Journal of Architecture and Planning , Vol. 30(1) , pp. 125-143, Riyath (2018/1439H)

Evaluating the Experience of Developing and Using Building Construction E-Courses in Architectural Education

Mohammed Nabil Ghonim

Associate Professor
Department of Architecture and Building Science, King Saud University
Department of Architectural Engineering, Cairo University

mohammed_ghonim@yahoo.com

(Received 31/5/2016; accepted for publication 3/11/2016.)

Abstract: Despite its relative spread recently, e-learning applications are as yet limited in architectural education, and few experiences about this topic have been documented. This study attempts to participate in filling this gap and in revealing the impact of e-learning on architectural education by evaluating an experience of developing and using building construction e-courses. The research applied an analytical methodology, and it has been divided into four parts. The first part reviews the theoretical background related to e-learning, the second part analyzes the standards and qualities of e-learning and e-courses, the third part documents the case study which comprises two building construction e-courses, and finally, the fourth part presents a comprehensive evaluation of the experience and demonstrates a SWOT analysis for its positives and negatives

Keywords: Architectural Education, Building Construction, E-courses, Blended Learning, E-learning

1. Introduction

Architectural education is a special type of education through which creativity is stimulated and valued, logic is encouraged and respected, and art and science are engaged; and since humaities and engineering are studied, it is a discipline of contradiction yet integration. Indeed, it has its particularities. Architectural programs include versatile theoretical, practical, and studio coures. Through these courses, knowledge is transferred and many skills are developed, including intellectual, personal, and professional competencies. Building construction courses represent the link between architecture and engineering; they teach students how to realize architectural ideas in the form of buildings. Through adopting particular pedagogical methodologies, such courses acquaint students with the knowledge and experience related to building construction systems, materials, and processes to engage them with the real world.

Although one and a half decades have passed since the emergence of e-learning, its applications in architectural education remain limited. The traditional face-to-face learning approach dominates the common practice of education in architecture. At present, online architectural clases are avaiable, and are beginning to substitute a number of traditional classes. However, few experiences in e-learning in architectural education have been documented. Intensive research is needed to determine and define the best practices for e-learning and to shed light on its impact on architectural education. Before adopting e-learning in architectural education, certain questions need to be addressed: Can students learn architecture through virtual classes? Do all architectural subjects need face-to-face learning environments? Do all e-learning environments hinder face-to-face learning? What are

the positive and negative impacts of e-learning in architectural education? The present work attempts to answer these questions and participates in revealing the impact of e-learning on architectural education.

This study aims at evaluating the experience of developing and using building construction e-courses in architectural education, through demonstrating a case study of two e-courses at the College of Architecture and Planning (CAP) at King Saud University (KSU), Saudi Arabia. To achieve this aim, an analytical comparative methodology is applied, and the research is divided into four consecutive parts. The first part reviews the theoretical background and then provides an overview that explains the concepts, approaches, and types of e-learning. The second part analyses the standards and qualities of instructional design, e-courses, and e-learning, which had been considered in developing the e-courses that are the subject of the case study and used as a reference to evaluate them. The third part documents the case study, which comprises two building construction e-courses; it describes the preparation phase, the methodology of developing the courses, and samples of their product. The fourth part includes the evaluation of the e-courses from the instructor-developer perspective as well as the students' perceptions, and finally, it analyses and concludes the strengths, weaknesses, opportunities, and threats related to this experience.

2. Understanding E-Learning

The term 'e-learning' refers to a computer-based educational system or tool that allows students to learn anywhere and at any time; it emerged in education in 2002 and became an umbrella term that covers 'online learning', 'web-based instruction', 'networked learning', and 'computer-assisted learning' (Littlejohn & Pegler, 2007).

2.1 Approaches of E-Learning

Three approaches are adopted in e-learning: 'wholly online e-learning', 'blended e-learning', and 'adjunct e-learning'. Wholly online e-learning occurs entirely in virtual classrooms: there is no traditional classroom; all learning activities, communications, assignment submissions, and feedbacks occur online (Rice, Campbell, & Mousley, 2007). Blended e-learning mixes traditional learning with online learning; it adopts face-to-face classrooms combined with computer-mediated e-learning (Singh, 2003; Strauss, 2012). Adjunct e-learning employs e-learning as an assistant and complementary part to the traditional classroom, providing relative independence to the students (Al-Gahtani, 2011). However, blended e-learning is considered the most advantageous approach. It is likely to emerge as the predominant learning model in the future (Tayebinik & Puteh, 2013).

2.2 Types of e-learning

E-learning may adopt 'synchronous' and/or 'asynchronous' activities. The benefits of both types are different as they suit different learning conditions, as shown in (Table 1) which demonstrates the characteristics of the two types and summarizes when, why, and how to use them. The synchronous and asynchronous e-learning types complement each other, and their combination efficiently supports several ways of learning (Hrastinski, 2008). Synchronous e-learning allows live communication between the instructor and the students; all of them are logged in and communicate simultaneously in a

Table 1. Asynchronous vs. synchronous e-learning (Adapted from Hrastinski, 2008).

	Synchronous E-Learning	Asynchronous E-Learning
When?	When discussing less complex issues, and When group meetings are expected, and there is need to exchange ideas and plan tasks.	When reflecting on complex issues, and when group meetings are not required or cannot be scheduled.
Why?	Because students become more committed and quick responses are expected.	Because students need more time to response, and the instructor does not expect immediate answers.
How?	Use synchronous means such as video-conferencing, instant messaging and chat.	Use asynchronous means such as e-mails, discussion forums, and blogs.

social environment, which is commonly supported by media, such as videoconferencing and online chat (Littlejohn & Pegler, 2007). Asynchronous e-learning is not live, the instructor and the students log in and access the e-learning content at different times. Thus, it is more flexible and self-paced as it can occur freely at any time, and the communication is commonly supported through emails, messages, and/or discussion forums (Littlejohn & Pegler, 2007).

2.3 Components of e-learning

Through tracking this topic in e-learning literature (FAO, 2011; Fee, 2009; Iskander, 2008; Keengwe, 2015; Veeramani, 2010), the research concludes that e-learning systems include different components: 'e-courses', 'learning management systems', 'e-tutors', 'e-learners, 'digital infra-structure', and 'technical suport'. The relationships between the six components of e-learning systems are shown in (Figure 1). (1) E-courses include the learning resources, interactive e-lessons, and electronic simulations. (2) Learning Management Systems (LMSs) are web-based software packages that represent the virtual environment in which the students engage with the content, peers, and instructor. LMSs are used to administer online courses and provide the instruction media essential for Internet-based education. (3) E-tutors represent the human component of e-learning, they provide educational support and assistance to the students through the e-learning experience. (4) E-learners are the students who are supposedly qualified, motivaed, and capable of receiving their learning electronically. (5) The digital infrastructure includes local network servers and high-speed internet connectivity. (6) Technical support is provided to solve the technical problems that both the students and instructors face, and to ensure that both are qualified to use the e-learning facilities.

