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Assessment of Video Based E-Learning in a Construction Measurement Course

Johnny K.W. Wong[1], Olugbenga Timo Oladinrin[1*], Christabel M.F. Ho[1], Eric Guilbert[2], Roy C.Y. Kam[3]

[1]Department of Building and Real Estate, Hong Kong Polytechnic University, Hong Kong

[2]Department of Geomatics, Laval University, Canada

[3]Education Development Center, Hong Kong Polytechnic University, Hong Kong

[*]**Corresponding author:** Olugbenga Timo Oladinrin, Department of Building and Real Estate, Hong Kong Polytechnic University, Hong Kong. Tel: +85268452582; Fax: +85227645131; Email: timothy.oladinrin@connect.polyu.hk

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Abstract

E-learning has been touted as a new phenomenon and formidable frontier of education, offering tremendous benefits to teachers, learners and the education system at large. However, despite the adoption of e-learning in many educational institutions worldwide, with a view to enhancing teaching and learning experience, delivery of construction measurement courses has been limited to traditional lecture approach and the use of little technology such as PowerPoint. Therefore, this study investigates learners' satisfaction, benefits, and the usefulness of e-learning approach, relative to instruction videos. A total of 76 undergraduate construction students were surveyed using a closed and open-ended questionnaire in one of the universities in Hong Kong. The results showed that students were satisfied with design and content of the instruction videos. Students also considered e-learning approach useful because it allows them to control their pace, time and location for learning. Learners prefer blended learning i.e. combination of e-learning and traditional face-to-face method at 41% and 59% respectively, they perceive that blended learning has more significant benefits in delivering measurement course. The results of this study should assist educators in structuring blended learning approach.

Keywords: E-Learning; Construction; Measurement; Face-to-face; Hong Kong

Introduction

Education is changing rapidly by the keenness of so-called 'net generation' to use technology for learning. Hence, Attwell (2007) [1] opined that e-learning is central to learning in the future. Advancement in information and communication technology has generated significant transformation to e-learning. The transformation is enhanced by the introduction of technical support in form of learning management systems (such as Blackboard, Sakai, Moodle, Angel, and Desire2Learn etc.), which have contributed to effective learning and teaching in higher education institutions [2,3]. Given the tremendous benefits offer by e-learning [4,5], the adoption of e-learning as a global phenomenon, has been discussed in previous studies [6,7,8]. Therefore, it is important to embrace the new opportunities provided by emerging technologies for teaching and learning. In an attempt to extend the dominant traditional method of teaching and learning, several approaches have been employed. For instance, the use of internet for online teaching and learning that allow for distant learning, is becoming popular)[9]. Some educators are creating instruction video contents as adjuncts to classroom instructions [10]. Another common practice is the uploading of lecture materials on the learning management system (such as Blackboard) so that students can access the materials outside the classroom. Instruction video, assignments and quizzes as well as other relevant activities that can aid students learning and understanding can be uploaded on Blackboard. The use of instruction video is considered relevant and useful for learning construction measurement course because, in traditional teaching method, the quantities of materials are measured directly from design drawings and students that lack prior knowledge of construction technology may find it difficult to comprehend. Instruction video will help display the building

components in a three-dimensional view.

However, due to the challenges inherent in delivering an interactive construction measurement course [11], limited number of technology features are being used in the delivery of measurement module [12]. Even though e-learning application at universities has become very popular, little is known about students' perceptions regarding e-learning approach in construction measurement course. In order to create a professional knowledge foundation for quantifying construction works, construction measurement course is crucial for developing students' interest. However, for learning to be effective, certain conditions are required. Mladenovic et al. (2016) [13] revealed that students' preconceptions are imperative to learning process, and disregarding such preconceptions can lead to creation of knowledge gaps and ineffective learning. Also, beyond curricular content, innovative pedagogical approaches are contributory to enhancing student learning [14]. Thus, the aim of this study is to obtain a general view about students' specific perceptions of video-based e-learning contents in relation to teaching and learning construction measurement course. By means of descriptive analyses, the usefulness of the approach, students' satisfaction and benefits of e-learning, as well as students' preferred mode of delivering measurement course, were assessed in order to obtain a clear picture of e-learning application in this regard.

Related Works

Advancement in technology has brought significant changes in the way can enhance students' preparedness for a dynamic and complex world. A good number of education institutions have adopted e-learning [3], using different forms of strategies and processes [15]. E-learning could take the form of online/distance learning or the use of computer-aided approach for teaching and learning. Technological advancement has brought about evolvement of technical facilities such as digital video, which has made learning more interactive. Video had long been encouraged as powerful adjunct to classroom instruction [10]. Past study revealed that video-based instruction strategy is as effective as face-to-face instruction [16].

