A Conceptual Framework for Online Course Teaching and Assessment in Construction Education

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With the proliferation of online education, there has been a paradigm shift in higher education over the past two decades. Academic institutions have offered online courses for students and are still trying to expand online learning offerings. However, regulators and accrediting bodies have raised some concerns about online education compared to on-ground face-to-face education. One of the biggest concerns resides in the quality of online instruction. It might be difficult to define the quality of online teaching and learning because "quality" tends to be measured based on a relative experience or an individual's level of expectation. Several quality standards for the delivery of online instruction have been proposed. However, different programs in higher education offering online courses may have their own unique perspective and interpretation of the quality of online education. Without criteria of quality standards in construction education, it can be extremely difficult to assess existing online courses within the construction management curriculum. Course assessment is the most essential area of online education since it is a key indicator of the quality of online education. This study investigates best practices in online education, addresses some quality standards criteria in construction education, and proposes strategies for online course teaching and assessment. For this purpose, a survey was carried out to explore students' educational experience in online classes; to evaluate the instructional effectiveness of various instructional tools used in the online class; and to assess the viability of online course offering in CEM education. The results of this study will be able to provide a conceptual framework for the quality of online course design and development in construction education.

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Introduction

Academic institutions have offered a multitude of online courses for students and are still trying to expand online learning offerings. Several attempts to define quality standards for the delivery of online instruction have been proposed [1, 2, 3, 4, 5, 6]. However, it is difficult to define the quality assurance of online education because "quality" tends to be measured on relative experience or an individual's level of expectation. Furthermore, criteria for quality assurance vary across various areas, ranging from technical (e.g., engineering and construction management) to humanity (e.g., communication and sociology) [3]. Different programs in higher education offering online courses may have their own unique perspective and interpretation to define the quality of online education [7]. However, there should be common ground to establish general characteristics for quality online instruction (e.g., clear statements of educational goals, instructional commitment to support learners, and collaborative processes of discovery). Without criteria of quality standards in online education, it can be extremely difficult to assess existing online construction engineering and management (CEM) courses within the CEM curriculum. The most essential but understudied area of online education is course assessment, which is extremely important because course assessment is an indicator of the quality of online education. In the CEM domain, however, online education is still at the beginning stage. For instance, there is still only one course teaching online in the construction management undergraduate and graduate programs at Central Connecticut State University (CCSU). Therefore, it is important to develop a conceptual framework for online course teaching and assessment. This framework will be able to provide a guideline for the quality of online course design and development in construction education.

Literature Study

An extensive literature review was conducted to create a conceptual framework for online course design and development in CEM education. The results of this literature review are summarized below.

Effective Online Teaching and Pedagogy

A recent survey of online education in the United States reported that more than 1.88 million students enrolled in online courses in 2013 at public academic institutions (4-year or above) [8]. This report also indicated that online education is becoming an important long-term strategy for many postsecondary institutions. 70.8% of the participants answered "agree" to the question "Is Online Learning Strategic?" in fall 2014 [8]. Considering all of these facts,

it is imperative that post-secondary institutions offer quality online courses.

Pelz, in 2004, suggested three principles of effective online pedagogy and also provided specific examples of activities [9]:

- Principle #1: Let the students do the work.
  - Student-led discussions
  - Students find and discuss web resources
  - Students help each other learn (peer assistance)
  - Students grade their own homework assignments
  - Case study analysis
- Principle #2: Interactivity is the heart and soul of effective asynchronous learning.
  - Collaborative research paper
  - Research proposal team project
- Principle #3: Strive for presence.
  - Social presence
  - Cognitive presence
  - Teaching presence

For successful online teaching, the Institute for Higher Education Policy provided benchmarks. In this report, "feedback to student works and students", "student interaction with faculty and other students", and "student engagement in course assignments" are important elements for effective online teaching [10]. Savery, in 2005, identified VOCAL (**V**isible, **O**rganized, **C**ompassionate, **A**nalytical, and a **L**eader-by-example) as the characteristics of an effective online instructor [11]. Kim and Bonk, in 2006, conducted a survey to substantiate some ideas about online learning and refute others. They found that group problem-solving and collaborative tasks, problem-based learning, discussion, and case-based learning are the preferred instructional methods for online instruction [12].