2.4 Advantages and disadvantages of e-learning

Many scholars have studied the advantages and disadvantages of e-learning (Al-Shorbaji et al., 2015; Arkorful & Abaidoo, 2014; FAO, 2011; Kruse, 2002; Sedawi, 2013; Tayebinik & Puteh, 2012). The most common ones are discussed below in comparison with traditional face-t face learning. In this regard, blended learning is considered a better solution.

Advantages. Flexibility in time and place; e-learning has less time and place regulations, as the learners decide when and where to study. Adaptability; this method considers the differenes among the students. Asynchronous e-learning allows self-pacing and permits each student to study at his/her own pace, which relatively decreases the psychological stresses in studying. Consistency; the same content can be delivered with the same quality, especially when there is a large volume of information. Cost efficiency; although developing e-learning is more expensive than preparing traditional classroom materials, the overall costs for e-learning are considerably

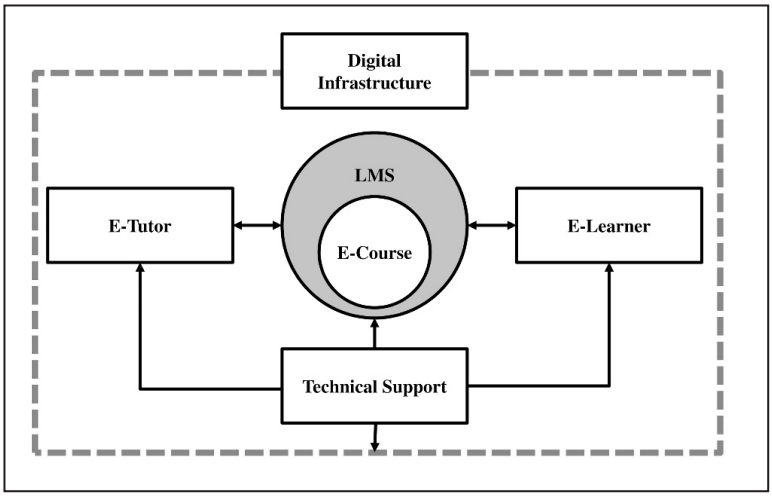


Figure 1. Components of e-learning systems (Source: Author).

lower compared to traditional learning, taking into consideration the costs of instructors' time, students' travel expenses, and job hours that may be lost to attend classroom sessions.

Disadvantages. Social issues; the most obvious criticism of e-learning is the absence of social and personal interactions between the students and instructors. Moreover, the issues of social isolation and remoteness become critical in the cases where wholly online learning is adopted. Limited appropriateness; e-learning cannot be employed in all types of education, as it is more appropriate for the social sciences but less so for technical and practical education. The difficulty of control; traditional face-to-face learning is much easier than e-learning and needs less planning. In e-learning, it is difficult to control fully the examination and assessment processes. Technology issues; as it relies to a high extent on technology, poor internet connection, and unexpected operation problems are the main reasons for interruption in e-learning.

2.5 E-learning in architectural education

E-learning in architectural education is spreading. Currently, there are National Architectural Accrediting Board (NAAB) accredited programs offered partially or fully online (NAAB, n.d.). In addition, a number of architecture classes are offered online from reputed universities across the globe, such as Harvard, MIT, and the University of Hong Kong. However, other classes are more time regulated and include a set lesson plan, assignments, and quizzes (Watkins, 2015). The Canadian Athabasca University, in collaboration with the Royal Architectural Institute of Canada (RAIC), is offering a full online architecture program. Boston Architectural College offers an online master's degree in architecture.

Nonetheless, the barriers and difficulties related to e-learning in architectural education persist. Mizban (2006) studied the potentials and limitations of e-learning in architectural education and concluded that most of the studied samples faced network problems, system complications, software incompatibility, and bandwidth shortage. Other difficulties were due to students' lack of previous experience in collaboration and teamwork, and in certain cases, lack of motivation and assistance. A later study showed that almost the same problems plague e-learning in architecture education (Sidawi et al., 2015).

Architectural programs include a number of theoretical, practical and studio courses, through which knowledge is transferred and many skills, including cognitive, interpersonal, and psychomotor ones, are developed. The current e-learning systems commonly target developing knowledge and cognitive skills. However, interpersonal and communication skills can be developed through specific methods and tools, including presentations and negotiations. E-learning also can support teaching certain psychomotor skills required for architects as it may include videos teaching drawing, rendering, and model making. However, most of the psychomotor skills are best learned by doing and cannot be learned totally through a computer; supportive studios, labs, and workshops are necessary environments for learning (FAO, 2011).

Undoubtedly, architectural education has its particularities that distinguish it from other types of education. It is a type of education that promotes learning in a very social environment. It does not only acquaint the students with knowledge and skills but also provides them with the opportunity to acquire ethics, principles, values, and norms needed to perform their role as architects who are aware of their social responsibilities. The main concern about e-learning in architectural education is that it may affect this aspect negatively because one of its disadvantages is the relative isolation of the learner; however, e-learning may also promote socialization in a global manner. Consequently, blended e-learning may present a satisfactory compromise that respects both the particularities of architectural education and the developments of educational technologies.

2.6 E-learning in KSU

KSU seeks to increase the quality of e-learning and provide the electronic environment that supports the performance of the faculty members and students through the Deanship of E-Learning and Distance Learning (DED). DED provides facilities and services, including hardware tools such as e-podiums, interactive boards, media projectors, kiosk services, and video conference equipment. In addition, they offer software tools for e-course development, training programs on virtual and smart classroom and e-course development, as well as management and support for all electronic educational facilities (DED, 2015).

3. Standards and Qualities of E-Learning and E-Courses

Standards and qualities guide the applications of e-learning and e-courses in education. E-learning may be considered more critical than traditional face-to-face learning because e-courses must be rationally designed for learning and engagement, otherwise students might lose focus. (Pollock, 2013).

