Introduction

The current TDG project started in July 2013 with a comprehensive literature review on established strategies of promoting active learning and contributing factors of active learning. With a view to the Strategic Plan for 2012/13-2017/18 aiming at enriching the students’ learning experience by encouraging active learning among the students, strategies that are compatible with features of LEARN@POLYU were selected, such as the use of blog to deliver brainstorming questions and Wiki for database development. Other e-learning activities such as Review and Fill-in-the-blank questions, and Resource Section were also developed and delivered on Blackboard with the eLDSS support for content building.

In most cases, construction students acquire knowledge of management subjects through the use of in-class lecture and tutorial which may not be the most effective and efficient way to learn the subject contents. As stipulated in the Strategic Plan for 2012/13-2017/18, one of the University’s core functions rests in Learning and Teaching which aims at enriching the students’ learning experience by encouraging active learning among the students. In particular, most students studying
construction-related subjects have been adapted to hands-on exercise in technology and measurement subjects giving them a perception that the more exercise they do the better their performance. As a result, management subjects filled with mostly theories and abstract terms make it difficult for students to learn in an effective manner. Hence, it is of vital importance to promote active learning in management subjects for construction students to arouse their interest and strive for excellence.

Process of Research

In order to achieve the objectives of the project, a brief literature review was conducted to find out some established strategies of promoting active learning. Further to the release of the new Blackboard learning management system, LEARN@PolyU (理學網) in recent years, both teachers and students should make full use of the device for teaching and learning purposes and the implementation of active learning strategies with the use of LEARN@POLYU should no doubt benefit construction students in learning management subjects.

A database with the use of newspaper clippings which captures the real-life cases related to the topics of project management and procurement, including quality, safety and sub-contracting-related issues in project management, and design-build, private-public-partnership and partnering matters in project procurement was developed with the use of Wikis to improve students’ competence in self-learning by investigating the problems of the real-life cases from the management point of view and make appropriate operational decisions in business organizations accordingly. The information in the database can further be digested and manipulated by students to quote examples in attempting exam questions and group presentations. With the use of the database, students can start by self learning the construction management issues and then share with fellow classmates to induce further discussions for peer learning.

Brainstorming questions which are in the form of open-ended questions were developed with the use of Blogs to test their basic understanding and concepts. Review and Fill-in-the-blanks questions with answers were also provided to correct any misconceptions if detected and students can benefit in a self-learning manner. The brainstorming, and review and fill-in-the-blanks questions are not only parts of the important deliverables for the Project, but also provide a device for students to experience its usefulness to comment on its effectiveness on learning outcomes, which were displayed for every topic in the subject of BRE350 Project Management and Procurement at the implementation stage. Not only can an informal platform be provided for students to exchange ideas among fellow classmates to learn from peers in a more lively manner, but also students’ communication skills and their team spirits can be enhanced in the development of the database and interactions with different parties on the blog.

The Department of Building and Real Estate (BRE) has a competitive track record since its establishment and its ranking is influential in terms of paper publications in top-tier journals. Hence a Resource
Section was created to enable students to make the best use of the research papers in the management field to enrich the subject contents from an international perspective so that the link between research and teaching can be tightened. With the use of the resource section, students can early develop their habits of reading research papers which enables them to understand how new knowledge in the management field can be created, and provides them with insights on how research findings can be put to practice.

Research Methodology

In order to address the issues developed from the project, a comprehensive literature review was conducted to find out some established strategies of promoting active learning including contributing factors of active learning and ways of active learning. These form parts of the skeleton of the questionnaire survey form with a view to investigating the relative importance of different active learning strategies and the impacts of active learning strategies on students’ learning. The survey form was set to examine students’ perception about various learning instructional strategies and to determine which approach aids their learning so that appropriate decision-making regarding teaching and learning management subjects for construction students can be made.

