INTERSECTII
http://www.intersections.ro
INTERSECTIONS

Benefits and Drawbacks of Using on-line Assessments of Student Learning in Construction Education

Cristina Cosma
Department of Construction Management, Wentworth Institute of Technology, Boston, MA, 02115, USA

Summary

Assessment of student learning is a critical step for achieving a quality learning environment in construction/civil engineering education. Proper assessment strategies are also significant drivers of the paradigm shift from instruction based education to learning based education. Additionally, accreditation requirements call for programs to "implement and support a systematic and broad-based approach to the assessment of student learning".

The paper will review and compare the two major points of view on student learning: the constructivist instructional reform and the measurement/technical quality approach. The two methods of measuring student learning (summative evaluation and formative evaluation) will be described.

Even if on-line assessments of student learning use typical summative evaluation tools like tests, quizzes and surveys, they can also be categorized as formative when used constantly during the semester (i.e. practice tests or quizzes).

For the past three years the author has been the principal instructor for CONM150 "Heavy Construction Equipment" class which is taught to Construction Management (CM) freshmen. After two years of using traditional assessment techniques, in spring 2015 the instructor adopted Blackboard Learn (BB) as a course management software. Class assessments were exclusively offered through BB. The paper will cover the way in which assessments on BB were designed. A list of lessons learned will be presented based on grade comparison and also on the students' feedback and comments.

KEYWORDS: Instructional Paradigm, Learning Paradigm, Accreditation, Quality Learning Environment, Student Assessment, Blackboard Learn.

1. INTRODUCTION

Higher education in the 21st century is characterized by a dramatic change from the "instruction paradigm", where the mission of the college is to deliver (50-min) instruction to students, to a new "learning paradigm" which envisions the institution itself as a learner-over time [2]. The ultimate goal of this transformation

ISSN 1582-3024

is to improve efficiency and effectiveness of learning through the change in emphasis from objective-based/input-based education to outcome-based education [4].

The growing importance of transparency and accountability that characterizes the new paradigm has led to increased demands for colleges and universities to engage in outcomes assessment [13]. Institutions of higher learning started to design new program structures, identify desired learning outcomes, determine ways to align and attain their outcomes through revising course content, provide pedagogical training for faculty, adopt a variety of teaching and learning methods, and devise appropriate assessment criteria and methods [4].

Another important driving force towards the design and implementation of a proper assessment system in US (engineering) education was the Accreditation Board for Engineering and Technology (ABET) which specifically requires the education institutions to set in place "an assessment and evaluation process that periodically documents and demonstrates the degree to which the program outcomes are attained" [1]. The data and evidence accumulated through assessment practices will further be interpreted and will result in and evaluation process whose final goal is to determine the extent to which program outcomes or educational objectives are being reached; the end result of this process will be decisions and actions taken to improve the program and achieve higher quality education.

As far as assessment history is concerned, four major components influenced assessment practice in the past century: psychometrics (the measurement of skills and knowledge, abilities, attitudes, personality traits, and educational achievement), theories of cognition, the nature of curriculum, and the sociopolitical context of education [10]. Consequently assessments were directed towards checking whether students can perform according to certain predefined measurements of appropriate responses and were routinely carried out to estimate the strengths and weaknesses of students. In the 21st century these type of assessments show little effectiveness in contributing to improve the educational outcome.

2. CONSTRUCTIVIST VS TRADITIONAL APPROACH

Two main teaching approaches are coexisting in the 21st century academic system: the traditional (instructor centered) teaching and the progressive (student centered) constructivist approach. Present pedagogical approaches make use of a mixture of both systems depending on the requirements and configuration of a particular class, on the subject taught, on the instructor's own beliefs and also on the administrative policy of the college itself.

ISSN 1582-3024

INTERSECTII
INTERSECTIONS
http://www.intersections.ro

2.1. The traditional approach in teaching

The most common approach at university level remains the traditional teaching approach that is using the lecture method (Figure 1a). Traditional instruction is based on a theory of learning that suggests that students will learn facts, concepts, and understandings by absorbing the content of their teacher's explanations or by reading explanations from a text and answering related questions [11].

This approach has been criticized lately for the unilateral transfer of information from instructor to the (passive) students. In the traditional approach instruction is strictly based on a fixed curriculum, curriculum which will rely mainly on textbooks. The approach is instructor centered showing reduced level of student choice, involvement and/or interaction. The instructor has total authority and decision power on the selection of subject matter (based on the Syllabus), structure presentation, teaching methods and pace.