3.1 Standards of e-learning

The International Association for K-12 online learning investigated and analyzed a set of e-learning standards (iNACOL, 2011) that are generic and could be considered valid for higher education as well. These standards are related to the following aspects of e-learning. First, instructional design is a process that aims at linking the learning outcomes, course activities, teaching strategies, and use of media and technology. It requires a collaborative effort between instructional designers and course instructors to deliver a comprehensive instructional design. Second, e-course development ensures that the e-course offers multiple ways of engaging the students with learning experiences that promote their mastery of content. The content is expected to be well-organized, easily accessible, linguistically correct, graphically attractive, and including sufficient activities and resources. Third, student performance assessment; e-learning incorporates multiple strategies and activities to assess students, monitor their progress, and evaluate their achievement and development. Fourth, technological aspects. E-learning benefits from the advantages of the current educational technologies and tools. It has a user-friendly interface and meets the standards of accessibility and interoperability. Fifth, support and evaluation; both instructors and students are expected to be prepared to use online learning facilities and are provided with support during the e-course. The quality of e-learning, as well as e-courses, is expected to be evaluated regularly to check effectiveness and relevance to the current time.

3.2 Analyze, Design, Develop, Implement, and Evaluate (ADDIE): Standard for instructional design

In instructional design, instructional systems are designed for traditional or electronic learning. Many models were introduced for this process, however, ADDIE remains the most dominant and common (Rothwell & Kazanas, 2016). It is the closest model to a standard for professionally developed online learning programs, and it is considered as the core of many other models proposed for instructional design (Thomas, 2010). ADDIE shows the iterative nature of instructional design (Figure 2).

The following is a summary of the activities of each phase of the ADDIE model (Branch, 2009; Goodman, 2009; McGriff, 2000). The analysis phase is the foundation for all other phases. In this phase, the instructors determine the goals and

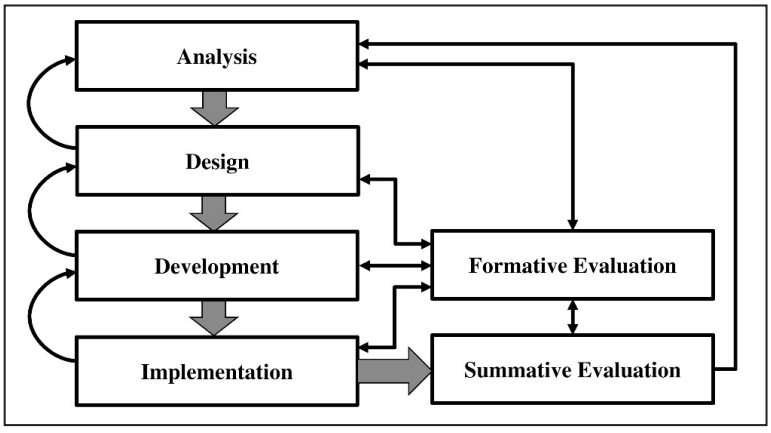


Figure 2. ADDIE Model (Adapted from McGriff, 2000).

objectives, specify and understand the intended audiences (students), analyze their characteristics, and investigate the delivery options and available instructional technologies. The output of this phase will be the input for the next phase. The design phase focuses on how to approach and achieve the instructional goals and objectives determined in the analysis phase. The goal is to plan and organize all the instructional and learning activities, and then select the media and technologies that will be used to deliver the e-course. The development phase builds on both the analysis and design phases, and it may be considered as the core of the process by which e-content is generated and developed. Its purpose is to prepare all the materials, whether hardware or software, to be used for the instruction. The implementation phase refers to the actual delivery of the e-course content. It includes the preparation process for both the instructors and learners. Evaluation activities are usually linked to this process to investigate the effectiveness and efficiency of delivering the course content and ensure successful knowledge transfer. Evaluation is performed throughout the instructional design process within and after each phase, and at the end of the process. The evaluation activities are divided into two categories: formative and summative. Formative evaluation is performed within and after each phase, whereas summative evaluation is conducted after implementing the final version of the e-course.

3.3 Qualities of e-course development

After investigating several resources, the current study did not find unified standards for developing e-courses. However, many scholars and institutions (Chao, 2006; iNACOL, 2011; Pappas, 2015; Wright, 2007) have tackled this topic and introduced quality guidelines and checklists based on their own experiences to assist e-course developers.

These guidelines are: (1) Information accessibility; students can find and access information easily and quickly. The side margins should identify where the student is in the course, as well as help in instructions for accessing information. (2) E-course content; topics covered in the course are expected to be relevant, appropriate, sufficient, complete, and current, whereas the examples, stories, and scenarios used must be relevant and enlightening. (3) Goals and objectives; the learning objectives should be realistic, beneficial, and clearly identified at the beginning of each unit. The consistency between the course goals and objectives and the content should be considered. (4) Organization and structure; the e-course is expected to be organized, well-structured and divided into small units. The relationship between units has to be reasonable, consistent, and suitable for both the subject and the students. (5) The visual design relates to the formal aspects of the e-course, such as the navigational icons to facilitate control, good design, the hierarchy of the headings, and the correlation, wise use, and readability of the text and graphics. (6) Language; the level of the language used must be suitable for the intended learners. The writing style must be clear and direct. Familiar and common words, brief paragraphs, and consistent terms should be used, and the content is expected to be free of spelling and grammar errors. A supporting glossary to define new or technical terms is needed. (7) Multimedia and technology; the e-course incorporates video, audio, and animations to efficiently facilitate understanding the knowledge being taught. Information and communications technology (ICT) must be adopted wisely. (8) Interactivities and activities; the e-course includes interactive learning options that enable the student to engage in the learning process and control its pace. Versatile, sufficient, realistic, and applicable activities should be included to stimulate creative and critical thinking. (9) Learning resources; the e-course is expected to include a variety of learning resources, such as books, journals, and websites.

3.4 Qualities for assessing student performance

Assessing student performance in e-learning has much in common with traditional learning. However, in e-learning, it needs more planning. The following is a conclusive summary of the qualities of this process as discussed through literature (Bianco, Marsico, & Tempirini, 2005; Chao, Saj, & Tessier, 2006; Wright, n.d.).

Consistency; the assessment process should be consistent, as the course learning outcomes and course assignments are interrelated. Reasonableness; the number of assignments is appropriate and reasonable, and offer suitable timing for solving the assignments. Versatility; the assignments should be designed carefully to measure the different skills and knowledge

developed during the course, such as critical thinking and problem solving skills. Fairness; the evaluation and grading process should be clear, explicit, and fair. Reviewability; after an exam or a quiz, feedback and review should be provided. LMS or Blackboard includes tools for creating assignments and exams, as well as offer options for automated grading. Most of these options are used to measure knowledge and are limited to cognitive skills; synchronous discussions and videos can be organized as tools for oral examinations.

3.5 Sharable Content Object Reference Model (SCORM): Technical standards of online learing

Standardized specifications for producing and packaging e-courses have been formulated to enable importing, sharing, using, and exporting over different LMSs (Jayal & Shepperd, 2007). SCORM is one of several standards that have been introduced and widely used (Bianco & Marsico & Tempirini 2005), as a comprehensive set of technical standards and specifications that enable producing e-content that is accessible, adaptable, affordable, durable, interoperable, and reusable (ADL, 2011; Bianco, Marsico, & Tempirini, 2005).

