# Pre and Post Evaluations for Assessment of Student Learning Outcomes; A Simple Approach

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Accrediting bodies for construction programs have instituted mandatory assessment of programs. More specifically they are expecting faculty to assess student learning objectives in their courses. This can become a difficult and time consuming endeavor. However there are some tools that have been developed for the collection of data utilized in the analysis of learning outcomes. This paper examines one such tool that was developed to measure a component of assessment that is easy to use and administer. An assessment approach using pre- and post-course evaluations has been made into a simple and effective tool for gathering data and performing student learning outcomes.

**Key Words:** Assessment, Student Learning Objectives, Pre- and Post Course Surveys

## Introduction

There is a new and robust thrust by accrediting bodies to require program assessment. This is driven by a number of factors, including the need to determine learning objective outcomes and proficiencies. Student Learning Outcomes have become the metric on which many assessment plans are built.

The Accreditation Board for Engineering and Technology (ABET) Engineering Criteria 2000 attempts to shift the focus of accreditation from an education process to that of student outcomes. In the past ABET accreditation criteria focused on the education process that each engineering program provided. For example, programs documented the number of credits required by their curricula, categories to which these credits were assigned, quality of courses, and quality of laboratory experiences. Under the ABET 2000 criteria, programs are expected to document their assessment plan, their processes for assessing and improving student outcomes, and student performance requiring specified outcomes. Similarly student outcomes assessment is becoming a mandatory component of the American Council for Construction Education (ACCE) accreditation standards.

## Developing Student Outcomes for Assessment

Typically, faculty development of course topics begins with broad goals such as “acquiring the fundamentals of estimating” or “learning to set up spreadsheets for quantity take-offs.” The broad goals are broken down into more specific objectives which, in turn, are further refined until a faculty member has reached a level of detail at which specific assessment activities can be developed. Simultaneously, the faculty member decides appropriate levels of learning for each row. Deciding the appropriate level of learning requires that a faculty member answer questions such as “Should a student recall the specified topic?”, “Should a student demonstrate understanding of a topic when the context of the topic is clearly specified?”, or “Should a student to be able to apply the topic without the context being supplied?” If the answer to the first question is yes, then at least “knowledge” level of learning is required. If the answer to the second question is yes, then at least “comprehension” level of learning is required. If the answer to the third question is yes, then at least “application” level of learning is required. In this way, a faculty member builds a matrix which indicates that desired performance for the goal on which the faculty member is working.

An example on how to measure appropriate levels of learning is through formative assessment. Formative assessment refers to assessment that is specifically intended to generate feedback on performance to improve and accelerate learning (Sadler, 1998). A central argument is that, in higher education, formative assessment and feedback should be used to empower students as self-regulated learners. The construct of self-regulation refers to the degree to which students can regulate aspects of their thinking, motivation and behavior during learning (Pintrich & Zusho, 2002). In practice, self-regulation is manifested in the active monitoring and regulation of a number of

different learning processes, e.g. the setting of, and orientation towards, learning goals; the strategies used to achieve goals; the management of resources; the effort exerted; reactions to external feedback; and the products produced.

Intelligent self-regulation requires that the student has in mind some goals to be achieved against which performance can be compared and assessed. In academic settings, specific targets, criteria, standards and other external reference points (e.g. exemplars) help define goals. Feedback is information about how the student's present state (of learning and performance) relates to these goals and standards. Students generate internal feedback as they monitor their engagement with learning activities and tasks, and assess progress towards goals. Those more effective at self regulation, however, produce better feedback or are more able to use the feedback they generate to achieve their desired goals (Butler & Winne, 1995). Self-regulated learners also actively interpret external feedback, for example, from teachers and other students, in relation to their internal goals. Although research shows that students can learn to be more self-regulated (see Pintrich, 1995; Zimmerman & Schunk, 2001), how to enhance feedback (both self-generated and external) in support of self-regulation has not been fully explored in the current literature.