2.2. The constructivist approach in teaching

The constructivist approach (Figure 1b) is based on a theory of learning that suggests that understanding arises only through prolonged engagement of the learner in relating new ideas and explanations to the learners' own prior beliefs [11].

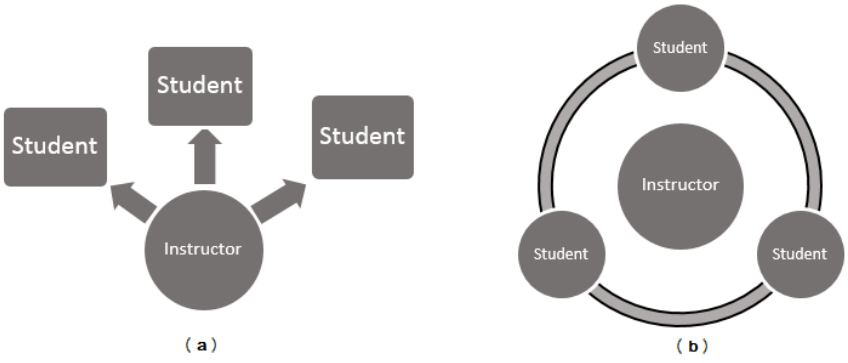

Figure 1. Traditional teaching approach (a) vs constructivist approach (b)

Some distinctive characteristics of constructivist teaching according to Kim [7] are:

- Students are encouraged to engage in free discussion, ask questions, share and test own ideas and be innovative;
- Students are invited to generate ideas even before any instructional material is presented to them;
- Students are encouraged to challenge and/or use different concepts and ideas after a thorough reflection and analysis;
- Instructional strategies are changed to enhance students' thought, experience and interests.

ISSN 1582-3024

2.3. Teaching Approach in (Construction) Engineering

Student success can be achieved if the teaching style will match the students' learning styles. From the 32 student learning styles identified by researchers, the usual methods of engineering education tries to address five main categories: intuitive, auditory, deductive, reflective, and sequential.

Most engineering courses will favor the intuitive learners by emphasizing concepts rather than facts and through using primarily lectures and readings (words, symbols) to transmit information. But the majority of engineering students are sensors (hands-on, practical learners), suggesting a serious learning/teaching style mismatch in most engineering courses which might result in low test grades, unresponsive classes, poor attendance and dropouts [6].

Some of the teaching techniques recommended to be used in engineering in order to address all learning styles and enhance student education according to Felder are [6]:

- Motivate learning;
- Balance concrete information and abstract concepts;
- Balance practical-problem solving methods with fundamental understanding;
- Provide explicit illustrations of intuitive patterns and sensing patterns;
- Follow scientific method in presenting theoretical material;
- Use pictures, schematics, graphs and show films;
- Use computer assisted instruction.

3. TYPES OF ASSESSMENTS

3.1. The need for assessment

Assessment of student learning is an intrinsic part of the learning process as a whole and one of the most powerful tools used both for feedback and for advancement of instruction. In tandem with the paradigm shift in education the approach on assessment has also evolved from the traditional assessment *of* learning towards the assessment *for* learning. Assessment is also an influential tool that drives student learning as students allow assessment define and prioritize what is important to learn, and ultimately how they spend their time learning it [9].

Figure 2 below shows the four eras of progressive evolution of learning assessment in US [12] driven towards the newly expressed demand for a culture of evidence of student learning.

ISSN 1582-3024

INTERSECTII
http://www.intersections.ro

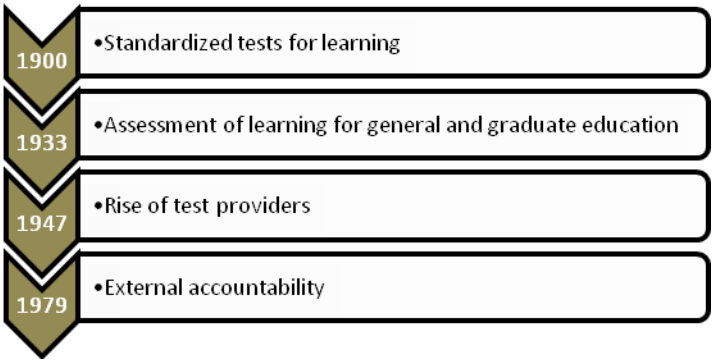

Figure 2. The evolution of assessment in US

Before the beginning of the 20th century assessment had already developed into the forms and procedures that still characterize it today [14]. Alternatively there is new attention to developing creative ways to assess student learning. The new approach is trying to align assessment tasks with real life processes of problem-solving as the traditional examinations are believed not to resemble the work and life situations the graduates will have to face. The new technological possibilities are also a major source of innovation, with universities actively exploring the potential of computer-based assessment to assess learning and provide students with rapid and informative feedback [8].