Accessibility; the e-course can be located, accessed, and tracked simply and with the same quality from remote locations, as needed. Adaptability; The e-course can be simply customized according to different individual and organizational needs. Affordability; the e-course consumes less time and cost to deliver the knowledge to the students. Durability; the e-course can be used and developed regardless of the discontinuity or the change in technologies used to produce it, whether software or hardware, for example, upgrading the operation system from Windows 7 to Windows 10 should have no impact on delivering the e-course to the learners. Interoperability; the e-course can be delivered and operated correctly on different LMSs and across a variety of hardware, regardless of the applications and tools used for creating it, for example, e-courses developed by Macintosh systems can be operated in Windows systems and vice versa. Reusability; the e-course can be easily modified and reused in different situations; this standard is achieved when the e-course is divided into smaller units that are independent of the learning context and can be used to formulate a new e-course.

3.6 Qualities of continuous support, evaluation, and improvement

E-learning needs continuous support to both its technical and academic components. E-courses have to be investigated to check that the targeted learners can achieve their objectives. Such investigation should be done by experts reviewing academic content, instructional design, and technical aspects, as they must all be up-to-date. E-courses have to be regularly revised and evaluated. Modifications may be permitted especially if the e-course is used by other instructors who did not participate in its development.

4. The Case Study

In 2014, the author was assigned by the Department of Architecture and Building Science (DABS), at the College of Architecture and Planning, King Saud University, to develop two e-courses under the curriculum of building construction, the case study of this paper: 'Building Construction 2' (BC2), and 'Contemporary Building Construction Methods' (CBCM). The author had taught both courses traditionally several times prior to developing their e-courses.

4.1 The Preparation

In the analysis phase, the instructional design problem for Building Construction courses was formulated, and then it's components: learning objectives, characteristics of the students, and available resources and technologies were identified.

BC2 is a compulsory course offered to students at level seven. It is a three-credit, four contact hours course, delivered as a 2-hour lecture and 2-hour practical weekly. The BC2 e-course applies to the theoretical lecture part only, whereas the practical is undertaken in a studio setting. The course objectives are as follows: to clarify the criteria for selecting appropriate finishes systems for specific architectural spaces; to discuss the materials, processes, and details of a group of secondary components; to draw and prepare construction details relevant to the course topics; and to explain the considerations for supervising construction works. This course is a typical building construction course that introduces the theory and practice of implementing secondary and non-structural

building systems, such as floor, wall, and ceiling finishes, thermal and moisture insulations, partitions, curtain walls and fenestrations. Each topic provides modular knowledge of the relevant historical and theoretical backgrounds, advantages and disadvantages, construction process,materials and tools, and construction details.

CBCM is an elective course offered for senior students at level nine. It is a two-credit, two-contact hours course, delivered as lectures only. The course objectives are to clarify the criteria for proposing appropriate construction methods for specific architectural projects; to discuss the materials, processes, and details of construction methods; to explain construction details relevant to the course topics; to explain the considerations for supervising construction works; and to keep track of recent developments relevant to the topics of the course. This course focuses on explaining, analyzing, and comparing a group of contemporary building construction methods, such as precast and pre-stressed concrete, lift-slab method, tilt-up construction, tunnel and slip forms, timber framing, light gauge-steel framing, space frame construction, prefabricated buildings, and contemporary construction equipment. Each topic provides modular knowledge of the relevant historical and theoretical backgrounds, advantages and disadvantages, construction processes, materials and tools, and construction details.

A variety of resources were offered for developing these e-courses. Training workshops were held for faculty assigned to develop e-courses at the College, covering the basics of instructional design, as well as training on software packages used in developing e-courses. Each e-course developer received original copies for these software packages, in addition to a technical assistant to provide advice and support.

4.2 The Development Process

Building construction courses represent the link between architectural and engineering education. Teaching these courses has particularities. They provide modular knowledge based on typical methodologies related to different topics, as well as involve explaining processes of production, that requires strict organization and sequencing of the information. The courses deal with many construction details that require higher imagination and sensitivity for colors, shapes, and textures; and with real-world facts that require explicit and direct language for describing them. Finally, they cannot depend only on theoretical instructions as a strong linkage between classroom teaching and construction site visits is required.

In view of these particularities, an appropriate pedagogical methodology was adopted in developing BC2 and CBCM e-courses, as follows: The structure of the courses was divided into modular units, and each unit was further structured into modular parts to maximize the students' comprehension. The 'compare and contrast' instructional technique was adopted in clear tables. Construction site documentary videos, as well as computer-generated animations were used as appropriate to demonstrate the construction process and support the link between the classroom and real-world construction sites. Neat drawings and impressive images were used to clarify construction details, and all the units included in-class activities and assignments to ensure the achievement of the learning objectives. The BC2 and CBCM e-courses were delivered using blended and asynchronous e-learning approaches.

Many software packages were used to develop BC2 and CBCM e-courses: PowerPoint 2013 was used to create and develop the initial slide-based presentations, where articulate programs were plugged in and operated, Articulate Presenter 2013 was used to transform PowerPoint slides into presentation-based courses and wrap the presentation in a player that can include controls and add narration to the slides; Articulate Quizmaker 2013 was used for creating assignments and tests in different formats; Articulate Replay 2013 was used to record screencasts and edit videos; and Articulate Engage 2013 and Raptivity were used to add interactive content to the e-courses to enable interactive learning. In addition, Adobe Photoshop CS5 was used occasionally for image and raster graphics editing. SCORM standards and applications were applied in packaging and uploading the e-courses to a Blackboard-based LMS, which is SCORM compatible and certified.

4.3 The Product

The CBCM e-course was implemented in Spring 2015, a year earlier than the BC2 e-course, implemented in spring 2016. Each e-course

required about three months to develop, and about two weeks to be revised and approved. Ease of information accessibility was considered in designing the display of the e-courses. Help and home buttons were utilized clearly, and instructions for using and controlling the e-courses were included, as shown in (Figures 3 and 4). The goals and objectives of the e-courses were clearly identified in the introductory unit. A table of the learning objectives was included at the beginning of each unit.

