Comparing Student and Faculty Assessments of the Effectiveness of Learning Activities

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Abstract

A robustly designed course normally comprises a variety of learning activities, each intended to facilitate the achievement of specific learning objectives to a specific depth or level of learning. In other words, faculty usually design the learning activities of their courses with specific learning objectives in mind. With the implementation of outcomes-based assessment, student self-assessment of their own learning and of the effectiveness of the learning activities in their courses is a significant part of the course and program assessment of learning effectiveness.

Students in an introductory engineering class were required at semester's end to assess the effectiveness of course learning activities (homework, projects, lectures, assigned textbook readings, etc) in supporting their achievements of the course learning objectives. This was accomplished through the use of a matrix that mapped each of the course learning objectives to the course learning activities. Instructional faculty: also assessed the *intended* impact of the course's learning activities, as well as their judgment of the *actual* effectiveness of the learning activities.

Faculty assessments of *intended* impact fairly closely matched their estimates of *actual* impact, however, there were significant differences between faculty assessment of effectiveness and student assessments of effectiveness. Detailed results and their implications for using student assessments of the teaching effectiveness of various learning activities will be presented.

Introduction

Student evaluations of faculty teaching effectiveness are a well-established, essentially universal element of post-secondary education[1]. There are many approaches taken in the design of such evaluations, including both quantitative questions (e.g., "Rate on a scale on 1 to 5 . . .") and qualitative questions (e.g. "What did you like best. . .") regarding faculty attitudes and behaviors, and student satisfaction with these. While the major expected outcome of faculty teaching is student learning, surprisingly, aside from questions concerning the textbook, few student evaluation instruments at the course level explicitly elicit student assessment of the *learning effectiveness* of the activities, assignments, feedback, and other aspects of the learning environment designed and implemented by the faculty. Many of the questions that *are* asked might be plausibly linked to the quality of student learning, but in most cases, the link is inferred rather than documented. For example, it is plausible that “returning graded material within a reasonable time period” might enhance student learning, especially if later work requires mastery of earlier work, and it is certainly unprofessional not to do so, yet, we are unaware of any documented significant link between student learning and the amount of time students must wait for return of graded materials. We propose that too much of the assessment of faculty by students (and of students by faculty) is based on affective elements (behavior, attitude) rather than cognitive elements (teaching and learning effectiveness).

We have proposed in earlier work methods for assessing both affective[2] and cognitive[3] elements of student performance, and for incorporating both of these aspects into course grading. In this work, we present a preliminary study of a method use to assist faculty with course planning, and better faculty self-assessment of teaching effectiveness, as well as for better student assessment of the learning effectiveness of faculty activity.

Starting Point Assumptions

Before presenting the assessment method we need to make three assumptions about the initial state of a course.

1. Learning objectives for a course have been developed. They can be developed by any of a number of approaches, including top down approaches (objectives developed for a curriculum, detailed objectives then generated and assigned to particular courses) bottom-up approaches (current/proposed courses reviewed to generate actual or implied objectives), or some combination of these. Whatever the method of course objective generation, course learning objectives are assumed to be well developed before the start of the course.
2. Learning activities associated with the course have been defined. Learning activities include any activity made available or required by the course designer with the intent of engaging student learning. These can include passive (e.g., lecture) or active (e.g., student presentations); graded (e.g., homework) or non-graded (e.g., showing of a video); individual or team activities.
3. A matrix of objectives vs. activities has been generated. While such a matrix is extremely useful in course planning and development, helping to ensure a match between the outcomes and the activities, in this paper we will focus on its use in course and instructor evaluation. An illustrative example for a fictional technical communication course is given in Table 1, below which shows the course objectives as the columns and course learning activities as the rows.

Assessment Method

For use in course evaluation, the instructor completes the course objectives vs. activity matrix at semester’s end, entering in each cell his or her assessment of the effectiveness of each activity in

	Students will be able to construct effective written technical reports	Students will be able to present effective oral technical reports	Students will be able to critically evaluate other students' technical reports
Course lectures			
Presentations by invited speakers			
Short reports			
Long report preliminary draft			
Long report final draft			
Oral report presentation			
Peer-review of oral reports			
Final Exam			

Table 1: Example of Objectives vs. Activity matrix for a fictional technical writing course

helping students achieve each learning objective. Students in the course also complete the assessment.

