The Effect of Active Collaborative Learning on Instructor Evaluations: An Observational Study

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Abstract

This paper describes an ergonomics lab course that was initially redesigned utilizing Bloom's Taxonomy to align lab report results with a depth of student knowledge. Student feedback elicited the need for clarity and change in the classroom methods to improve teaching effectiveness. Small changes requiring very little instructor preparation time turned the class around into a high-scoring, active and collaborative learning environment. The IDEA Evaluation System is described and utilized to compare quantitative results of teaching effectiveness, teaching methods, course description and student description for two consecutive and nearly identical ergonomics courses.

The combination of active and collaborative learning has been shown to increase student learning but what happens to the perception of the instructor? The end-of-term summative instructor evaluation provides a method for institutionalized feedback from a student to the professor and to the university administration about their delight or dissatisfaction with a particular course and professor. Instructor evaluations by students can prompt a bitter discussion between professors about the effectiveness of teaching versus the likability of the professor. Evaluations in general have long been the topic of disgruntled professors and students.

A transformed ergonomics lab structure resulted in low student evaluations prompting a quick fix using active collaborative learning techniques. The results of active collaboration on the instructor evaluation were surprising. A substantial increase in perceived teaching effectiveness based on a 5-point Likert scale shows the positive effect of active collaborative learning in the ergonomics industrial engineering laboratory and classroom.

1. Background: Process Model for Course Delivery

The goal of a course is to enable student learning. The process model illustrated in Figure 1 shows a simplistic view of the inputs, outputs and feedback mechanism for a generic course delivery. This paper is about the back-to-back teaching of the same course, same syllabus, and same instructor with even, coincidentally, the same number of students. This comparison is noteworthy in the reduction of other variables since a complete course redesign was not possible with just one week between course offerings.

The Ergonomics Course described in this paper was offered for two consecutive terms with the same professor, syllabus, classroom, grading scheme and laboratory experiences. Of course, there are other sources of variability in the input factors of this observational study. There were coincidently eighteen (18) students registered in both terms. All students were upper class Industrial Engineering (IE) students with multiple cooperative industrial experiences as part of their academic background. The only major difference between the two course offerings is the addition of active learning techniques included in the second course offering.

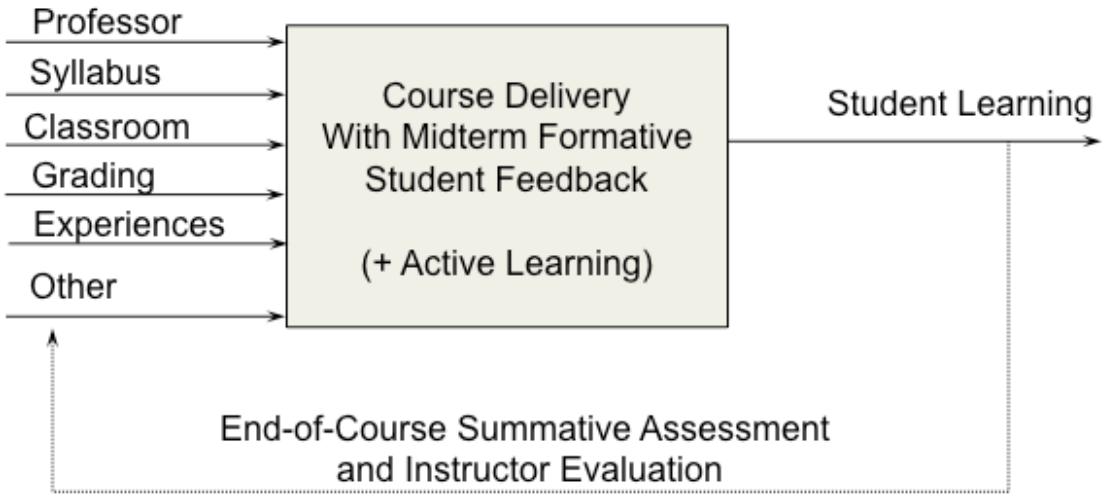

Figure 1. Simplistic Course Delivery Process

There are various models of type and depth of learning. One commonly used model is Bloom's Taxonomy. In 1956, Benjamin Bloom headed a group of educational psychologists who developed a classification of levels of intellectual behavior important in learning. [Bloom, et al, 1956] This paper describes an ergonomics lab course offered as part of the core curriculum to Industrial Engineering students. The "initial offering" described in this paper was initially transformed utilizing Bloom's Taxonomy for the design of the weekly lab report. Although the course had been taught several times with high instructor evaluations, this initial offering with

the new lab report rubric based on Bloom's Taxonomy resulted in lower than expected instructor evaluation scores. In the subsequent term, the delivery method was slightly modified to include active learning techniques and the instructor evaluation showed amazing results. Note that the IDEA instructor evaluation form was used for the first time in this initial offering so previous instructor evaluations are not comparable. The IDEA survey was administered to students in an online format and class time was allowed to increase the likelihood of response by a majority of registered students.