Each e-course was divided into smaller units, each concerned with a specific topic of the subjects. A unit began with the instructions, lecture objectives, and introduction to the topic, followed by modular knowledge on the theoretical backgrounds, advantages and disadvantages, construction processes, materials and tools used, and construction details relevant to the lecture topic. Each unit ended with an activity, a summary, a list of references, and a quiz. The e-courses incorporated rational visual design. Dark backgrounds with bright text

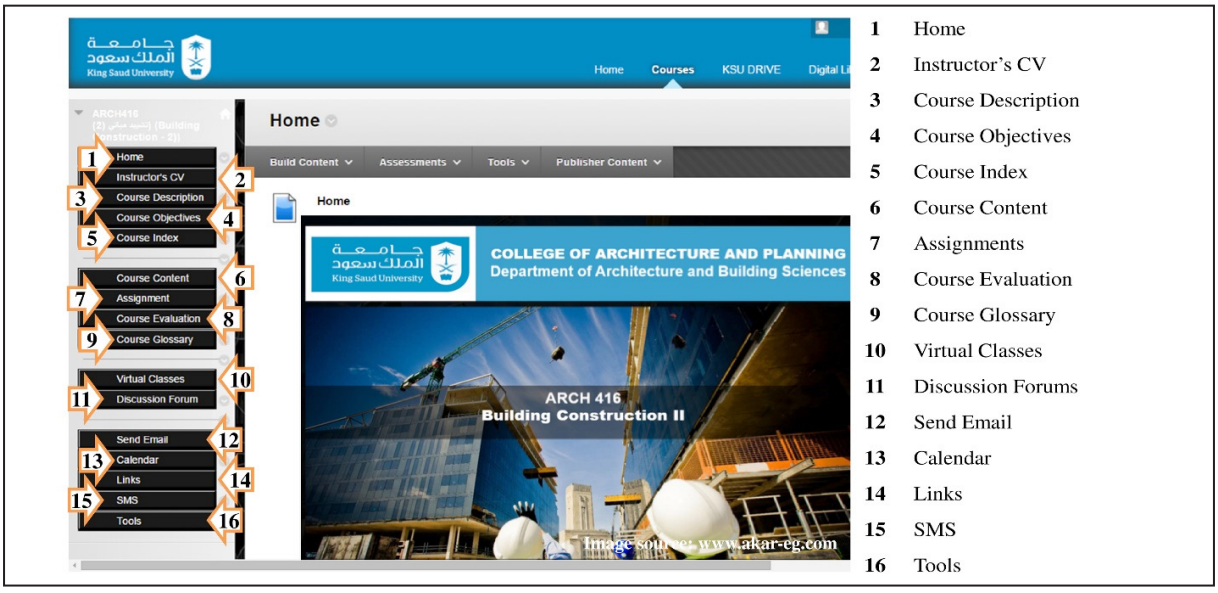
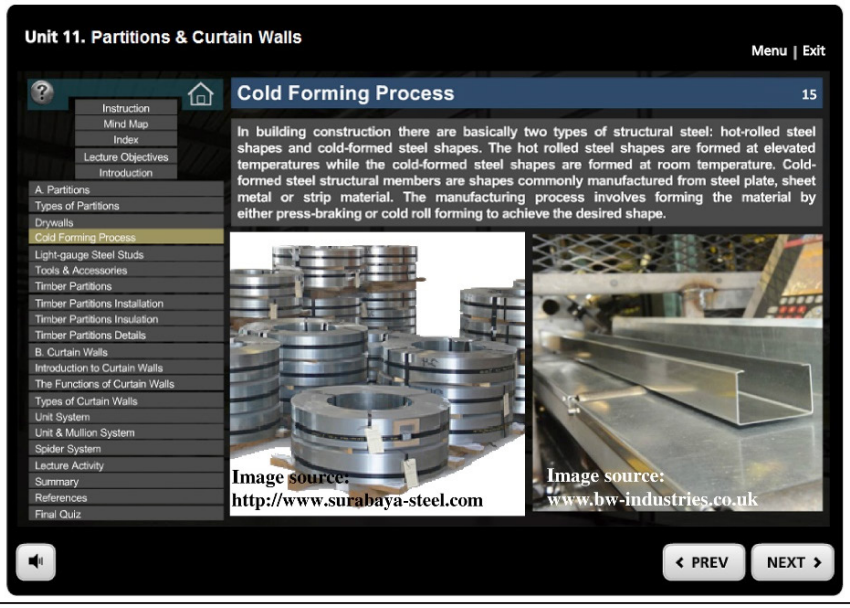


Figure 3. Components of the side menu of the BC2 e-course home page.

Figure 4. Typical components of a BC2 page to facilitate information accessibility.

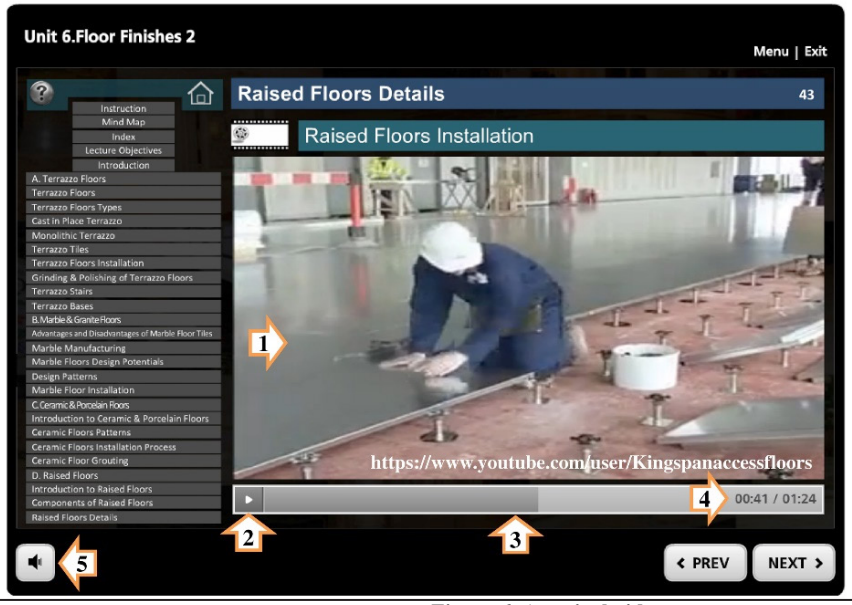
were used to eliminate visual stresses. A correlated combination of text, images and figures was employed to facilitate comprehension. Control, volume, and navigation buttons were included (Figure 5).

The language of instruction for both e-courses is English, with consideration for language simplicity as the students first language is Arabic. Short phrases and paragraphs were utilized, and scientific terminologies were defined in a comprehensive glossary. Narrations were enabled for the headings and important parts of the units to ensure comprehension and proper pronunciation. Multimedia were adopted effectively in both e-courses, as instructional videos and animations were embedded to explain the processes of construction and installations. Components of a video page were shown in (Figure 6).



The e-course incorporated rational visual design, dark backgrounds with bright text are used to eliminate the visual stresses.

Figure 5. Aspects of the visual design of the BC2 e-course.