The traditional method of teaching construction measurement course involving the lecturer trying to; expound on the construction technology on a drawing, explain the prescriptive set of rules in the Standard Method of Measurement (SMM) and, show students the taking-off process to quantifying construction work, with little or no technology involved, may not fully support students' learning in this era [12]. Previous researchers have questioned the efficacy of traditional teaching approach [17,18]. Besides, teaching construction measurement is challenging because it requires students' understanding of; construction technology, sets of building drawings, and measurement rules, without which students may not be able to measure the quantity of materials needed effectively [19]. Construction measurement involves a lot of arithmetic calculation and students need to build necessary math skills in the context of construction management [20]. Therefore, instructors need to deliver both the technical knowledge and measurement process at the same time in order to facilitate students' skill in measuring and describing construction works. In a recent study by Sunindijo (2016) [21], it was revealed that the practicality of lecture content aids students' satisfaction because construction is perceived as a very hands-on industry. The students confirmed that they appreciated the use of real projects or cases as examples to demonstrate how theory can be applied in practice and lectures [21]. This implies that the use of instruction video is important to enhance visualization of drawing and construction technology.

Research on video-supported e-learning have shown that both educators and students benefit tremendously from instruction video [10,16]. Some of the benefits include; flexibility in time and location, cost effectiveness, fosters self-paced learning, and better and clearer illustration of points. Some researchers advocated for a mixture of face-to-face and e-learning approach, a term commonly refer to as blended learning or mixed mode or flexible learning [22,23], based on the argument that e-learning alone cannot satisfy diverse students' needs. Blended learning has become popular in many higher education institutions, involving combination of face-to-face with other computer aided approach to enhance learning [24]. However, understanding students' perception about a particular e-learning approach, enhances the creation of appropriate e-learning environments for teaching and learning. Liaw (2008) [25] posited that the perceived satisfaction and perceived usefulness concerning e-learning approach will positively affect learners' disposition towards e-learning usage. Continuous use of technology-based e-learning depends on students' initial perceived satisfaction (Sun et al., 2008) [26]. Hence, the students were asked about their opinion regarding the perceived usefulness and satisfaction as well as benefits derived from video based e-learning approach.

Research Methods

The participants of this study consisted of third-year undergraduate students enrolled in construction measurement course, at a university in Hong Kong. Prior to data collection to obtain feedback, the students were engaged in three different settings including: traditional face-to-face classroom setting only; the use of software for measuring building components (such as BIM) only; and the use of instructional video only. This paper focuses on the assessment of video-based e-learning contents which is identical to the face-to-face lectures. The videos described the quantity taking-off measurement of important construction trades including; concrete, reinforcement and formwork. Students were used for this study because they are the best source of feedback, and they are the ones who will benefit the most from effective teaching methods. This kind of feedback can be acquired via

questionnaire or interviews. However, questionnaire was used in this study for the purpose of anonymity such that students can freely express their opinions without prejudice. The questionnaire consisted of both open-ended questions for clarification as well as closed-ended questions structured in five-point Likert-type scales.

Some of the questions were adopted from previous studies on students' perception of use of e-learning and blended learning [23,27]. The questionnaire was then subjected to a number of iterations to ensure accuracy and clarity of language. The survey in its final form had a total of 13 choice questions and 2 open-ended questions. The questionnaires were administered to all the students that attended the final lecture of the 2015/2016 session and were collected in the class. Past studies revealed that single session lecture is more effective in collecting feedback data regarding computer-aided learning [16,28]. Respondents were properly guided on how to complete the questionnaires accurately. The data was analyzed using Statistical Package for Social Science (SPSS) software 21. This involved calculation of frequency distribution, mean scores and spearman correlation. The frequency distribution was used to ascertain the gender, students' prior e-learning experience and other related information. Mean score analysis was used to rank variables associated with Likert scale entry, while correlation analysis was used to quantify the association between variables for perceived e-learning usefulness and students' satisfaction.

Results and Discussion

A total of 76 students participated in the survey out of which 72% were male and 28% were female. The percentage of gender distribution is not surprising as built environment related courses have always been male-dominated [29]. The e-learning experience is presented in Table 1. Out of 76 participants, 28% have e-learning experience prior to this study, while 72% have no experience of e-learning. This shows that e-learning is a potential assisted learning tool for undergraduate students, which could imply that e-learning is still a potential market for universities [25].