Best Practices in Online Course Teaching and Assessment

In online education, one of the essential ingredients for successful online teaching is online course design. When designing online course, the instructor must develop clear and measurable course and module learning objectives [13]. Using bloom taxonomy verbs would be very useful in describing the objectives [14]. Moreover, the course and module learning objectives should be aligned with the four most critical course elements: assessments, instructional materials, course activities and learner interaction, and technology [15]. In other words, the course elements work together to ensure that learners meet the desired learning outcomes. Therefore, all learning objectives should be clearly stated and written from the learner's perspective. The relationship between learning objectives and course activities should be clearly stated. In addition, the learning objectives should be suited to the level of the course. Before selecting technology for the course or module, course planning needs to be done so that the instructor can select the most appropriate technology to achieve certain learning objectives [16]. Course technology should be matched with the instructor's pedagogical style and strategies as well as the course subject.

Student interaction with faculty and other students is one of the key elements for effective online teaching. Therefore, online discussion forums are one of the most common pedagogical techniques to encourage student interaction and promote collaborative learning in the virtual classroom [17]. However, for the effective use of online discussion forums, the instructor is required to develop stimulating and relevant questions and moderate responses in accordance with the needs of the students in the virtual classroom [17].

Assessments of student learning should be aligned with the course and module learning objectives in online education. Assessment strategies need to be integral to the course activities, enable students to assess their progress, and have clearly articulated criteria [18]. Chickering and Gamson, in 1987, suggested seven principles for good practice in undergraduate education. The seven principles are listed below [19]:

- *Principle 1: Good Practice Encourages Student-Faculty Contact*
- *Principle 2: Good Practice Encourages Cooperation Among Students*
- *Principle 3: Good Practice Encourages Active Learning*
- *Principle 4: Good Practice Gives Prompt Feedback*
- *Principle 5: Good Practice Emphasizes Time on Task*
- *Principle 6: Good Practice Communicates High Expectations*
- *Principle 7: Good Practice Respects Diverse Talents and Ways of Learning*

Graham et al. from Indiana University's Center for Research on Learning and Technology (CRLT) used these principles as a general framework for evaluating four online courses in 2000 [20]. Based on the seven principles, they reviewed online course materials, student and instructor discussion forum postings, and faculty interviews. In 2004, Tobin suggested administrators to use the Checklist for Online Interactive Learning (COIL) [21] to evaluate online instruction with focus on student behavior, faculty-student interaction, technology support, and the completeness of the learning environment [22]. Tobin also emphasized that a high degree of objectivity can be achieved using the COIL [22].

Finally, there are several organizations devoted to advancing online course quality such as Online Learning Consortium and Quality Matters. These organizations

have provided general guidelines and standards for quality assurance of online courses. In particular, QM's quality assurance processes can be used as a resource to improve and certify the design of online and blended courses. QM has developed a rubric to evaluate the design of online and blended courses, emphasizing the concept of alignment to ensure students achieve desired learning outcomes [23]. It would be extremely helpful to apply the QM rubric in online course review and online course development for improving the quality of online education.

Method

The main objective of this study was to develop a conceptual framework for online course teaching and assessment in CEM education. Therefore, this study began with a review of extensive literature on best practices in online education, focusing on some quality standards criteria in construction education. Moreover, a survey was carried out to explore the students' educational experience in the online classes; to evaluate the instructional effectiveness of various instructional tools used in the online class; and, to assess viability of online course offering in CEM education.