1	Video Screen Area
2	Play / Pause
3	Seek Bar
4	Time Indicator
5	Volume Control

Figure 6. A typical video page content.

The e-courses included interactive learning options that promote engagement and pace control. Side and pull-down menus were utilized to enable the students to navigate the unit content freely and to facilitate the repetition of specific parts regardless of the intended sequence. Text narrations were interlinked with their related images by highlights or indicators. Each unit also included a brief activity. Versatile learning resources were used.

The e-courses relied partly on the online quizzes to assess the students' performance. Each unit included a quiz to review the students' understanding in addition to sample exams. The quizzes incorporated different types of questions: true-or-false, multiple-choice, and drag-and-drop questions (Figure 7). The results of online quizzes were provided immediately. The e-courses also enabled the students to review their answers and/or retry the quiz (Figure 8). Meanwhile, comprehensive assessment through midterm and final exams were held traditionally in class to measure all the skills developed during the course.

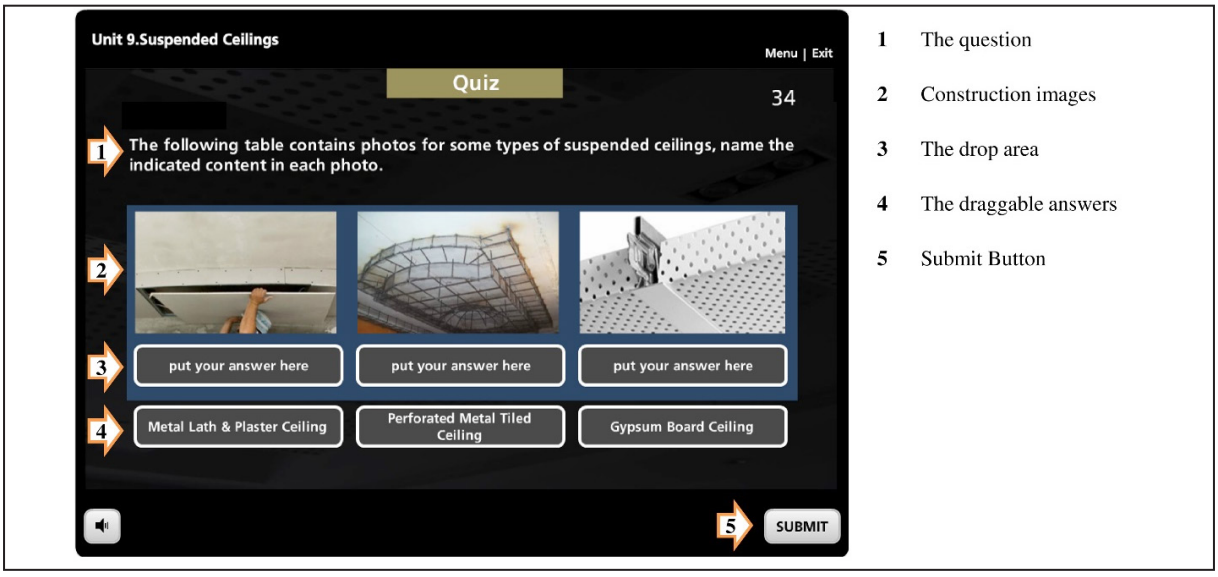


Figure 7. A sample of drag-and-drop question.

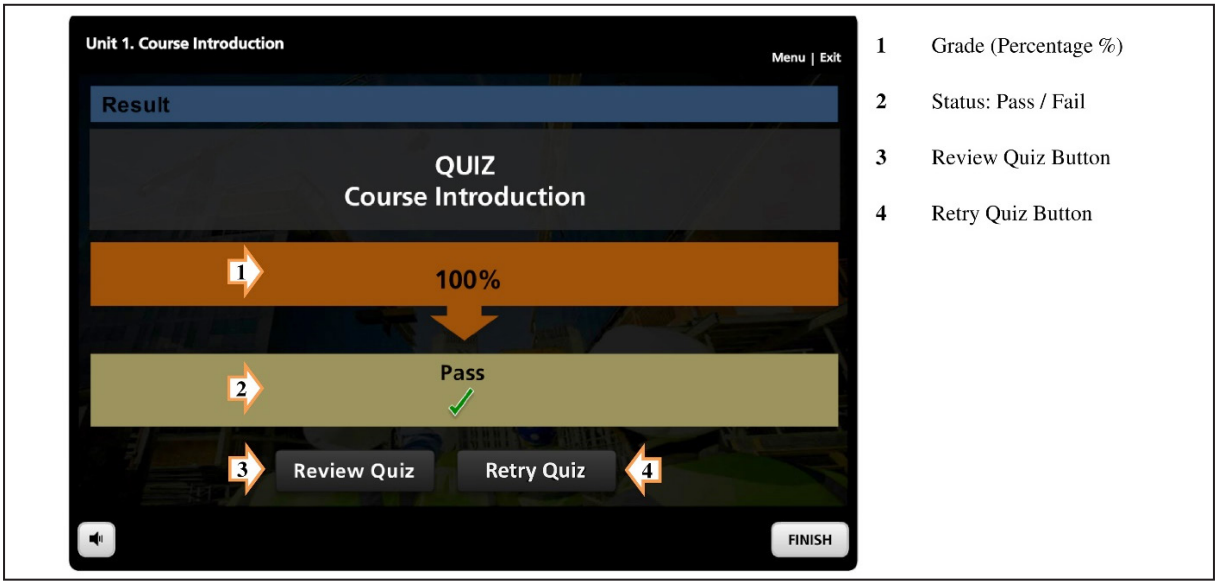


Figure 8. A sample of quiz results page.

5. The Evaluation

Both BC2 and CBCM e-courses were subject to two stages of formative evaluation during development: first, approval by an academic committee responsible for reviewing the e-courses for their coverage of all learning objectives and topics; second, checking the quality of the instructional design and technical requirements. After each e-course was validated, it was activated to enable it to be implemented and used by all the instructors and students of this course. This part presents the comprehensive evaluation for the experience of developing and using the e-coures. This evaluation was based on many aspects: firstly, the harmony between these e-courses and the standards and qualities of developing e-coures, secondly, the instructor-developer perspective regarding the effectiveness of e-courses, and thirdly, the investigation of students' perceptions.

Finally, a SWOT analysis has been performed to summarize and visualize the whole evaluation of this experience.

5.1 E-course evaluation: Instructor-developer perspective

Using these e-courses clearly enhanced a number of the students' skills compared to traditional course delivery, while some negative aspects had been reported during this experience. Although, these e-courses were less suitable for developing some educational skills regarding the subject of building construction that had been covered traditionally in-class, the experience of developing and using them proved advantageous. Moreover, the author's expertise in teaching these courses traditionally allowed for deeper investigation and thorough observations for the differences between the two educational methods, the traditional and the e-learning.