Education models continue to move us away from the traditional teacher-centered learning to student-centered learning. It is for this reason that adopting methods for understanding student learning must be utilized in a comprehensive assessment system that is in part created and implemented by faculty. Unfortunately, faculty members' ambivalence towards assessment is fueled by their perceptions that much of what is done in the name of assessment is of little use to them in improving their own teaching, student learning, or the curriculum.

Indeed, until fairly recently, much of assessment has focused more on issues of external accountability, fulfillment of necessary requirements for accreditation for example, other than on developing assessment activities that directly improve educational practices. Among the reasons why the assessment effort has had little effect on the teaching-learning process is faculty have not been adequately involved in identifying relevant assessment questions or in developing appropriate assessment methods that could indeed inform teaching and learning.

This lack of faculty involvement is unfortunate because, at its best, course-based assessment can facilitate student learning by:

- Helping you clarify your teaching goals and what you want students to learn.
- Giving your students a better understanding of your expectations for their work in your course and how you evaluate their performance.
- Opening up the lines of communication and feedback between you and your students.
- Actively engaging students in their own learning.
- Providing you with increased information about student learning in your classroom, allowing you to adjust your teaching as the course progresses.

In an effort to encourage faculty participation in the assessment process, and more specifically in course assessment and student learning, a new approach was developed at Wentworth Institute of Technology (WIT). The Department of Civil, Construction, and Environment (CCEV) has two programs of study: A BS in Construction Management accredited by ACCE and a BS in Civil Engineering Technology accredited by the Accreditation Board for Engineering and Technology (ABET). Both of these organizations require an assessment process as part of accreditation standards.

In order to satisfy both accrediting bodies with one assessment tool, a process was developed to analyze course objectives utilizing student input. One of the most effective ways of assessing student learning from the start of the semester to the end is to track student progress throughout the semester.

It is somewhat more unusual for instructors to do this type of analysis because collecting data about student learning on specific learning outcomes across the semester is sometimes seen as troublesome and time-consuming. This is not always the case and can be avoided with a well-organized and simplistic assessment tool. It is frequently worth the effort because increases in knowledge and understanding from the beginning of the semester/course until the end can identify how well students learned and whether long-term course goals and objectives were achieved. Long-term assessment can be especially helpful in evaluating how well a course has succeeded in meeting its central goals. It can also help identify areas of content or instruction that were not as successful as others in facilitating student

learning. Portfolio Analyses, Systematic Progression of Assignments, and Pre and Post Tests are all examples of "over-time" assessment.

## *Pre and Post Surveys for Outcome Assessment*

Pre- and post-test surveys are a way to assess student learning from the start of the course until the end. A ***pre-course survey*** can be used at the beginning of the semester to capture the extent of student knowledge and understanding about key course concepts they will study that semester. It can also be used to measure students' attitudes and values relevant to course concepts and is predictive of students' responses and positions on course materials. Using a follow-up ***post course survey*** (either the same as the pretest or somewhat different) at the end of the semester and comparing results from the two can be an effective way to demonstrate student achievement over time.

The process of evaluating student pre- and post-performance surveys for a course is essentially a threefold operation:

1. Develop concrete goals and learning objectives that reflect the instructor's desired knowledge level for the class.
2. Determine the minimum acceptable results for student comprehension and performance based on acceptable criteria.
3. Organize the lecture and laboratory exercises to ensure the goals and learning objectives are presented and featured in class.

Periodic listing, review and discussion of course goals and learning objectives throughout the semester is essential to determine whether acceptable progress is being made, and, if not, to address the shortfalls early on.

It is important to keep the number of goals to a reasonable amount. If too many goals or overly detailed goals are set, the students may view them as unrealistic, and lose interest in the process of studying and working toward achievement of the goals. If, on the other hand, too few goals or overly general goals are set, the students may not cover the subject matter adequately or fail to comprehend the full scope of the instructor's expectations for achievement of the goals.

Determining the minimum acceptable level of learning that is to be demonstrated for each goal and carefully framing the goal to elicit at least that level is also critical, as is striving for learning and achievement that surpasses the minimum standards. A useful guide the framing of goals is from Benjamin S. Bloom's *Taxonomy of Educational Objectives*, Handbook I (Bloom, 1956). Bloom lists and categorizes numerous verbs that can be effective in defining and helping elicit knowledge, comprehension, application, analysis, synthesis, and evaluation.

