

ASSESSING LEARNING AND TEACHING STRATEGIES OF A POST-GRADUATE CAPSTONE COURSE: STUDENTS' PERSPECTIVE

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Quality enhancement and quality assurance are the means by which higher education institutions are monitoring to ensure the standards are maintained worldwide. The views of students are in integral component in this process: as such extensive studies have been conducted in this regard. The students' perspective, over a three year span (2010 to 2012), on the design and delivery of a post-graduate capstone course that has undergone a recent restructuring is presented in this paper. The research utilised an anonymously e-assessed questionnaire: thirteen (13) closed-ended and two (2) open-ended questions. The instrument was administered a week after the delivery of the course. The results indicate a generally significant positive reception to the learning and teaching strategies employed. However, the negative feedback also indicates the level of dissatisfaction and lack of understanding of the intentions of the course structure. The research can be used to guide others engaged in the development of capstone courses to ensure quality is achieved from the perspective of the key stakeholder - the students.

Keywords: quality, education, capstone course, e-assessment, student perception, accreditation.

INTRODUCTION

Quality enhancement and quality assurance are the means by which higher education institutions are monitoring to ensure the standards are maintained worldwide (Harvey 2001; Jones 2003; Lomas 2007; Blackmore 2009). The views of students are an integral component in this process; as such, extensive studies have been conducted in this regard (Harvey 2001; Edström 2008; Denson et al 2010; Fluckiger et al 2010; Yueh et al 2012).

The Quality Assurance Agency for Higher Education (HE) is the body responsible for safeguarding the standards of UK higher education and also assists universities and other providers improve the quality of the learning experience (QAA 2012). The Institution of Civil Engineers (ICE) along with three other professional engineering institutes have joined together to form the Joint Board of Moderators (JBM) with the intention of strengthening the links between HEI and industry (JBM 2009). One such thrust would include a merger between the QAA and the JBM to establish guidelines

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for checking output standards of degree programs (JBM 2010). The JBM adopted the QAA's "Framework for Higher Education Qualifications in England, Wales and Northern Ireland" (QAA 2009).

The Department of Civil & Environmental Engineering at the University of the West Indies (UWI), St Augustine Campus, Trinidad & Tobago has a long standing relationship with the JBM in accrediting its degree programs at the undergraduate and postgraduate levels. Based on a previous visit to the University, the department was asked to revise its programs to maintain its accreditation. Concurrently, a new Strategic Plan 2007-2012 was put forward by the Vice Chancellor of the UWI that required a number of desired attributes to be developed in the graduates (UWI 2007). These recent events led to the restructuring process to redesign the learning outcomes for its MSc programs of the Department as follows:

- Lead and work within teams to identify and solve technical, business, social, cultural and ethical issues in Civil Engineering both systematically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences;
- Demonstrate self-direction, critical thinking and originality in tackling and solving problems, and act autonomously in planning and implementing tasks using Information Technology.
- Continue to advance their knowledge and understanding, and to develop their new skills to a higher level. Candidates will have the competencies, qualities and transferable skills necessary for employment requiring: the exercise of initiative and personal responsibility; decision-making in complex and unpredictable situations; and the independent learning ability required for continuing professional development as a practicing Civil Engineer.

The program learning outcomes were weaved in to the courses of the various programs. This study focuses on a capstone course known as COEM 6025 - Practical Team Project, hereafter referred to as the Course, with specific learning outcomes to:

- Lead and work within teams.
- Identify technical, business, social, cultural, and ethical issues for a given Project.
- Solve technical, business, social, cultural, and ethical issues for a given Project both systematically and creatively, make sound judgments in the absence of complete data.
- Communicate conclusions clearly to specialist and non-specialist audiences.

Teaching & Learning Strategies

To measure the fore-mentioned learning outcomes industry techniques were introduced as best practice into the Course developing five (5) innovative forms of assessment: a bespoke 360-degree feedback questionnaire; Zero Tolerance; Institution of Civil Engineers (ICE) Development Objectives (D.O.); an Interview and a Written test (Essay) based on the Professional Review stage of the ICE (Ellis et al. 2011; Ellis & Petersen 2011).

The teaching and learning strategy involved the students being placed in teams of five members with each student role playing as leader for a weekly objective based on the nine Knowledge Areas of the Project Management Body of Knowledge (PMI 2008). Each student was given an opportunity to lead their team twice throughout the

semester based on rotation of the roles of leader and team player. The teams were assigned a client: an industry liaison or a staff member with industry experience. The projects were hypothetical "real world" scenarios that required the students to address learning outcomes 2 and 3 to produce a Project Plan. A marking criteria and rubric was created for each form of assessment that allowed for quality control throughout the process and to reduce the level of subjectivity in the evaluation. The interview session was conducted by a pair of panellist that assigned the Essay question to each student individually based on their contribution to the Project Plan and their personal ICE Development Objectives.