Strategies that are compatible with features of LEARN@POLYU were selected. These include the use of Blogs to deliver brainstorming questions and Wikis for database development. Other e-learning activities such as Review and Fill-in-the-blank questions, and Resource Section were also developed and delivered on Blackboard. Before the full implementation stage was in place, all the e-learning activities were developed between Aug and Dec 2013 with the eLDSS support for content building to prepare for the pilot work in Jan 2014. At the implementation stage, a subject (BRE 350 Project Management and Procurement) offered to undergraduate students was selected for pilot study. The subject was introduced in a way that can help students learn about construction management concepts and apply them to real life situations. Two lecture topics, Safety Management in Construction and Managing Safety Climate for Repair, Maintenance, Minor Alteration, and Addition Projects were selected as Pilot topics for trial run in the pilot work and evaluation. Meetings were held with EDC colleagues regularly to ensure the Project is on the right track. Full implementation of the project was carried out in Nov 2014 after the e-learning activities were fully developed for all the lecture topics in the subject BRE350 for implementation.

In order to investigate the relative importance of different active learning strategies and the impacts of active learning strategies on students’ learning, the perceptual learning experience of students was explored for evaluation purpose. Surveys of similar studies on active learning by construction students in the educational and construction fields, both locally and internationally were reviewed, and statistical techniques of determining the relationship between active learning strategies and
students' learning effectiveness were explored throughout the data analysis stage for making rigorous conclusions. A survey questionnaire was developed and piloted among the PT and FT students in May 2014, and results were recorded after full implementation of the survey in Jan 2015.

Presentation of Results

A total of 263 students registered for the subject of BRE350 Project Management and Procurement and altogether 221 valid questionnaires were received, giving a response rate of 84% which is considered representative for the findings presented and conclusions made. Regarding factors that contribute to effective active learning for construction students, ‘Continuing evaluation and making changes’ and ‘Encouraging feedback from students and teaching staff’ are considered as the most influential factors while ‘Designing new active learning curriculum and defining educational outcomes’ was considered the least important as students may show more concern on intended learning outcomes rather than the curriculum design issues, which should be the concern of the instructors. In addition, construction students, like most students in other study fields, consider ‘PPT lecture material’ as the most effective learning activity probably due to the exam-oriented nature of Hong Kong students, followed by other features created from the Project via the use of Blackboard, namely, ‘Reading uploaded PDF materials in resource section’ and ‘Developing database by uploading relevant materials’, implying the gradual significance of the impacts of reading research papers on the academic performance from the perspective of construction students, and reading case studies from newspaper clippings on enriching the contents of projects and examination answers.

With the active learning strategies developed from the project, most students find it helpful to acquire facts and information. Their problem-solving abilities can be enhanced and the activities grant them an opportunity to pursue the topics in depth. They can also be better prepared for assessment which is conducive to both teaching and learning. However, active learning strategies may not offer them motivation to learn and interest in attending classes, which may be owing to the practical nature of subjects in the construction field which places more emphasis on hard science like measurement and technology; as a result, active learning strategies may not mean a big deal to construction students as long as they have acquired knowledge from traditional modes of teaching by way of lecture and tutorial. Nonetheless, most construction students agree that the active learning strategies delivered for the subject enable them to attain the intended learning outcomes set for the subject, which include ‘Apply knowledge of time, quality, safety and environmental management for construction projects’, ‘Apply and compare alternative procurement systems for all types of construction work’, ‘Communicate with others in a team’ and ‘Identify and propose solutions to problems’. To further determine the relationship between different learning strategies and learning effectiveness, structural equation modeling was applied which shows that ‘Web enhanced instructional strategies’ such as introducing brainstorming questions, the use of Wiki and blogs, ‘Activity-based strategies’ such as having students do in-class role-plays and presentations and ‘Student-centered strategies’ such as group discussion are considered significant with students’ learning effectiveness.
Instead of evaluating the effectiveness of active learning strategies on the actual academic performance of students participating in the e-learning activities, which confers no statistically significant relationship, a focus meeting was held with 5 construction students experiencing the use of active learning strategies in order to evaluate its impact on students' learning. All the respondents agree that the activities are all relevant and helpful, in which Brainstorming questions of the active learning activities are regarded as the most impactful in terms of learning experience. However, there are limitations on the effectiveness of active learning strategies on students' learning. Two students expressed concern on the development of the database which is hindered by the habitual and selfish characters of students. The allocation of marks to the e-learning activities is not much in the overall subject mark, regardless of the weightings of other coursework in the subject, which makes students less motivated to partake in the activities as "no grading, no participation". As a whole, all participants believed that both the active learning strategies and the traditional modes of teaching like lecture and tutorial should coexist for proper dissemination of information regarding the subject taught. The active learning strategies developed from the Project not only confer students complete understanding of the subject, but also provide them with an introduction to the topics and help in drawing reasonable conclusions for the entire subject.