## *Determining Goals and Learning Objectives*

It is recommended that four to five learning objectives be developed for each goal. Drawing from Bloom's verbs, the instructor can develop such learning objectives and goal statements to focus upon and distinguish prior knowledge of the subject and new knowledge and skills that are to be acquired from taking the course.

Example:

Goal #1: Demonstrate competency in preparing earth work take-offs.

Demonstrate is a comprehension verb.

Learning objective: Calculate earth work volumes.

Calculate is an application verb that demonstrates comprehension.

## *Determine Minimum Acceptable Results*

Determining a minimum acceptable result can be difficult. It requires that the instructor decide how much knowledge of the subject matter the student is expected to bring to the class. A course that presents information for the first time might expect higher growth in knowledge than a course that builds on refinement, development or more in-depth application of information from a previous course.

Example:

> A structures course that depends on previous course work might require the instructor to record the students' perception of knowledge from the previous class. In contrast, a course that introduces information for the first time may not require such information.

The pre-survey based goals and learning objectives establish the baseline for student understanding. This baseline is a reference point for the instructor to organize the pace and in-depth explanations that will be required to impart mastery of the subject.

A post survey using the same goals and learning objectives should show an increase in perceived knowledge by the student.

Establishing the acceptable level of knowledge is the difficult part. Using the school's grading system is one option. Establishing an acceptable level of knowledge within a grade range of "B-" to "C+", or scores of 76-80%, by definition, means that the student learning and accomplishment acceptably meets the published objectives for the course.

Surveys are taken anonymously, and the responses are aggregated into scores. The instructor must then evaluate the survey results against the grades for the class. Comparing course test/assignment scores and student work should demonstrate the same level of understanding as was dictated by the survey.

Determination of the core teaching objectives can be difficult and may require changes to these objectives based upon the results of the pre- and post-survey results. Most textbooks provide learning objectives for each chapter. These examples may be excellent first choices.

Once the goals and learning objectives have been developed for the course, they are documented in the course syllabus. These same goals and learning objectives are put in statement or question format for both the pre- and post-performance surveys. For example:

"I have a complete understanding of construction drawings, and developing quantity take-offs".

> ___ Strongly Agree ___ Agree __Disagree __Strongly Disagree"

The survey results are anonymous and submitted by students on their computers. Student responses prior to the course and again after the course, can be compared and evaluated. For example, the relative percentages of "strongly agree," "agree" "disagree" and "strongly disagree" responses provide the instructor with an indication of the extent to which students perceived knowledge of the subject.

These surveys provide considerable insight to the instructor. The instructor can evaluate each learning objective and determine if the message is getting through. If disconnect is discovered, the instructor can change the teaching approach, revise the objective, or alter the course, all to the betterment of the learning process.

In order to simplify the process and delivery of the surveys, a web based tool was selected. SurveyMonkey.com is a revolutionary tool to create and publish custom surveys in minutes, and then view results graphically and in real time. An example of survey results for both pre- and post-course surveys can be found in Appendix A. The faculty then completes a simple form with an analysis of the student learning. See Appendix B. This form has been established as a template that all faculty must submit to the department head for each course they teach.

In addition to conducting a comparison of learning objectives between the pre-course and post-course surveys, the faculty also prepares a brief conclusion/observation section. This section allows for some introspective observations of the students' perceived learning and also allows the faculty to discuss things they may change for next offering of the course.

The final step is to collect these over a period of time and prepare an analysis of the effectiveness of the changes and the scores.

## Conclusion

Program assessment is a function that now is mandated by all accreditation bodies in construction programs. There are many discussions on how to best establish and perform the required functions to collect data for analysis. This approach to assessing student learning outcomes has been used successfully as a simple tool for faculty to gather data.

It must be understood that this assessment tool, pre- and post-course surveys cannot be used solely to determine a student's learning. A comprehensive assessment plan must be developed and multiple tools must be utilized to gather data for validation of learning.