The Course was delivered in the final semester over the 15 week duration. The first week was used to introduce the students and assisting industry liaison, role playing as clients on the project, to the teaching and learning strategies of the course. The following ten weeks had weekly assessment conducted based on the bespoke 360-Degree Feedback (learning outcome 1) and Zero Tolerance (learning outcomes 2 & 3). The ICE Development Objectives (Learning outcomes 2 & 3) were submitted on week 13, while the remaining forms of assessment, Interview and Essay (learning outcome 4) were conducted in week 14 based on all components previously covered in the Course. These forms of assessment are described in detail in Ellis et al (2011) and Ellis & Petersen (2011).

The students were invited to complete an anonymous questionnaire (Post Evaluation), via an e-learning platform, following the completion of the Course (week 15) to determine their level of satisfaction with its design and delivery as well as its ability to advance their professional development. This study focuses on the Quality of the teaching and learning strategies used in the Course in meeting the needs of the students as a key stakeholder in the educational process over the period of three academic years spanning (2010 to 2012). Quality is defined as "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs" (BSI 1991). Green and Harvey (1993) in their study identified five different approaches to defining quality; however this study focuses on one: as fitness for purpose (meaning the product or service meets the stated purpose, customer specifications and satisfaction).

LITERATURE REVIEW

Quality enhancement and quality assurance are the means by which higher education institutions are monitoring to ensure the standards are maintained worldwide (Harvey 2001; Jones 2003; Lomas 2007; Blackmore 2009). In the study of Harvey (2001), it was found that in the 1980s feedback from students concerning their experience in higher education (HE) was a rare event. However, due to the expansion of tertiary education and the greater concern with quality, the need arose for such practices. The common practice is to collect the students' views in the form of 'satisfaction' feedback. The feedback from students has two main functions: Internal information to guide improvement and external information for potential students and other stakeholders. Our research focuses on the former, but also looks at their reflection on learning.

Harvey (2001) separated 'satisfaction' surveys in HE into five forms: (a) institution-level satisfaction with a total student experience or a specified sub-set; (b) faculty-level satisfaction with provision; (c) program-level satisfaction with the learning and teaching and related aspects of a particular program of study; (d) module-level feedback on the operation of a specific module or unit of study; (e) and teacher-

appraisal by students. At the University of the West Indies, we are engaged in the latter three forms of feedback, but this research is focused at only the module-level feedback based on the Course. The University conducts a generic course evaluation; however this study focuses on a course evaluation design to highlight specific aspects of the Course.

Module-level feedback tends to focus on specific learning and teaching associated with the module and is generally collected with the aid of a questionnaire as in this research. One challenge with this form of feedback is the fact that the information collected has little benefit to the students who provided the same (Harvey 2001). While this is true, this research is also geared towards reflective learning for the students thereby creating a benefit to both parties involved in the process.

It is said that there are a few common characteristics that are shared by student evaluations of teaching (SET) regardless of their application (Sproule 2000; Algozzine et al., 2004): (1) a mixture of open-ended and closed questions; (2) a single item which addresses overall teaching satisfaction/effectiveness; (3) written comments about the course or instructor; (4) anonymity; (5) responses are obtained at the end of the term, in the absence of the instructor; and (6) responses are analysed.

Open-ended questions can be utilized in this process which provides a wider pool of information and allows for more reflection on learning. In addition to the “what” questions, the “why” and “how” questions can drive students to think deeper and wider in their evaluation of their own learning (SEDL 2000). Due to difficulty in analysing and the time consumed in arranging them, open-ended questions are infrequently used (Harvey 2001).

Learning is not just a process of accumulation of information. It could be considered as a network of co-existing ideas (Moon 1999) or it is about how the new knowledge that the learner encounters is integrated with his existing schemata of prior knowledge (Ong 2000). This new knowledge is a combination of experiences (action) and thought (reflection) (SEDL 2000).

In the extant literature on the subject of reflection many of the authors promote a diverse range of constructivist approaches in defining and explaining the construct, drawing theory into practice (Donaghy and Morss 2000; Fisher 2003; Jones 2004; McCollum 2002; Moore 2004; Price 2004; Rodgers 2002; Spalding and Wilson 2002). Based on a review of the literature “Questioning” is seen as a practical inquiry that requires critical incident analysis and develops higher order skills, such as analysing and evaluating (University of Sydney n.d.).

When considering learning from the students’ perspective it requires us to: (1) appreciate how students perceive our intentions as teachers and assessors; (2) understand the institution’s intentions towards us in terms of evaluation; (3) design and use methods of assessment that will contribute to deeper student learning; and (4) choose evaluation methods which contribute to the development and improvement of learning and teaching (University of Sydney n.d.).