2. Purpose: Improving Student Learning

Continuous improvement in the classroom is necessary to meet the needs of today's college student. The term "digital native" generally refers to people who grew up with the technology that became prevalent in the latter part of the 20th century and continues to evolve today. [Prensky, 2001] Today's traditional college student comes to class with technology in their pockets and backgrounds different from their professor who may be referred to as a "digital immigrant, an individual who was born before the existence of digital technology and adopted it to some extent later in life. Providing tools and skills, teaching students how to learn, how to find information and how to work collaboratively is an ongoing challenge in this highly technological generation.

Thus, topics and the method of delivering an education must be constantly under scrutiny with feedback from many sources, including the students themselves. The end-of-term summative instructor evaluation provides a method for institutionalized feedback from a student to the professor and to the university administration about their delight or dissatisfaction with a particular course and professor. Instructor evaluations by students can prompt a bitter discussion between professors about the effectiveness of teaching versus the likability of the professor. Evaluations in general have long been the topic of disgruntled professors and students.

Most college instructors will agree that we need to provide students with the tools and skills necessary for gainful employment. Since today's graduates are likely to have at least three different professions during their lives, it is it is important that students learn how to find information, and how to work collaboratively. [Wise, 2013] There are many research studies to suggest that active learning methods by an instructor can increase student learning [Mills, 2012]

Bloom's Taxonomy in the Lab Report

The grading rubric for lab reports in the ergonomic classroom was designed to closely align with the original levels of Bloom's Taxonomy at least through the synthesis level. The purpose of the improved lab report was to enable assessment of the depth of learning for each topic covered in lab experiments. The grading rubric for the lab report and detailed explanation was provided with the course syllabus and emphasized each week for student lab formatting. The lab report

was just one aspect of the course with many other variables possibly affecting student learning. The professor confidently felt that the addition of the lab report grading rubric based on Bloom's taxonomy would enhance learning and improve the classroom experience.

There were seven factors considered in the grading rubric:

I. Knowledge (10 pts): Demonstrate knowledge of the lab topic by defining ergonomic terms that are fundamental to the lab experiment. Describe how the terms may be used in the workplace and provide appropriate references. At least one traditional reference is required for full credit.

II. Comprehension (15 pts) : Demonstrate comprehension of the lab topic by defining all measured variables. Include all dependent and independent variables with units of measure and experimental levels. Explain how the variables and other related factors may influence human performance and capabilities

III. Application (15 pts): Describe the lab experiment and it's application to workplace design. Discuss the experimental procedure as a sequence of activities. Include all ergonomics tools used for measurement and specific techniques required for repeatability and validation. Include a statement of hypothesis and the expected outcome of the experiment.

IV. Analysis (20 pts): Demonstrate analysis of ergonomic principles through data evidence from the lab experiment. Report the results of the experiment in tabular or graphical form and cite appropriate statistics for significance. Provide appropriate analyses to test the stated hypothesis and evidence to arrive at a conclusion. Any special circumstances encountered during the lab experiment should be discussed as relevant to the lab topic.

V. Synthesis (20 pts): Demonstrate Synthesis of the lab topic by describing how the results of the lab experiment can be used to design a safe and productive workplace.

VI. Lab Specific (10 pts): Provide raw data sheet(s) and specific analysis as required by lab experiment discussion.

VII. Spelling, Grammar, Neatness (10 pts)

3. Method: Using Feedback for Improvement

There is no doubt that feedback is required for continuous improvement. Three different methods of feedback are utilized for the enhancement of the course. Formative assessment through a midterm student feedback form, summative evaluation through an end-of-term evaluation and information from a CETL workshop all proved helpful for getting feedback on the initial offering.

Formative assessment is utilized to guide changes during the course offering and was achieved through a midterm student feedback survey. Strengths, areas for improvement and insights (SII) were solicited halfway through the course to identify some quick changes to improve learning. Summative assessment is achieved through the use of an end-of-term instructor evaluation as

provided by the institution and is measured using the IDEA evaluation described later in this paper. In between the courses, the Center for Excellence in Teaching and Learning (CETL) hosted a workshop on active learning described in greater detail later in this section. CETL frequently provides professional development to assess and improve teaching strategies.

Figure 2 shows a simplified timeline illustration of this observational study. The Initial Offering of the course occurred in Winter 2013 with the Active Learning Enhanced offering beginning just one week following the completion of the initial offering. Figure 3 more clearly shows the additive nature of continuous improvement characteristics of the course. Note that the initial offering contained a new lab report rubric utilizing Bloom's Taxonomy in addition to other characteristics of a well-designed course. Past offerings of the course had consistently high instructor evaluation ratings and the new lab rubric was meant to improve on an already well-developed ergonomics course.