Compared to the traditional method, the development of the e-courses required many preparations, arrangements, and consumed a lot of time as well as costly software and hardware; these facts may negatively affect the applications of e-courses in architectural education in general, and in building construction in particular. In architectural education, lack of time for instructors may hinder the production of e-courses. Also, the relatively small numbers of students may affect the economic feasibility of e-courses. Moreover, the expected validity time of building construction courses is relatively short, as these courses are subject to frequent updates, and such these updates become more difficult in the case of e-courses.

Regarding the availability of learning resources, one of the advantages of this experience was the sufficiency and versatility of the available learning resources related to building construction, offered by academicians or professional firms, especially the large amount of instructional videos available on video-sharing websites that could be linked to the e-course and accessed easily.

Because of the standardized and comprehensive nature of the e-course material, available to all students, the consistency of the educational content taught to different sections increased. Accessibility to course material improved apparently because the instructor and students were able to access the material anywhere, on and off campus. The availability of these materials since the beginning of the semester allowed the students to review them, which enabled more time for discussions and exercises during face-to-face lecture time, and to a certain extent, helped them to decide on enrolling or with drawing from the CBCM elective course.

The use of video instructions showing the construction process in real sites had a strong positive impact on the students' level of knowledge acquisition and understanding. The virtual animations included played an important role in demonstrating clearly the sequence of construction processes. However, these virtual tours decreased to some extent the students' enthusiasm to visit construction sites and consequently their engagement to the real world of building construction.

Electronic quizzes potential was limited and not able to measure all the skills in building construction courses. However, they allowed each student to individually access the quizzes and solve them, as well as review the feedback and grades. Further, a number of ideas for assignments and quizzes were replaced owing to difficulties in realizing them using the available software.

Moreover, as these e-courses were offered in English, formal narrations were utilized for all unit headings, terminologies, and important paragraphs. In this way, the students' pronunciation of the English terminology was enhanced. In addition, self-learning skills notably increased; as the students' need for extra academic support

during the instructor's office hours apparently decreased, especially in the case of absent students.

Regarding the technical resources, the experience of using e-courses was positive, as no major difficulties were reported for students while operating the e-courses, including internet access shortage and hardware issues. However, minor technical issues were reported with regard to incompatibility of the web browsers used. The tools and software packages used were generally suitable but not flexible enough to realize all of the instructional ideas. Limitations were faced in designing the interface of the e-courses, as they could not proportionally fit certain screen dimensions.

Table 2. Responses of the students' assessment for questions 1 to 24.

Aspect	Question No.	Questions	Answers				
			Strongly agree	Agree	Relatively Agree	Disagree	Strongly disagree
Information Accessibility	1	It was easy to access the definitions of terminologies, symbols, and abbreviations.	18	26	8	6	4
	2	Instructions and assistance on explaining how to deal with lectures are available, clear, and sufficient.	22	17	18	4	1
E-course Content	3	The electronic content of this course is relevant, appropriate, and worked well.	34	11	13	4	0
	4	In studying this course I depended mainly on its electronic content.	21	14	19	3	5
Goals & objectives	5	The Educational objectives were mentioned at the beginning of each unit.	39	15	6	1	1
	6	The Educational objectives are clear and sufficient.	24	21	12	4	1
Organization & Structure	7	The e-course structure is organized and logical.	33	19	6	2	2
	8	Each unit has consistent content which facilitates perceiving the information.	37	15	5	4	1
Visual Design	9	The design of e-course units and slides is effective and appropriate.	23	15	17	3	4
	10	The text, figures, and images have suitable size and resolution.	19	22	11	7	3
Language	11	The language of the lectures is clear and sound.	17	16	20	6	3
	12	Narrations and voice instructions are clear and useful.	25	16	14	6	1
Multimedia & Technology	13	This e-course applied most of the instructional techniques (texts - figures - images- audio - video).	37	18	6	0	1
	14	This e-course used information and communication technology (ICT) effectively.	31	20	6	4	1
Interactivity & Activities	15	The e-course content adopted interactive learning activities.	20	24	12	2	4
	16	Lectures activities are versatile and sufficient	20	20	16	3	3
Learning Resources	17	Animations and instructional videos expanded my understanding of the topics.	41	15	4	1	1
	18	References provided at the end of each lecture are relevant & sufficient.	26	20	14	1	1
Assessments & Assignments	19	Assignments are sufficient and they improve the understanding of the lectures.	23	20	13	4	2
	20	Evaluation of assignments is fair and clear.	22	18	18	3	1
Time & Speed	21	Time consumed to browse e-course units is suitable.	22	9	19	10	2
	22	The speed of downloading the e-course contents is reasonable.	15	17	17	12	1
Overall Evaluation	23	The learning objectives and expectations have been met during this e-course.	19	26	15	1	1
	24	In general, I am satisfied with the quality of this e-course.	23	26	11	1	1

Table 3. Responses of the students' assessment for question 25.

No.	Question	PC	Tablet	Smart Phone
25	Specify the device(s) you mostly use to access the electronic content of this e-course.	43	12	18

Table 4. Responses of the students' assessment for question 26.

No.	Question	
26	If you have suggestions or comments to develop this e-course, please indicate.	
Answers	None.	25
	Allow for instant arabic translation.	18
	Allow downloading and offline access.	9
	Visual design improvements.	5
	Technical issues.	4
	Provide more and versatile exercises.	3
	More interaction.	2

5.2 E-course evaluation: Students' perceptions

A student assessment survey, using a 26-items questionnaire tool, was conducted to evaluate both e-courses. The questions covered the standard and quality of e-learning and e-courses. Out of 106 students who studied one of these e-courses, 62 students (59%) responded to the questionnaire. This level of response was considered sufficient for the purpose of this study. It is worth mentioning that the survey results for both e-courses showed almost the same evaluation and comments. This was considered reasonable, as both e-courses employed the same standards and were similar in design. Therefore, the responses of all the students were collectively presented and summarized in (Tables 2, 3, and 4).

In general, the respondents agreed that the quality of the e-courses was satisfactory. However, their responses showed relative differentiation regarding the standards measured: standards for organization and structure, multimedia and technology, and learning resources were rated high, whereas those related to the goals and objectives, visual design, language, and assessment and assignments were rated relatively medium. Those on information accessibility, course content, and interactivity and activities were rated lower in comparison to other standards, and finally, the lowest rating was for time and speed. The responses for question 25 showed that popularity of PCs to access the e-courses is still the highest, although smartphones and tablets were also used but with lower rates.