One constraint that may exist with the feedback process and reflecting is the student’s inability to critically reflect on their learning over the period of time (University of Sydney n.d.). Some students may be better reflectors than others, however, throughout the Course the students’ were given weekly opportunities to reflect on their leadership abilities and the abilities of their teammates which would prepare them for this form of feedback.

Another important barrier to the effective implementation of this form of feedback is the atmosphere in which the feedback is solicited. For students to feel open and honest about their views, they must feel that they will not be penalized for their unfavourable opinions (SEDL 2000). This issue is addressed by the anonymity of the data collection in this research.

METHODOLOGY

A questionnaire comprising 15 questions was administered to the students in the final week of the semester. The questionnaire was divided between closed-ended and open-ended questions. Questions 1 – 10 were closed-ended and focused on the delivery of the course and its relevance to the career goals of the students. These were measured with the aid of a 5-point Likert scales, ranging from strongly agree to strongly disagree. Question 11 sought to determine how the course could be improved from the students' perspective with an open-ended question. Questions 12 and 13 were focused on the students' leadership and the contribution the course may have made to its improvement. Question 12 required a "yes" or "no" response, while question 13 was open-ended. Questions 14 and 15 were geared towards to students' rating of themselves on a scale of 1 to 5, based on their perception of their Professionalism, Sustainability, HSE Management, Risk Management, and Design before and after the course. These five areas were integrated into the design of the course as common threads throughout the weekly objectives, forming their Project Plans, based on the nine Knowledge Areas of the PMBoK.

The questionnaire was administered via the e-learning open-sourced platform, Moodle (Heap et al 2004), termed MyElearning at the UWI. The students were asked to log into the course online and complete the anonymous questionnaire to allow for openness and honesty. The data was collected and analysed over a period of three academic years (2009/10, 10/11, and 11/12) with a total of 69 of the 95 students enrolled in the course over the period responding to the questionnaire.

The data was statistically analysed using One-Sample t-test and Paired-Sample t-test in SPSS. The results have been presented in the following section.

RESULTS

In Table 1, the results indicate the levels of significance (P value) that have been ascribed to questions 1 through 10. The level of significance used in this study was $p > 0.01$. The results in Table 1 indicate an overall agreement that teaching and learning strategies used in the Course were effective. The students' indicated that the material covered in the course was easily understood and original when compared with the other courses. The students' were in agreement that overall structure and objectives of the Course were clear; however they had a few suggestions as to how the Course could be improved as indicated in their responses to Question 11. Attempts have been made to improve the course. The system of feedback has been improved with an increased use of MyElearning for submission of coursework and feedback outside of the allotted class time. The "best" projects from each cohort are used as examples to the incoming group to give a general idea as to the quality standard expected. This has resulted in a consistent level of improvement in the quality coursework submissions.

Table 1: Showing the results of Questions 1-10 using a One-Sample t-Test

Questions	N	Mean	SD	T	df	P
1. The material covered in the course was easy to understand	69	3.29	0.91	2.648	68	0.01
2. There was too great an overlap with other courses in the Department	69	2.81	1.13	-1.387	68	0.17
3. The overall structure of the course was clear	69	3.23	1.15	1.672	68	0.099
4. The objectives of the course were clear	69	3.35	1.16	2.489	68	0.015
5. The course load for this course was comparable to that of other courses in the Department, taking the credit into account	69	3.25	1.17	1.752	68	0.084
6. The feedback on the marked coursework was relevant to my career objectives	69	3.22	1.07	1.689	68	0.096
7. The material covered in the course was relevant to my career objectives	69	3.42	1.29	2.711	68	0.008
8. I am glad I decided to take this course	69	3.48	1.22	3.256	68	0.002
9. This course should be compulsory for all M.Sc. students in the Department	69	3.48	1.23	3.225	68	0.002
10. This course needs much improvement	69	3.04	0.86	0.418	68	0.678

NB. Test Value = 3

The respondents also indicated that the feedback received from coursework and the materials covered in the Course were relevant to their career objectives. As construction managers and engineers, the educational curriculum should have a direct impact on the professional development of the students. The Course focuses on leadership and team working on 'real world' problems that allow the students to role play making critical decisions that could have long term effect on projects. The Zero Tolerance approach to errors and omissions give the students' the opportunity to change a culture of mediocrity for professional excellence. The 360-Degree feedback allows the students to be aware of their leadership and its impact on the quality of the project. As a result we have seen significant improvements over the 10 week period (Ellis & Petersen 2011).

Question 11- In a few words, how could this course be improved?