The rating scale used to complete the matrix can be chosen from many possibilities: a three-level or five-level Likert scale, a zero-to-10 scale, or (as in this work) a 0, 1, 3, 9 scale typically used in Quality Function Deployment Diagrams.[4]

Results of Using the Matrix

We implemented this approach in an introductory general engineering class for transfer students (ECE 200). The students represented aerospace, biomedical chemical, civil, computer systems, electrical, materials, mechanical, and industrial, engineering majors, as well as computer science and construction majors. The first two authors had each taught this course several times, and had collaboratively developed all course materials and learning activities. The authors each evaluated all of the learning activities against each of the objectives. Thirty-six complete student responses (out of thirty-eight registered students) were received. The remaining part of this section details the matrix used in this course and the instructor and student responses.

The course learning objectives and the learning activities designed to achieve these objectives are given in Table 2,. The assessment scale used to rate the effectiveness of each activity in helping student achieve the learning objective was

Not effective – 0
Somewhat effective – 1
Very effective – 3
Extremely effective – 9

ECE 200 Course Learning Objectives	ECE 200 Course Learning Activities
• **Interest in Engineering/ Professionalism:** Students will demonstrate knowledge about the fields of engineering and construction, and about common aspects of professionalism • **Self-regulation:** Students will develop and exhibit the behaviors associated with taking personal responsibility for time management, learning new material, setting goals, etc. • **Customer/Quality:** Students will demonstrate a working knowledge of the role of the customer indefining quality, and will demonstrate the ability to meet customer-defined expectations • **Modeling:** Students will create purposeful representations of artifacts and processes • **Problem Solving:** Students will develop and demonstrate the behaviors of effective problem solvers • **Teaming:** Students will demonstrate the ability to perform technical work and resolve conflicts in groups and teams • **Technical Communication:** Students will demonstrate the fundamentals of organizing and presenting technical work	• **Assigned reading** in each of three texts , Engineering by Design[5], How to Model it[6], and the "Orange Workbook[7]" • Class **Lectures** • Approximately 10 three-minute individual **quizzes**, a team midterm exam, and an individual final exam • Three individual **modeling assignments** (M1, M2, and M3) • An individual **research** report • An individual **Excel tutorial** assignment · An individual **report & presentation on the profession** of the student's major • In-class graded **team ass**ignments, two **team self-assessment** reports, • A team **manufacturing-focused proj**ect (Project 1) · A team **design, construction, and performance demonstration project** (Project 2) • A **team modeling assignment** (M4) on the artifact of Project 2

Table 2: Course learning objectives and learning activities for introductory engineering class ECE 200

In addition to rating the effectiveness of each activity, the students also rated their own level of learning (according to Bloom's taxonomy[8]) for the level at which they believed they entered and exited the course.

The average of the students' responses with the average of instructors' assessments of the effectiveness of each of the learning activities towards achievement of the learning objectives is shown in Table 3. There are several trends of note in this table. First, whether averaging by objective, or averaging by learning activity, student assessments of effectiveness are nearly always higher than instructor assessments of effectiveness. Based on student responses to traditional course evaluation questionnaires, the authors were at first surprised by this. However, it has also been our experience that students tend to over-assess their own mastery level, which suggests that the students' evaluation of learning effectiveness is linked to their assessment of their own mastery of the content. Taking into account that student responses are skewed