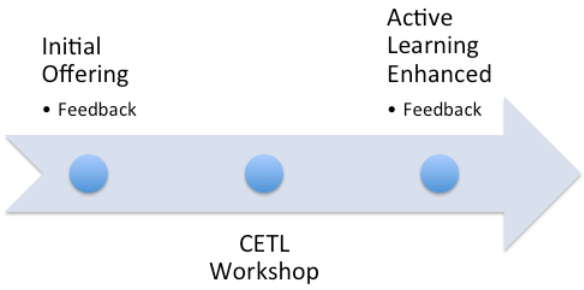

Figure 2. Simplified Timeline of Observational Study

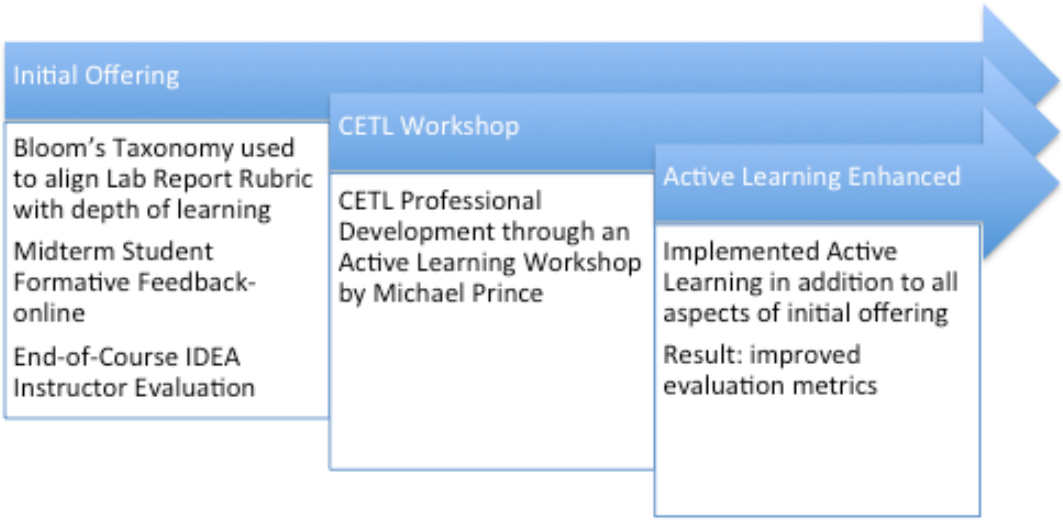

Figure 3. Timeline Including Additive Aspects of Continuous Improvement

Midterm Formative Feedback from Initial Offering

Halfway through the term, the professor regularly requests student feedback utilizing the SII Method to identify strengths, areas for improvement and insights to make some midterm corrections. In past terms, the midterm student feedback has provided opportunities for the students and faculty member to engage in dialogue about how to improve the second half of the course. In general, attributes of the class organization and lab applications were identified as strengths.

During this first term using the new lab rubric, one area for improvement focused on the lack of clarity in the lab report expectations and the feeling that student questions were left unanswered. Thus, additional time was spent explaining the lab report rubric and grading expectations.

Regarding student comments about unanswered questions, the professor felt that there must be a better method to engage students in their own learning process. During the initial offering of the course using this new lab rubric, the instructor was unable to address student's feelings that their questions were left unanswered. In fact, the instructor felt that the students needed to take more ownership of their learning to get questions answered. The unsettling question remained – how can the course be better designed to promote engagement with the material and more effective answers to questions? Since the next offering of the course would begin just one week after the first offering, there was no time for a complete course redesign.

Summative Feedback Using the IDEA Evaluation Instrument

The IDEA Student Ratings of Instruction system, [IDEA, 2013] hereafter referred to as simply IDEA, was recently adopted by the university to replace a home-grown instructor evaluation system. The commonality between the two systems was the 5-point Likert scale. The previous system was simply an average of all questions whereas the IDEA system focuses and weights the scores based on specific objectives.

Research has shown there is no single, correct way to teach. As a result, The IDEA Center tailors each report to fit the instructor's selected learning objectives and offers recommendations for improvement based on their national database. In essence, IDEA builds in objectivity — while accommodating the creativity and artistry necessary to facilitate student learning. In addition to measuring instructional effectiveness, the IDEA system draws upon research from The IDEA Center's national database for comparative data to provide a basis for identifying strengths and diagnosing areas in need of improvement, while factoring out variables beyond the instructor's control, such as student work habits, student motivation, and class size.

