and graphically (ETAC 3g)

College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment

6. Intended Outcome:
Students will be able to understand professional, ethical, and social responsibilities. (ETAC/ABET criteria 3i)

College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment.
Goal number 2. To provide students with a broad academic foundation which includes an appreciation of the interrelationships among the applied sciences, technologies and society.
Goal number 3. To enhance students’ appreciation of culture, ethics, esthetics and cultural diversity fully empowering them to participate in the lives of their communities.

7. Intended Outcome:
Students will demonstrate a respect for diversity and knowledge of contemporary professional, societal and global issues. (ETAC/ABET criteria 3j)

College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment.
Goal number 2. To provide students with a broad academic foundation which includes an appreciation of the interrelationships among the applied sciences, technologies and society.
Goal number 3. To enhance students’ appreciation of culture, ethics, esthetics and cultural diversity fully empowering them to participate in the lives of their communities.

8. Intended Outcome:
Students will demonstrate a commitment to quality, timeliness, and continuous improvement. (ETAC/ABET criteria 3k)

College Goal(s) Supported:
Goal number 1. To foster teaching and learning in a supportive environment.
9. **Intended Outcome:**
Students will demonstrate a recognition of the need for, and ability to engage in life long learning. (ETAC/ABET criteria 3h)

**College Goal(s) Supported:**
Goal number 1. To foster teaching and learning in a supportive environment.
Goal number 6. To stimulate self-motivation and curiosity so that learning continues beyond commencement

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**PROGRAM LEVEL ASSESSMENT REPORT**

Civil Engineering  
(Instructional Degree Program / Prof. Area)  
B.Tech_  
(Degree Level)  

October 2013  
Academic Year 20012 - 13  
(Submitted By and Date)  
(Assessment Period Covered)

(Note: Restate intended outcome and indicate corresponding number)

**Intended Outcome: (number 1)**
Students will be able to apply current knowledge, techniques, skills and modern tools learned in the discipline and by adapting emerging application of mathematics, science, engineering, and technology to identify, analyze and solve technical problems. (ETAC/ABET criteria 3a, 3b, and 3f)

**First Means of Assessment for Intended Outcome (number 1):**

1. **Means of assessment and criteria for success:**

Course level assessment of the following courses will be considered:
CIV350,CIV302,CIV303, CIV401, CON402, CIV403, and CIV404. These materials will be evaluated and combined by a group of faculty. The evaluators will be specifically looking for students’ ability to apply current knowledge, techniques, skills and modern tools learned in the discipline and by adapting emerging application of mathematics, science, engineering, and technology to identify, analyze and solve technical problems.
- Score of 85 and above exceeds the standard
- Score between 70 and 84 meets the standard
- Score between 60 and 69 approaching standard
- Score below 60 does not meet the standard
Criteria for Success: 70% of the students will meet or exceed the standard.

2. Description of the population to be sampled:
All students in the above mentioned courses will be required to participate.

3. Method used to choose the sample. (Please include the sample size):
(Please note that the recommended minimal sample size is 20%. However, if using objective testing, it is most desirable to assess the entire population. If the population to be sampled is less than 30, the entire population must be assessed).

A random sample of 25% of the population will be assessed.

4. Summary of major findings for this assessment:

5. Action to be taken in addressing these assessment findings:

PROGRAM LEVEL ASSESSMENT REPORT

Civil Engineering B.Tech.
(Instructional Degree Program / Prof. Area) (Degree Level)

October 2013 Academic Year 2012 - 2013
(Submitted By and Date) (Assessment Period Covered)

(Note: Restate intended outcome and indicate corresponding number)

Intended Outcome: (number 2)
Students will be able to conduct, analyze and interpret experiments and apply experimental results to improve processes related to the discipline. (ETAC/ABET criteria 3c)
Means of Assessment for Intended Outcome (number 2):