	Interest	Teaming	Problem Solving	Technical Commun.	Modeling	Self-regulation	Customer/quality	Average by Activity
EBD Text readings	3.4 6	1.1 1	3.2 2	2.1 1	3.7 1	2.5 2	2.8 3	**2.7 2.3**
HTMI text reading	4.2 2	1.6 1	5.3 3	1.9 1	5.6 9	1.6 1	1.8 2	**3.2 2.7**
Orange Workbook reading	1.6 1	3.0 3	1.6 1	3.3 3	1.4 1	3.0 2	2.0 3	**2.3 2.0**
Class meetings ('Lectures')	4.2 3	6.0 3	4.8 3	4.8 1	5.0 6	5.4 2	3.6 2	**4.8 2.9**
Quizzes	1.0 1	0.4 1	0.7 2	1.6 1	0.9 1	5.1 6	1.3 2	**1.6 2.0**
In-class Team Assignments	3.9 3	8.4 9	6.0 5*	4.3 2	4.5 5*	3.2 2	2.6 2	**4.7 4.0**
Excel Tutorial	1.7 1	0.4 1	2.1 1	3.1 6	3.3 2	2.1 2	2.3 2	**2.1 2.0**
Professions Assignment	5.9 9	0.8 1	0.6 1	3.4 6	0.7 1	2.6 2	2.2 3	**2.3 3.2**
Team Self Assessments	1.8 1	8.0 6	2.1 2	3.9 2	1.7 1	4.6 2	2.6 2	**3.5 2.3**
Team Midterm Exam	2.6 1	8.3 3	7.1 3	5.4 4	6.2 3	4.3 1	4.1 2	**5.4 2.4**
M1, M2, & M3	4.6 3	1.3 1	7.8 6	5.9 9	7.8 9	5.1 2	4.9 3	**5.4 4.7**
M4	5.3 9	8.0 3	7.7 6	5.9 6	7.8 9	4.9 1	4.6 2	**6.3 5.1**
Individual Research Assignment	3.6 3	0.5 1	1.2 2	2.6 3	1.8 1	3.4 3	2.6 2	**2.3 2.1**
Project #1	5.3 3	8.0 6	6.9 6	6.3 3	5.8 1	5.2 3	5.3 3	**6.1 3.6**
Project #2	5.8 9	7.7 9	7.2 9	6.6 3	7.3 5*	5.2 6	5.7 3	**6.5 6.2**
Average by Objective:	**3.7 3.9**	**4.2 3.3**	**4.3 3.5**	**4.1 3.1**	**4.2 3.7**	**3.9 2.4**	**3.2 2.4**	

Table 3: Upper numbers are the average of 36 student responses; lower number is the average of the instructor responses. Numbers with * are where the instructors differed by more than one level.

towards higher numbers, the student and instructor numbers tend to follow each other fairly closely, i.e., never by as much as an entire rating level, and usually by much less.

The biggest differences between instructor and student assessment of activities were for the team midterm examination and the first project. We suspect that the differences were due to the difficulty level of these activities, as students tended to rate more difficult activities as more effective.

As noted above, there are many aspects of learning environment and instructor behavior that, while not themselves designed as learning activities, can still have impact on students learning. We use this same type of approach to assess these other aspects of learning environment, where students assess the impact of learning environment elements such as classroom facilities, the grading process, and the use of cooperative learning on the learning objectives. We have not used this matrix method for student assessment of faculty behaviors (such as enthusiasm, promptness, impartiality of grading), as questions on these comprise much of the standard college course/instructor evaluation.

Discussion and Conclusions

This work, although limited in scope, has several important implications for both evaluation of faculty performance, and the use of student assessment of learning in program assessment.

Commonly, a large fraction of institutional evaluation of faculty teaching derives from student course evaluations, and such evaluations only rarely elicit explicit feedback from students on the learning effectiveness of faculty efforts. Even more rarely, will such evaluations elicit feedback explicitly linked to the course and/or curriculum's learning objectives. We propose a very simple structure for a more authentic course evaluations that can be used by faculty for course planning and for teaching self-assessment, by students for evaluation of faculty teaching effectiveness, and by administrators for use in formal program assessment (for example, to meet EC2000 requirements). This tool can also be used to at least partly separate effects of *course design* (structure and implementation of learning activities) from *instructional environment,* and each of these from *instructor behaviors*. Such separation can be quite useful in faculty development, and in assessing multi-section courses.

Assessment of learning outcomes is not a simple task. Institutions are required by EC2000 to include input from all constituents, which will always include students as well as faculty. We are unaware of any work that explicitly compares student assessment of the learning effectiveness of course learning activities with the instructors' assessment. Before implementation of this tool, the authors predicted significant deviation between instructor assessment and student assessment. The close match between instructor and student assessment was therefore, both unlooked for and encouraging.

Future plans for extension of this work include:

- Investigating the source of the students' higher assessments. We also requested that students assess their incoming and outgoing levels of learning on each of the course learning objectives. We hypothesize that the students' perception of the magnitude of the difference ("the delta") will correlate significantly with the students' perception of learning effectiveness.
- Application to a variety of courses: of varying class size, level, and technical rigor.

- Application to one or more multi-section courses to determine how well course design effects can be separated from instructor effects.

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