Student Survey of Online Education

An online survey was given to one hundred and one students taking construction courses at CCSU during the Spring 2015 and Fall 2015 semesters. 44.5% (n=45) of the CEM students had taken one or more than one online course before. Therefore, the forty-five surveys collected from the 44.5% students were analyzed for this study. The results of this survey are presented below:

Figure 1 shows the instructional tools the students used in their online classes. All of the students answered that they had used a learning management system such as Blackboard Learn and had online quizzes or/and exams in their online classes. In addition, accessible documents of lecture notes and reading materials were posted on the learning management system. 80% of the students answered that they used discussion board on Blackboard and 53.3% used lecture videos for online learning.

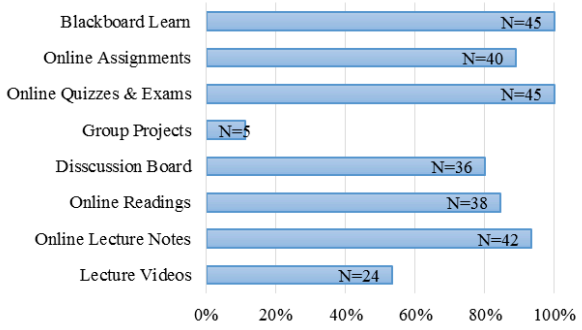

Figure 1. Instructional Tools Used in Online Classes

Only the CEM students who used particular instructional tools in the online classes were then asked to measure the effectiveness of the instructional tools they used online. As shown in Table 1, students consider Blackboard an effective learning platform. Students prefer, even in an online class, using Blackboard to read reading materials such as textbooks and lecture notes, ask questions on Discussion Board to complete assignments, and take quizzes and exams on Blackboard.

Table 1. Effectiveness of Instructional Tools in Online Learning

Instructional Tools	N	Min	Max	Mean	SD
Blackboard Learn	24	2	5	4.44	0.69
Online Assignments	42	3	5	4.40	0.78
Online Lecture Notes	40	2	5	4.38	0.79
Online Readings	45	2	5	4.24	0.88
Discussion Board	5	1	5	4.17	1.06
Online Quizzes & Exams	38	3	5	4.00	0.80
Lecture Videos	45	2	5	3.96	1.00
Group Projects	36	1	5	2.20	0.84

Note: Likert scale ranging from 1 (very ineffective) to 5 (very effective).

Finally, two simple questions were asked to assess viability of online course offering in CEM education:

- ***Question #1***: "If online construction courses are offered, will you take them?"
- ***Question #2***: "If online construction courses are offered, will you recommend other students to take them?"

The students were asked to answer these questions on a scale of 1 (definitely not) to 5 (definitely) and the results are summarized in Table 2. As shown in Table 2, online education in the CEM domain is as viable as online education in other domains.

Table 2. Viability of Online Courses in CEM Education

	N	Min	Max	Mean	SD
Question #1	96	1	5	3.63	1.22
Question #2	94	2	5	3.57	1.22

Note: Likert scale ranging from 1 (definitely not) to 5 (definitely).

Conclusions

Based on the extensive literature review, this study created a conceptual framework for online course teaching and assessment in CEM education. The framework will provide a guideline for the quality of online course design and development in construction education. Best practices in online education were discussed in this paper and some quality standards criteria such as the QM rubric were also addressed for online course design and development in construction education. In addition, some strategies for online course teaching and assessment were proposed in the section of literature study. The results of this survey

found the viability of online education in the CEM domain as well as in many other domains. CEM online courses are viable unless a course requires heavy hands-on activity. For these courses, using a mixed strategy based on an appropriate combination of on-ground and online is recommended. In the CEM domain, online education is still at an early stage. CEM programs may need to consider if they are ready to meet growing demands in online education.

Acknowledgements

The author would like to thank CCSU-AAUP Minority Recruitment & Retention Committee for supporting this study. I also would like to acknowledge the support of Kathy Knopf and Toi Earlington for this study.

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