The Project was successfully carried out to develop active learning strategies for construction students with the use of the e-learning platform, LEARN@PolyU. Although the strategies are not new to the whole education system, effort was made to maximize their potentials by hosting on a web-based course management platform, the Blackboard. The findings indicate that students spend more time on materials prepared by the instructor by means of PPT in learning the topics. This is born out of the belief that only the materials used for lecture will be relevant to examination questions. This could mean that students are more interested in passing exams rather than having deep understanding about the topic being taught. The Project reveals that students do not like wasting time acquiring knowledge in the areas not directly linked with the expected examinations. Despite the effectiveness of these activities, not all the students participated on the online tasks related to these items. This could be attributed to the result of students' attitudes towards non-graded activities as well as laziness of their nature. Although brainstorming questions provide a significant impact on students' learning experience, the strategy was not considered highly effective as long as it does not relate to examination. Moreover, unlike brainstorming questions, the review and fill-in-the-blank questions do not have direct answers from the lecture material, which require more thinking. Students therefore found it confusing due to the lack of model answers, which meets the assertion that students in Hong Kong place significant emphasis on model answers. This is echoed by the result of the focus group interview which revealed that students embrace surface learning approach that focuses on passing
examinations and having good grade. Also, students commit more times to graded tasks that count as part of their continuous assessment. In an attempt to enhance students' learning within the built environment, instructors should adopt active learning strategy which seems motivating and interested to the students.

Considering the impact of the adopted strategies on students' learning, it was found that 'opportunity to pursue the topics in depth' ranked highest and the second ranked impact was 'enhanced problem-solving abilities' while the least ranked was 'improved self-esteem'. This shows the success of the Project to offer learning opportunities to students to reach higher levels of knowledge while efforts should further be made on nurturing team-building and self-confidence of the students. This may include designing a variety of assessment tasks for students to show their talents and abilities. Another focus group meeting can also be held with other teaching staff, if any, to improve the delivery of the subject with the e-learning approach. Rather than measuring what students do, it is equally important to measure students' perception of effectiveness of instructional strategies adopted by the teachers. Results of the relationship between different learning strategies and learning effectiveness reveal that student learning effectiveness depends on combination of strategies. Thus, it is believed that learning effectiveness cannot be achieved by sticking to a particular instructional strategy; but a blended learning approach is desirable to bring about effectiveness. Findings in this Project can inform institution administrators to channel the available resources to promote strategies with higher effectiveness with regards to students' learning. Also, instructors in higher educational institutions can adapt their teaching styles to strategies that are more effective. The methodology as advocated in this Project can further be replicated in other schools or different countries other than Hong Kong so that international comparisons can be made and conducive conclusions drawn.

Advancement in technology has been one of the major drivers of change in the learning and teaching approaches. This has posed a new challenge in higher education and built environment disciplines are not exempted. This Project kicks a good start by introducing active learning strategies via the use of Blogs and Wikis with the e-learning platform, the Blackboard in teaching a construction management and procurement subject. Students' perceptions are encouraging and welcoming towards the embedment of e-learning methods in delivering the learning outcomes of construction management subjects. More efforts can be exerted on investigating the impacts of the active learning strategies on the actual academic performance of construction students in a more rigorous manner and exploring the possibility of adopting similar active learning strategies to other construction-related subjects, including the final year project subject so that construction students can develop their learning skills in a cross-discipline manner.