Recognizing that instructor evaluations have long been the topic of disgruntled professors and students, there is no perfect system. The IDEA System just happens to be the current evaluation system of choice mandated by this university.

CETL Workshop on Active Learning in the Classroom

The Definition of Active Learning is "Any instructional method that actively engages students in the learning process." This generic definition seems to include most every classroom activity. Combining an educational activity with students working together creates an active collaborative learning environment. Research suggests that this environment will promote increased student learning. [Prince, 2004]

Prior to the next offering of the ergonomics course, a workshop on Active Learning led by Dr. Michael Prince was hosted by the Center for Excellence in Teaching and Learning. [Prince, 2013] This professor took the workshop to heart and felt that many of the ideas were valuable to improve the classroom-learning environment. Small changes requiring very little instructor preparation time were implemented in the ergonomics course to turn the class into an active and collaborative learning environment.

The implementation of active learning in the ergonomics classroom was not included in the syllabus nor was it carefully designed into the course. Rather, it was included on a day-by-day basis using the tools presented in the Active Learning workshop hosted by CETL and presented by Dr. Michael Prince. For example, when the professor poses a question, students are asked to spend sixty seconds to consider and write down an answer. Further, they must discuss their answer with the student sitting next to them before the class will discuss the answer all together. Formally, the Think-Pair-Share method was simply implemented. In this way, students engage with the material and attempt to answer their own questions without relying solely on the expertise of the professor.

Midterm student feedback in the enhanced course offering did not suggest that students questions were unanswered as they were in the initial offering. In addition, students seemed to be more engaged in the discussion and took more ownership of their own learning.

4. Results and Conclusions

In this observational study, the variables of interest include course assessment and instructor evaluation scores. The factors in this study are students registered for an Industrial Engineering core course in Ergonomics and not controllable by the instructor. [Bowerman, 2011] Note that these students are human beings and have considerable within-subject variability. The statistical significance of the difference in course assessment measures is not as important as the fact that there is a step-function change in scores between two consecutive courses. A long-term longitudinal study may be a future study to show statistical significance. In the mean time, this observational difference is reported for continuous improvement attributed to simple active learning techniques in the classroom.

Selected scores from the IDEA instructor evaluation for the two consecutive course terms are presented in Table 1. Note that there is a positive increase in scores for all measures of teaching effectiveness as well as the teaching methods and styles categories. In contrast, the descriptions of the course and student motivations give mixed results between the two terms.

Note that in the summary Table 1, there is a positive improvement between the initial offering and the enhanced offering of the two broad categories (1) Teaching Effectiveness and (2) Teaching Methods and Styles. In these two categories, all sub-categories have an increase of at least 0.7 on a five-point Likert scale. In contrast, the description of the course and description of the student show mixed results on the same five-point Likert scale with both positive and negative differences less than 0.5 in all sub-categories. Thus, neither the course nor the student was apparently changed. The change in teaching methods resulted in improved instructor evaluation scores based on student survey results on the summative instructor IDEA evaluation form.

In conclusion, active learning was shown to improve student perception of teaching effectiveness based on an observational study of two consecutive ergonomics courses. The teaching effectiveness metric of study was based on IDEA instructor evaluations. This work is presented as an observational study and additional research controlling other course variables with statistically significant results may be a future study.

	Initial Offering	Active Learning Enhanced	Difference
Number of students enrolled in course	18	18	
Number of responses to IDEA evaluation	14 (78%)	15 (83%)	
Raw Averages on a 5-point Scale			
Positive differences were noted in all categories of teaching effectiveness and teaching methods			
Summary Evaluation of Teaching Effectiveness:			
Progress on Relevant Objectives	3.7	4.4	+0.7
Overall Ratings: Excellent Teacher	3.3	5.0	+1.7
Overall Ratings: Excellent Course	3.5	4.7	+1.2
Summary Evaluation	3.6	4.7	+1.1
Summary Evaluation of Teaching Methods and Styles			
Stimulating Student Interest	3.4	4.6	+1.1
Fostering Student Collaboration	3.9	4.7	+0.8
Establishing Rapport	3.7	4.5	+0.8
Encouraging Student Involvement	3.9	4.6	+0.8
Structuring Classroom Experiences	3.6	4.7	+0.8
Seemingly random differences were noted in the course and student descriptions			
Course Description:			
Amount of Reading	2.9	3.1	+0.2
Amount of Work in other (non-reading) assignments	4.1	3.9	-0.2
Difficulty of subject matter	3.1	3.2	+0.1
Student Description:			
I worked harder on this course than on most courses I have taken	3.6	4.1	+0.5
I really wanted to take this course regardless of who taught it	3.9	3.5	-0.4
As a rule, I put forth more effort than other students on academic work	3.6	4.1	+0.5

Table 1. IDEA Evaluation Results – Summarized

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