Choice	Frequency	Percent	Valid Percent
Yes	21	27.6	27.6
No	55	72.4	72.4
Total	76	100.0	100.0

Table 1: Frequency distribution of students' e-learning experience.

The students were asked to rank, based on their perceptions, the usefulness of the instruction video, judging from the video content, clarity and potential for future use. Table 2 shows the mean and standard deviation for each of the items, measuring the usefulness of instruction video. The findings show that all the respondents either agree or strongly agree with the usefulness of the video. This also implies that almost all the students rated the video content component as very clear, valuable to the achievement of learning outcomes and they therefore recommended its use in future course. Thus, technically, the instruction video is well designed by the instructors. Also, the involvement and effort of IT expert in recording and editing the video added significant value to its quality as Marchionini (2003) [10] suggested that, crafting a useful video content requires significant expertise. Another factor that could influence the perceived usefulness of e-learning materials is 'environmental characteristics' [23]. However, this factor is not considered in this study as the authors assume that 'environmental characteristics' is favourable to the students. Video demonstration also facilitates the learning outcomes due to the fact that students not only have capacity to view a building and details in the virtual world to develop a greater understanding of the properties of single components, but video can also provide them with a better idea of how the buildings systems fit together as a whole, in coherent with Hodgson et al. (2010) [19].

Usefulness of instructional video	Mean	Std. Deviation	Ranking
The video is in a clear and understandable manner	4.29	0.629	1
The content of the video is well-designed and well-structured	4.17	0.641	2
The demonstrated e-learning video facilitates the achievement of learning outcomes of BRE345	4.09	0.786	3
I recommend the re-use of the demonstration video for e-learning resources in future BRE345 subject, and/or similar subject in other course	4.04	0.824	4

Table 2: Ranking of perceived usefulness of demonstrated e-learning instructional video.

The perceived level of satisfaction with the instruction video addressed the extent to which the students are pleased with the use of the video for e-learning purpose. Table 3 shows the perceived satisfaction of students with e-learning video. The highest ranked item is concerning students' learning pace. Arguably, students do not learn at the same pace and it might be difficult for educators or instructors to satisfy every individual pace. With the aid of instructional video, not only will the learners be able to easily control their learning pace, but they will also have a sense of control over their learning process [23]. The students were also very satisfied with the flexibility offered by instruction video in that it allows students to decide on where and when to learn which can improve the understanding of the subject matter. Generally, students perceive e-learning as an approach which allows them to study at their own pace, in their own time and encourage them to become more motivated, knowledgeable and skillful in their learning [30]. Since the students indicated that the lecture contents

as contained in the video are useful, it was not surprising that they are equally satisfied with the approach. Well-structured and well-organized lecture contents are important factor that influence students' satisfaction (Sunindijo, 2016) [21].

Level of satisfaction with e-learning	Mean	Std. Deviation	Ranking
It allows me to decide on the pace of learning	4.28	0.704	1
It allows me to decide when and where to learn the subject materials	4.21	0.805	2
The e-learning video could help me develop a wide range of skills and necessary knowledge of building measurement	3.99	0.739	3
The e-learning video could make me become more motivated and more involved in the learning process	3.76	0.862	4

Table 3: Ranking of perceived level of satisfaction with e-learning.

Table 4 presents the results of the perceived benefits of e-learning based on students' opinions. The topmost ranked benefit is "convenience of not having to come to campus as often." A plausible explanation for this highest ranked item is that, it frees up students' time of preparing for lecture (including travelling time) and lecture period, which could be judiciously used for more concentration on the subject or for another purpose. Although this could be a good advantage for industrious students, it may negatively affect the learning of lazy ones. The students also felt that the e-learning approach helps their understanding of measurement concept and makes the concept more interesting. It can be inferred from the results that students would greatly benefit from the use of instruction video for e-learning approach in future course delivery. Although this study is acknowledged to be those of a small sample of students, the findings support the authors' hopes and expectations, and encourage further developments in this direction.

Benefits	Mean	Std. Deviation	Ranking
Convenience of not having to come to campus as often	4.13	0.772	1
Enhance my understanding of measurement concept	3.99	0.721	2
Make the measurement concepts more interesting	3.86	0.919	3
Improve my QS professional competence	3.75	0.881	4
Opportunity to pursue the measurement technique in depth	3.70	0.880	5

Table 4: Ranking of perceived benefits of adopting e-learning approach.