## References


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# Appendix A
# Pre and Post Examples of Web Based Surveys

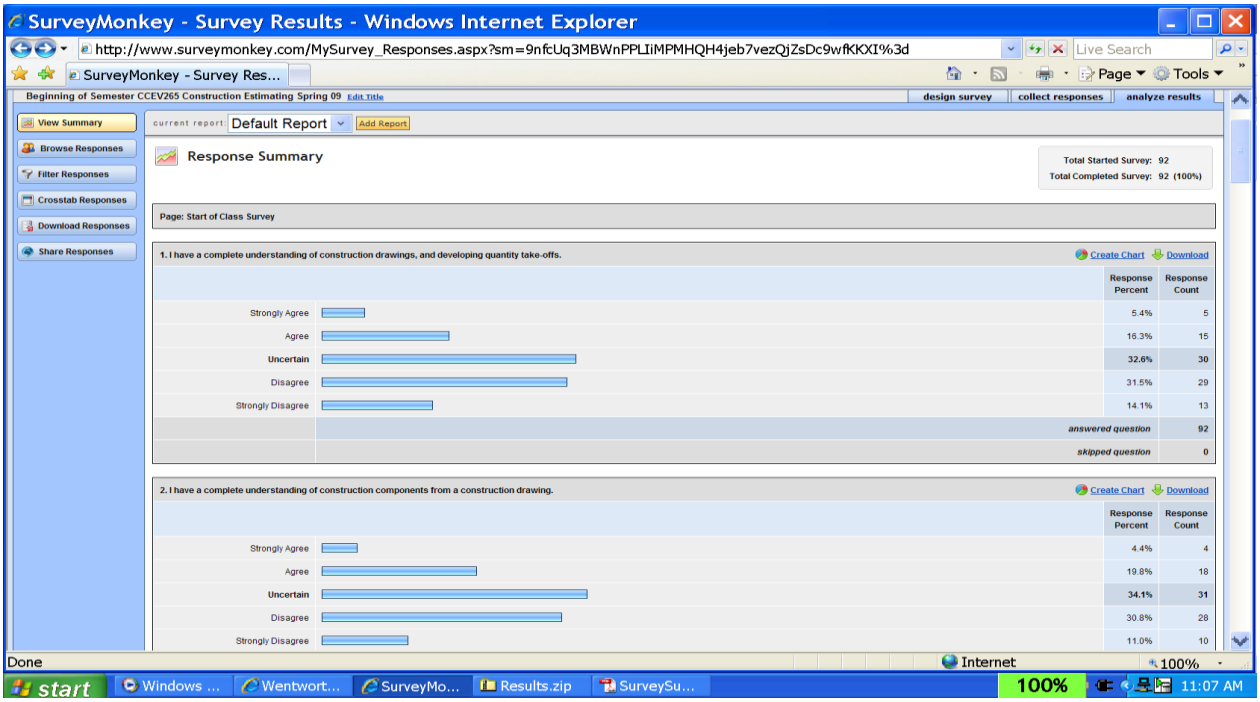


*Figure 1:* Pre-course Survey

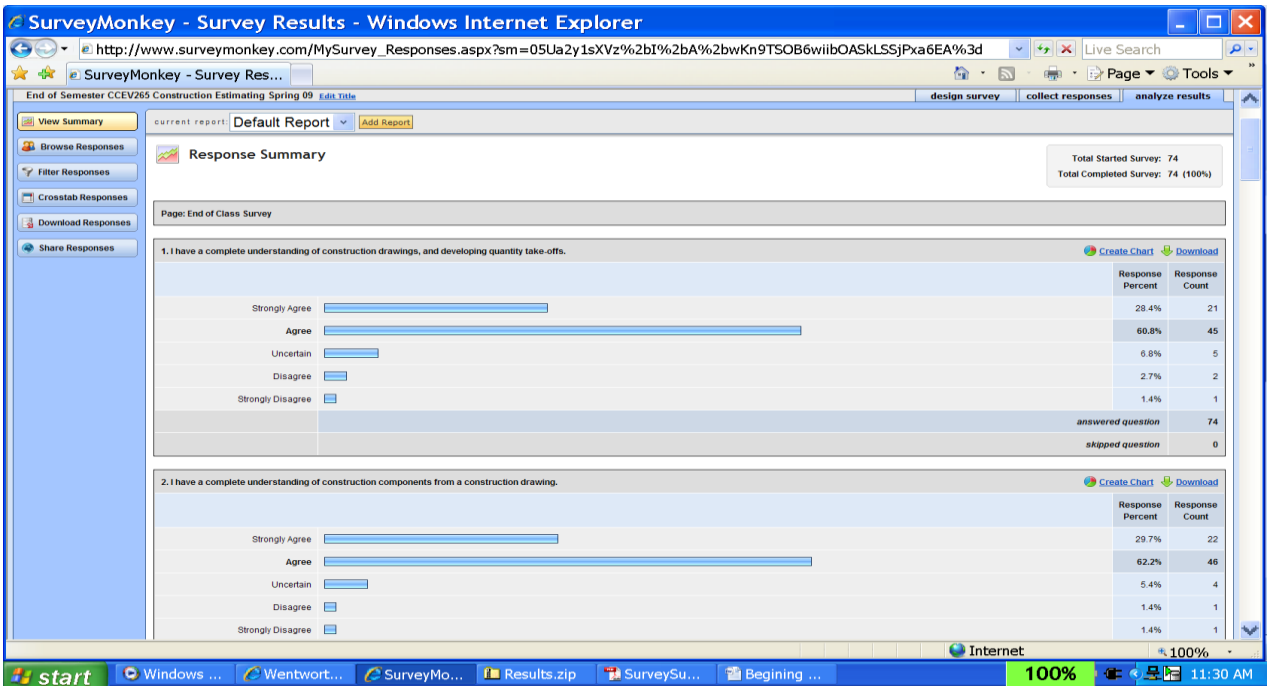


*Figure 2:* Post-Course Survey

## Appendix B
## Excerpt from Syllabus Showing Learning Objectives

Date 5/7/09

Professor: E. Scott Sumner
Subject: Evaluation of Start vs End of Semester Survey for CCEV 265 (Construction Estimating) Spring 2009

The following is my evaluation of the above course based upon survey results. Each question is summarized and the course beginning and course end results are provided. The comparison combines "agreed" and "strongly agreed" responses. I have also included an overall evaluation.

| | SURVEY QUESTION | BEGINNING% | ENDING% |
|---|---|---|---|
| 1 | Understanding of construction drawings | 21 | 89 |
| 2 | Understanding construction components from construction drawings | 23 | 94 |
| 3 | Understanding of how to calculate quantities from construction drawings | 13 | 90 |
| 4 | Understanding how to calculate costs for components | 12 | 81 |
| 5 | Understanding an assembly | 8 | 72 |
| 6 | Understanding construction specifications | 10 | 85 |
| 7 | Understanding CSI Uniform vs Master formats | 4 | 67 |
| 8 | Understanding the organization of the Master format | 10 | 92 |
| 9 | Differentiating preliminary and detailed estimates | 10 | 91 |
| 10 | How to calculate a preliminary estimate | 11 | 91 |
| 11 | Understanding the construction process | 34 | 93 |
| 12 | Understanding common CM terms | 18 | 93 |
| 13 | Understanding principal construction phases | 11 | 86 |
| 14 | Understanding the estimating cycle | 11 | 85 |
| 15 | Understanding construction project costs | 8 | 85 |
| 16 | Understanding between project vs construction costs | 11 | 91 |
| 17 | Understanding of different construction contracts | 9 | 82 |
| 18 | Understanding development of labor/equip/material costs | 15 | 94 |

**Conclusion/Observation:** The overall goal was to achieve at least 70% "agree" responses for each category at the end of the semester. I have achieved that goal on every category, and exceeded it 17 out of 18 times. The survey results confirm that the course material is presented in a manner that allows the students to increase their understanding of estimating. I will spend more time next semester on CSI formats, as that category was below the 70% goal. The students did not have adequate plan reading skills. Lab time was used to improve this skill. Plan reading is essential to understanding estimating.