Two main types of assessment practices have emerged in time and are widely used in academia: formative assessment and summative assessment.

3.2. Formative assessment

Formative assessment, is actually used as practice for the student and as a check for their understanding during the learning process. It provides feedback to the student on their learning and also allows students to make revisions and provides them with the opportunity to improve. Additionally the formative assessment process guides instructors in making decisions about future instruction. Homework, observations, conferences, Q&A sessions and other periodical in-class activities are specific examples of formative assessments.

3.3. Summative assessment

Summative assessment is assessment that is used to measure student performance and contribute to a student's grade in a course, module, level or degree. Summative assessments are cumulative and are scheduled at the end of a significant part of the course (Quizzes), half way through the course (Midterm Tests) and/or at the end of a course (Final Exam). Term papers, projects, portfolios and student evaluation of teaching effectiveness are other examples of summative assessments.

ISSN 1582-3024

The biggest difference between summative and formative assessments is that the summative assessments are product-oriented (learning achieved) while the formative assessments focus on the process toward completing the learning. Another difference is that once completed, no further revisions can be made on the summative assessments which will end up with a grade as a measure of student learning. If students are allowed to make revisions, the summative assessment becomes formative.

3.4. On-line assessment

The need to improve assessment techniques and strategies increased in tandem with the technological advances and transformations in the delivery of instruction. One of the most often used tools for offering on-line summative assessments is Blackboard.

Blackboard offers a wide variety of formats for questions used in assessments (Figure 3) and offers the advantage of providing the instructor with automatic grade calculation.

Blackboard also gives to the instructor the ability to administer quizzes 24/7 with safeguards such as random questions for each student, timed tests, password protection and adaptive release of quizzes. Using a variety of formats addresses multiple learning styles, and using pools of questions with random blocks for tests mitigates against student collaboration on tests.

A major concern is whether computer-based testing meets the needs of all students equally and whether some are advantaged while others are disadvantaged by the methodology [5].

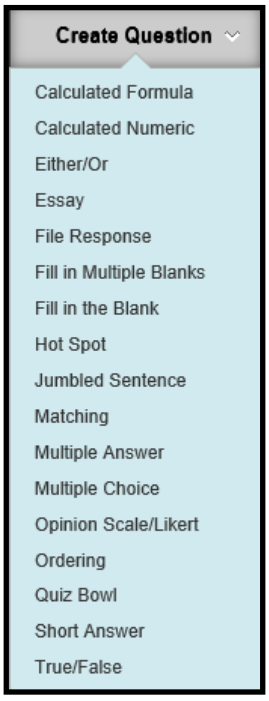

Figure 3. Question types

Among the main advantages of on-line administration of assessments are [3]:

- Immediate feedback for students;
- Objective grading by eliminating human error
- Easy to update and edit
- Increased accessibility (anytime/anywhere)
- Item analysis helps instructor identify areas for improvement

ISSN 1582-3024

INTERSECTII
http://www.intersections.ro

4. DEVELOPING ASSESSMENTS FOR CONM150

CONM150 "Heavy Construction Equipment" is offered every spring semester to the Construction Management (CM) freshmen class. The course introduces students to current methods and equipment used in heavy construction projects including highways, tunnels, bridges, dams, storm drains, and sanitary sewers. Formative assessments (weekly quizzes) and summative assessments (midterm and final tests) constitute 60% of students' final grade.

In 2013 student learning in CONM150 was assessed by using constructed-response (CR), 'traditional" open-ended problems. In 2013 tests scheduled during the semester contained mainly open-ended problems while the final exam consisted mostly of multiple choice (MC) questions. In spring 2015 all tests were offered on Blackboard Learn and consisted primarily of MC, true/false (TF), fill in the blank and matching type of questions. A dramatic difference was noticed in students' final grades (Table 1) with a constant increase in final scores as the dominance of MC questions in tests increased too.

