Program Level Assessment – In the Context of ABET Accreditation

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Abstract

In this paper a basic course embedded assessment strategy is discussed for programs in engineering, technology, and other related fields. This paper mainly addresses a survival strategy for programs to be accredited under outcome based ABET accreditation criteria. The discussion includes how simple modification in the traditional quiz/test/project based courses will help in fulfilling direct assessment of most of the student outcomes of ABET criterion 3 and continuous improvement of the program of ABET criterion 4. Using current ABET criteria the paper shows how easily a traditional course grading could be modified to establish course embedded assessment process. It also discusses what do we measure, when do we measure, and how often do we measure them. Discussion on rubrics includes using continuous scales. Examples of assessed courses are shared. Strategy of developing forms to document the extent the outcomes are attained is also discussed to minimize data collection time.

Keywords

Assessment, Accreditation, ABET, Rubrics, Outcomes

Introduction

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 [2]. 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 [3]. 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 [4]. 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

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, 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

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 –confirm-able through evidence.

Rubrics

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

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. 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.
Indirect – when assessments are mainly done by opinion surveys Course Embedded

Assessment.

What Do We Measure?

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

When Do We 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 We 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

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 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.

A Case Study

Based on the premises discussed above, an example of a case study is included in the appendix. This system of assessment was adopted at a college of technology for construction management 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 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 college 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. 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 program received full six years accreditation from ABET the following year.

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.

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Appendix

Here is an example of setting up program level assessment using course embedded assessment:

ANNUAL ASSESSMENT PLAN
COVER SHEET

Construction Management — B.S.

(Instructional Degree Program / Prof. Area) (Degree Level)

_____ Academic Year

(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 2a, 2b, and 2f)

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 2c)

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 2d)

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:

5. Intended Outcome:
Students will be able to function effectively on teams. (ETAC/ABET criteria 2e)

College Goal(s) Supported:

Goal number 1. To foster teaching and learning in a supportive environment

6. Intended Outcome:
Students will be able to communicate effectively in writing, orally, and graphically

College Goal(s) Supported:

Goal number 1. To foster teaching and learning in a supportive environment

7. Intended Outcome:
Students will be able to understand professional, ethical, and social responsibilities. (TAC/ABET criteria 2i)

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 respect for diversity and knowledge of contemporary professional, societal and global issues. (ETAC/ABET criteria 2j)

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.

9. Intended Outcome:
Students will demonstrate a commitment to quality, timeliness, and continuous improvement. (ETAC/ABET criteria 2k)

College Goal(s) Supported:

Goal number 1. To foster teaching and learning in a supportive environment.

10. Intended Outcome:
Students will demonstrate a recognition of the need for, and ability to engage in life long learning. (ETAC/ABET criteria 2h)

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

ANNUAL ASSESSMENT REPORT

Construction Management B.S

(Instructional Degree Program / Prof. Area) (Degree Level)

May 20XX Academic Year 20XX - XX

(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. (TAC/ABET criteria 2a, 2b, and 2f)

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

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

Course embedded data will be collected from the following courses: CON301,CON302,CON303, CON356, CON401, CON402, CON403, and CON404. Course data will be combined, combinations could be based on weighted average. 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

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**:**

----- 13% Exceeded the standard

----- 61% Met the standard

----- 14% Approached the standard

------ 12% Did not meet the standard

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

No specific action needed at this time. However, the faculty need to evaluate the course technical materials periodically to keep their currency and relevancy

Assessment of Course Level Outcomes Fall 20XX

Course Number and Title – XXX 350 Intro. to Construction Eng.

Student Learning Outcomes: 1. An ability to identify, analyze, and solve broadly defined engineering technology problems. 2. Apply fundamental computational methods and elementary analytical techniques in sub-disciplines related to construction engineering. 3. Perform economic analyses and cost estimates related to design, construction, and maintenance of systems associated with construction engineering.

Performance Indicators	Percentage Exceeded Standard >85	Percentage Met Standard 70-85	Percentage Approaching Standard 60-69	Percentage Did Not Meet Standard <60	Assessed in/Comments
1. Students would be able to draw, interpret, and perform necessary calculations on Haul-Mass diagram	31%	65%	4%	0%	Quiz 2
2. Students would be able to exhibit competency in power and efficiency calculations for heavy construction equipment	21%	75%	2%	2%	Quizzes 3,4,
3. Students would be able to determine cost effectiveness of hauling and excavating unit combination	18%	70%	9%	3%	Quiz 9 .

4. Students will be able perform economic analysis of capital cost, equipment cost, labor cost for heavy construction activities	3%	77%	11%	9%	Quiz 11

Action Needed : Economic analysis and construction economics need to be improved with additional instruction and additional assignments.