The students were asked whether they would prefer e-learning to face-to-face lecture, their responses were as follows: 18% wanted only e-learning; 16% wanted only face-to-face lectures, 66% wanted combination of e-learning and face-to-face. The participants were also asked to indicate the preferred percentage for face-to-face and e-learning, but their views were mixed. Therefore, average opinions of students were computed, and the results show that the students preferred 59% of lecture delivery to be concentrated on face-to-face approach while 41% should be on e-learning approach. This reveals that the acquisition of measurement skills in blended learning environments requires more of face-to-face lecture than e-learning approach. This could mean that students prefer asking questions about the instruction materials and getting answers immediately during face-to-face lecture instead of sequentially going through the instruction video to find an answer as in the case of e-learning approach. This is consistent with a study by Hadjerrouit (2008) [23] which compared blended learning approach in informatics and mathematics education. Based on the comments received via open-ended questions, majority of the students prefer blended learning because it allows good communication between lecturer and students, which coheres with findings by Poon (2012) [30].

The Spearman correlation coefficients among the variables for usefulness, and learners' perceived satisfaction of instruction video were presented in Table 5. The bivariate relationships indicate that all the variables were significantly correlated with each other. Of all the variables, "achievement of learning outcome for the measurement course" has the strongest association with development of skills and necessary knowledge of building measurement by the students. This implies that, for higher satisfaction, e-learning materials (such as instruction video) should be prepared in line with the predetermined learning outcomes for the course. Sun et al. (2008) [26] examined the critical factors influencing learner satisfaction towards a successful e-learning and found that course quality (including course design and teaching materials) has the strongest association with students' satisfaction.

Usefulness/Satisfaction		The e-learning video could help me develop a wide range of skills and necessary knowledge of building measurement	The e-learning video could make me becoming more motivated and more involved in the learning process	It allows me to decide when and where to learn the subject materials	It allows me to decide on the pace of learning
The content of the video is well-designed and well-structured	Correlation Coefficient	0.558**	0.544**	0.449**	0.553**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
The video is in a clear and understandable manner	Correlation Coefficient	0.521**	0.468**	0.474**	0.566**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
I recommend the re-use of the demonstration video for e-learning resources in future BRE345 subject, and/or similar subject in other course	Correlation Coefficient	0.586**	0.487**	0.453**	0.486**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
The demonstrated e-Learning video facilitates the achievement of learning outcomes of BRE345	Correlation Coefficient	0.666**	0.593**	0.530**	0.641**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 5: Correlation matrix.

Conclusion

This paper discusses the use of video based e-learning as an approach to enhance students' learning experience and engagement in construction measurement study. Students' perceptions of instruction video with regards to its usefulness, benefits and students' satisfaction were assessed. From the evaluations of students' perceptions, using questionnaire survey, a number of key findings can be drawn from this study. Firstly, video based e-learning approach is useful and beneficial for delivering construction measurement course. This implies that a well-designed instruction video could be a key success factor for e-learning approach. Secondly, well-designed e-learning resources alone may not provide sufficient information needed by the students to acquire necessary skills concerning construction measurement. In other words, e-learning cannot fully replace face-to-face lecture as human dialogue is required to; provide help for students with varying learning preferences, explain difficult aspect, and provide answers to questions raised by students. Hence, blended learning is recommended for the delivery of construction measurement course.

Blended learning is particularly useful for construction measurement education because it provides a useful platform for students-lecturer communication and fast response to questions which is vital for this type of professional course. Mixture of e-learning and face-to-face lecture will enable better simulation of real-world construction project conditions. It can also reinforce and enhance the fundamental measurement and estimating concepts being taught in traditional lectures and tutorials in an interoperable environment. The use of e-learning approach is a main direction for teaching construction measurement and estimating courses as the use of blended learning can reduce lecturer-student contact time in particular for the part time students who have difficulties in attending evening classes due to work engagement. This study offered proportion of teaching to be done by e-learning and traditional lecture for the achievement of learning outcomes. By implication, pure online or distant learning arrangement may not be suitable for construction measurement course currently.

As common with most research, this study has some limitations. First, the scope of the study was strictly limited to construction measurement course. Care must be taking in applying the results to other courses as some courses may be better-suited for e-learning than others. Second, cross-sectional approach was used for data collection in a single class session. Longitudinal study might give different results. Third, undergraduate students in a university in Hong Kong were used in this study; the results might have mirrored the specific situation in that university. Hence, the findings should be interpreted and generalized with care in an attempt to meet the needs of other higher institutions. Lastly, the results presented are based on student perception rather than student performance. Further study could consider teaching the course to two different sets of students, one using the video and the other without using the video so that student learning in each group could then be assessed and compared. With regards to teaching construction measurement course, the results of this study should be interpreted in the light of being just at the commencement of a transition process. However, this study gives some suggestions to educators regarding the learners' perceptions towards the adoption of e-learning approach.

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