The students' responses to this question were varied, however most were in agreement with their viewpoints. Ten of the most frequent responses are: clarity of objectives; increased time; understanding of course; removal of ICE Development Objectives; marks weighting of ICE Development Objectives; speed of feedback by clients;

knowledge of other projects; becoming a member of ICE at the end of course; deeper focus on PMBoK areas; and greater correlation between marking scheme and work load.

The responses indicated a greater concern for one of the assessment strategies used in the course: ICE Development Objectives. Greater focus has been placed in the introduction week as well as continuously throughout the course to ensure clarity and to give guidance to the completion of the document. The responses also indicated a revision in the weighting ascribed to the various forms of assessment, which had 20% assigned for each of the five forms. For greater satisfaction in these areas further revision would be needed. However, it must be noted that this aspect of the course has received favourable reviews from the successful JBM accreditation visit in 2011, and was mentioned in their Annual Report as good practice (JBM 2012: 21):

"The Construction Management programme that actively encourages students to aim for chartered status by using the format of the ICE Personal Development Objectives in the assessment criteria."

As such, this aspect of the course will remain, with a greater level of importance being expressed to the students for their understanding of its overall purpose to their professional development.

Question 12- Do you think you are a better leader as a result of this course?

Of the 50 respondents to this question, 90% indicated "yes" while the remaining 10% indicated "no." This reveals that the course, based on its project-based learning design, was able to develop the leadership of the Postgraduate students. It is said that purpose of construction education is to enhance leadership development while preparing construction professionals to manage and lead project teams that extend the organisations of owners, construction professionals, prime contractors, subcontractors, suppliers and others (Chowdhury 2013). This course has taken a direct approach to this topic of leadership.

Question 13 - If YES to question 12, how? If NO, why not?

A total of 50 students responded to this question. Based on the responses, 10 of the most frequently used phrases are presented. The students indicated that the course aided in their: self awareness; increased knowledge; conflict resolution; communication skills; management skills; level of confidence; ability to delegate effectively; understanding of different personalities; and people skills. The students responding negatively said: the team was strong; the lack of feedback; straying from intended process.

The responses would indicated that most students experienced positive improvements within themselves, while others did not see a marked improvement owing to various reason outside of the control of the course.

Question 14 - How would you rate yourself prior to this course on a scale of 1 to 5 (with 5 being the highest) on the various categories mentioned below?

Question 15 - How would you rate yourself after going through this course?

Table 2: Showing the results of Questions 14 and 15 using a Paired-Sample t-Test

	N	Mean	SD	T	df	P
14a. Professionalism (Before)	50	3.54	0.76	-9.333	49	0.000
15b. Professionalism (After)		4.34	0.52			
14b. Sustainability (Before)	50	2.98	0.80	-11.513	49	0.000
15b. Sustainability (After)		4.12	0.56			
14c. HSE Management (Before)	50	3.16	0.84	-8.359	49	0.000
15c. HSE Management (After)		4.08	0.60			
14d. Risk Management (Before)	50	2.88	0.75	-11.002	49	0.000
15d. Risk Management (After)		4.12	0.59			
14e. Design (Before)	50	2.64	0.90	-8.359	49	0.000
15e. Design (After)		3.56	0.99			

The results in Table 2 have indicated high levels of significant differences between the students' pre and post assessment of the respondents. These significant differences indicate that the course has been very effective in incorporating the five aspects throughout the course. Professionalism has been integrated with the aid of Zero Tolerance to errors and omissions. The ICE Development Objectives has also assisted in this area by giving the students the opportunity to systematically document their professional development to date while highlighting the existing gaps. The students were required to incorporate sustainable concepts focusing in the social, economic and environmental aspects of their projects. This also required the development of a HSE management plan for the respective projects. Risk Management being one of the nine knowledge areas of the PMBoK was a direct requirement for the Project Plan. The teams assigned were an integration of students from the various MSc programmes which comprised construction management and civil engineering students. This allowed for a greater development in Designs given the fact that the key personnel needed for the overall project success through the various phases (initiating to close out) of the project were involved from the project inception.

CONCLUSIONS

The authors developed the Course to meet the needs of the stakeholders of the MSc programs in the Department of Civil & Environmental Engineering at the University of the West Indies. The literature review highlighted the need for feedback in academia at various levels. A module-level feedback assessment was conducted for the course based on the experience of the students. The results of the feedback indicated that the Course was successful at improving the leadership and professional development amongst other key features from the students' personal viewpoint. The results also indicate that the course design and delivery had significantly contributed to this improvement. The accuracy of the results can be improved if the Likert scale was changed from a 5-point to 4-point with the removal of the "neutral" option from

questions 1 -10. This would have allowed for either positive or negative responses only.

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