Table 1. CONM150 (average) final grades

	2013 (CR)	2014 (CR & MC)	2015 (MC)
Average Final Letter Grade (Average Final Grade)	C- (72)	C (77)	B (87)

The design of the MC questions in 2015 included choosing distractors or wrong answers based on the most common mistakes and misconceptions identified in 2013/2014 CR problems. In order to reduce errors and increase performance, a fixed number of 4 alternatives was used in the 2015 MC tests. Wrong answers received a grade of 0 (zero), which definitely encouraged guessing.

Students were asked to comment on the effectiveness and clarity of the on-line tests when they were filling the class evaluations at the end of the semester. From their written and sometimes verbal comments, and also from the instructor's own observations some lessons were learned as follows (Table 2):

Table 2. Students' comments on on-line assessment

Positive comments	Negative comments
• Guessing is helpful • Instant grading is appreciated • Less time consuming • Easy	• TF questions are more confusing than MR • Fill in the blank created problems with following format requirements • The lack of partial credit is disappointing and unfair • Would prefer "not to know so fast how (bad) I did" • Pictures/graphs should be in paper format • Concerns regarding cheating • "I hate Blackboard"

ISSN 1582-3024

5. CONCLUSIONS

Recent developments in computer based technologies have a dramatic impact on teaching and assessment practices. On-line assessments are gaining more ground than ever due to undisputable advantages like time efficiency and accessibility (anytime/anywhere). Disadvantages in the area of connectivity issues, answer formatting and cheating can be handled through proper network development, student training and appropriate test design approaches.

Implementation of on-line assessments equally impacts students and instructors. Both test taking strategies and test development strategies must change accordingly while both students and instructor need training into taking/offering tests administered on Blackboard.

Comparison of traditional paper-based summative testing versus on-line testing in a CM freshmen class undoubtedly revealed the positive impact Blackboard administered test had on average class grades.

References

1. ABET, *Criteria for Accrediting Engineering Programs*, 2007, www.abet.org.
2. Barr, R., Tagg, J., From Teaching to Learning - A New Paradigm for Undergraduate Education, *Change Magazine*, Vol. 27(6), Taylor & Francis Group, Philadelphia, 1995, http://www.maine.edu/pdf/BarrandTagg.pdf.
3. Boyles, P.C., Maximizing Learning Using Online Student Assessment, *Online Journal of Distance Leaning Administration,* vol.14, 2011, http://www.westga.edu/.
4. Chung, C., Changing Engineering Curriculum in the Globalized World, *New Horizons in Education*, Vol. 59(3), Hong Kong, 2011, http://files.eric.ed.gov/fulltext/EJ955545.pdf
5. Erstad, O., Changing assessment practices and the role of IT, *International handbook of information technology in primary and secondary education*, Vol. 1, New York: Springer, 2008.
6. Felder, R.M., Silverman, L.K., Learning and teaching Styles in Engineering Education, *Engr. Education*, Vol. 78(7), 1988, http://www4.ncsu.edu/unity/felder/public/Papers/LS-1988.pdf
7. Kim, J.S., The Effects of a Constructivist Teaching Approach on Student Academic Achievement, Self-concept, and Learning Strategies, *Asia Pacific Education Review*, Vol. 6, No. 1, 2005, http://files.eric.ed.gov/fulltext/EJ728823.pdf.
8. McInnis, J.R., Devlin, M., *Assessing Learning in Australian Universities*, Centre for the Study of Higher Education, Canberra, Australia, 2002.
9. O'Farrell, C., *Enhancing Student Learning through Assessment – A Toolkit Approach*, 2005, http://www.tcd.ie.
10. Pellegrino, J. W., The Evolution of Educational Assessment: Considering the Past and Imagining the Future, *The sixth annual William H. Angoff Memorial Lecture,* Princeton, NJ, 1999, https://www.ets.org.
11. Ravitz, J.L., Becker, H.J., Wong, Y., *Constructivist-Compatible beliefs and Practices among U.S.Teachers*, NSF Grant #REC-9600614, 2000, http://www.crito.uci.edu/tlc/html/findings.html.
12. Shavelson, R. J., *A Brief History of Student Learning Assessment*, The Association of American Colleges and Universities, Washington DC, 2007, http://cae.org/.
13. Tremblay, K., Lalancette, D., Roseveare, D., *Assessment of Higher Education Learning Outcomes, Feasibility Study Report*, Vol. 1, OECD, 2012, www.oecd.org/edu/ahelo.
14. Wilbrink, B., Assessment in historical perspective, *Studies in Educational Evaluation,* 31-48, 1997, http://cae.org.

ISSN 1582-3024