<table>
<thead>
<tr>
<th>2. Means of assessment and criteria for success:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course embedded assessment of laboratory portion of the following courses will be considered: CIV302, CIV303, CIV 402. The evaluators will be specifically looking for overall experimental process, analysis, and interpretations of the results.</td>
</tr>
<tr>
<td>- Score of 85 and above exceeds the standard</td>
</tr>
<tr>
<td>- Score between 70 and 84 meets the standard</td>
</tr>
<tr>
<td>- Score between 60 and 69 approaching standard</td>
</tr>
<tr>
<td>- Score below 60 does not meet the standard</td>
</tr>
<tr>
<td>Criteria for Success: 70% of the students will meet or exceed the standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Description of the population to be sampled:</th>
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<tbody>
<tr>
<td>All students in above mentioned courses will be required to participate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Method used to choose the sample. (Please include the sample size):</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Please note that the recommended minimal sample size is 20%. However, if using objective testing, it is most desirable to assess the entire population. If the population to be sampled is less than 30, the entire population must be assessed).</td>
</tr>
<tr>
<td>Total population of students in above courses will be used, no sampling will be required.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Summary of major findings for this assessment:</th>
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<table>
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<tr>
<th>5. Action to be taken in addressing these assessment findings:</th>
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<table>
<thead>
<tr>
<th>5. Action to be taken in addressing these assessment findings:</th>
</tr>
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</table>
## Assessment of Course Level Outcomes Fall 20XX

**Course Number and Title** – XXX-XXX Const. Project Mgmt. & Scheduling

<table>
<thead>
<tr>
<th>Course Outcomes (Objectives)</th>
<th>Percentage Exceeded Standard &gt;85</th>
<th>Percentage Met Standard 70-84</th>
<th>Percentage Approaching Standard 60-69</th>
<th>Percentage Did Not Meet Standard &lt;60</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students would be able to produce meaningful construction schedule using modern tools</td>
<td>11%</td>
<td>76%</td>
<td>8%</td>
<td>5%</td>
<td>Quizzes 6, 7, Assignment 1</td>
</tr>
<tr>
<td>2. Students would be able to exhibit competency in basic construction project management skills</td>
<td>3%</td>
<td>83%</td>
<td>10%</td>
<td>4%</td>
<td>Quizzes 2, 3, 4, 10, 12, 13</td>
</tr>
<tr>
<td>3. Students will be able to understand professional and ethical responsibilities</td>
<td>6%</td>
<td>81%</td>
<td>9%</td>
<td>4%</td>
<td>.</td>
</tr>
<tr>
<td>4. Students will develop effective oral &amp; written communication skills</td>
<td>2%</td>
<td>69%</td>
<td>25%</td>
<td>4%</td>
<td>Weekly Class Presentation Assignment 2</td>
</tr>
<tr>
<td>5. Students should be able to work effectively in teams</td>
<td>10%</td>
<td>80%</td>
<td>7%</td>
<td>3%</td>
<td>Assignment 1</td>
</tr>
</tbody>
</table>

**Action Needed**: Additional instructions and assignments needed for communication skill development.
## ETHICS MATRIX

**CIV401**  
Construction Management & CPM Scheduling

### Direct-Assessment of ETHICS MATRIX outcome

<table>
<thead>
<tr>
<th>Course Outcome (Objective)</th>
<th>Percentage Exceeded Standard</th>
<th>Percentage Met Standard</th>
<th>Percentage Approaching Standard</th>
<th>Percentage Did Not Meet Standard</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;85</td>
<td>84 to 70</td>
<td>69 to 60</td>
<td>&lt;59</td>
<td></td>
</tr>
<tr>
<td>Spring 201</td>
<td>22</td>
<td>34</td>
<td>30</td>
<td>14</td>
<td>Test #3</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>35</td>
<td>35</td>
<td>28</td>
<td>2</td>
<td>Paper #11</td>
</tr>
<tr>
<td>Spring 201</td>
<td>21</td>
<td>29</td>
<td>29</td>
<td>21</td>
<td>Test #2</td>
</tr>
<tr>
<td>Fall 2011</td>
<td>30</td>
<td>40</td>
<td>18</td>
<td>12</td>
<td>Test #3</td>
</tr>
<tr>
<td>Spring 201</td>
<td>29</td>
<td>46</td>
<td>13</td>
<td>12</td>
<td>Paper #10</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>30</td>
<td>35</td>
<td>30</td>
<td>5</td>
<td>Paper #9</td>
</tr>
</tbody>
</table>

1. The Ethics topic is tested either as a question on an exam or as a separate paper written on the subject.
Bibliography