As for question 26, most of the opinions suggested that the e-courses should include instant translation to Arabic, as well as an option for downloading the content to allow offline access, Some respondents suggested visual improvements regarding slides colors and text sizes. Few respondents reported technical issues regarding the workability of the e-course, three respondents requested expanding the types and numbers of exercises, and two respondents recommended providing more interaction within the e-courses, allowing the student to access extra information through hyperlinks in the slides.

5.3 The SWOT analysis

The key findings of the whole experience of developing and using building construction e-courses are summarized and compiled in a SWOT analysis, as shown in (Table 5). This analysis was also extended to investigate the external opportunities as well as the expected threats that should be taken into consideration in future experiments.

Table 5. SWOT analysis of the experience of developing and using building construction e-courses.

	Positive	Negative
Internal	**Strengths**	**Weaknesses**
	The e-courses changed the building construction class environment into a more interactive one, through providing extra time for discussions and exercises.	These e-courses were less suitable for teaching all the skills of building construction, such as detailing and drawing skills, and these skills were taught traditionally.
	The availability of e-courses materials since the beginning of the semester allowed the students to review them, and especially helped the students to decide about enrolling to or withdrawing the CBCM elective course.	With regard to the expected validity time of a course content related to building construction, developing e-courses for this subject could be considered more time consuming and less feasible.
	The use of instructional videos to demonstrate construction processes significantly increased the students' understanding of the subjects of building construction.	Developing and implementing the e-courses required relatively costly software and hardware, and this might be considered less feasible in comparison to the few numbers of students of architecture.
	The use of narrations for course headings, terminologies, and some important parts expanded the students' pronunciation abilities and their interaction as well. An option for translation may also be beneficial.	Although the instructional videos were helpful, they relatively decreased the students' engagement to the realm of building construction, as they reduced the students' enthusiasm to visit construction sites.
	This experience ensured the effectiveness of electronic quizzes, as they facilitated feedbacks, and notably improved the performance of learning these e-courses.	Because of the limited types of exercises available in the software packages used, the electronic quizzes did not measure all the skills required by both e-courses.
	This experience ensured some advantages of e-courses, as it enhanced the students' skills of understanding, communication, and self-learning.	Some technical issues have been reported and affected the performance of e-course, and the lack of downloading and offline browsing increased this issue.
	Blended learning was appropriate for teaching building construction courses, as it combined the advantages of e-learning in theoretical parts and face-to-face learning in studio work.	While building technology courses require frequent updates, in the case of e-courses these updates require long administrative procedures.
External	**Opportunities**	**Threats**
	E-courses can deal effectively with the issues of increasing numbers of architecture students as well as the shortage of the faculty members, enabling higher student-faculty ratio.	Due to the mechanical nature of e-courses, they may have a negative impact on the architecture faculty teaching skills and their personal teaching styles.
	E-courses could be more appropriate for graduate programs of architecture that mainly develop the students' cognitive skills.	Nowadays, some architectural online programs started to emerge worldwide, and this might affect the competitiveness of local programs.
	Since a wide range of theoretical courses in architecture might be electronic, the need for physical classes may decrease leaving larger spaces and more time for the studios and studio activities.	Blended learning may change the identity of architectural education, so it should be adopted in a way that conserves the particularity of this education.
	E-courses allow for uniform and consistent access to the course content, and this leads to a better coherence of the quality of the students.	E-learning is relatively spreading in architectural education, however, its best practices are not yet identified.
	The infrastructure and technical support provided for developing these e-courses encourage broadening the experience for more adoption of blended learning in the CAP.	The common lack of time for academic architects might affect negatively the progression of e-courses in architecture, as these courses need relatively longer time compared to traditional ones.

6. Summary and Conclusions

Despite the apparent spread of e-learning in architectural education, its status remains 'emerging'. Moreover, intensive research is required to determine and define its best practices. This research aimed at contributing to filling this research gap by providing the demonstration and evaluation of an experience of developing and using building construction e-courses in architectural education. The research explained thethree approaches of e-learning, namely, wholly online, blended, and adjunct e-learning; compared synchronous and asynchronous e-learning, as well the conditions for adopting each, and investigated and categorized the components of e-learning. The advantages and disadvantages of e-learning were discussed, showing that blended learning is the transition that combines both traditional and online learning environments. E-learning in architectural education was also described with respect to future challenges.

This study outlined the qualities of e-learning, instructional design, and e-courses, mentioning standards in the field, such as ADDIE for instructional design and SCORM for the technical aspects of e-learning. Other qualities serve as guidelines or recommendations as they are still under progress, such as those for e-course development, student performance assessment, as well as the qualities for continuous support, evaluation, and improvement of the e-learning environment. The case study focused on demonstrating the experience of developing two building construction e-courses through clarifying their objectives, the available resources, their particularities, the pedagogical methodology used, the apps and tools employed, as well as sample slides.

A number of strengths were reported, most of which relate to the educational aspect of the learning process. The blended learning environment of teaching these e-courses was advantageous as it increased in-class discussions and activities, which enabled deeper understanding for the subject of building construction. This experience likewise enhanced the communication between the students and the course content on and off class. The use of video instructions and narrations significantly increased the students' interaction, communication, and self-learning skills. The benefits of using the electronic quizzes were verified through this experience, as they provided immediate grading and feedback, which positively affected the students' performance. The students played a positive role in this experience, as they were qualified and enthusiastic to engage in this type of learning. The e-courses also helped them to decide about enrolling or withdrawing from the courses, as they were able to review their contents in advance.

Meanwhile, a set of weaknesses was observed. The preparation of these e-courses was time consuming, and it needed extensive arrangements, and expensive resources. Thus, the economic feasibility of adopting building construction e-courses might be considered low with respect to the small numbers of architecture students and the expected validity time of the course content. Other weaknesses pertained to the educational aspect of e-courses, specifically in the subject of building construction. E-courses remain limited in terms of developing all the skills required for the building construction field, and even decreased, to a certain extent, the engagement of the students into real world of building construction sites as they were utilizing more virtual reality concepts. Lack of instant translations was reported as a weakness in this experience, further, dependence on internet connectivity is still an issue, especially in accessing the content off campus, and the lack of a downloading options increased the effect of this issue.

Nonetheless, some expected opportunities could be realized, mostly relate to the administrative aspects of the learning process. E-courses could deal effectively with the issues of faculty shortage and the growing numbers of students in architectural education. They could support the consistency of the course content through the different student sections and different semesters. Certainly, through dividing the e-courses into small units, they could be shared across courses or study programs. The infrastructure and technical support provided to develop and implement these e-courses provide the opportunity to broaden their application in the existing architectural programs and develop new online programs, especially in graduate studies, which emphasize cognitive skills.

However, a group of threats have been identified and should be taken into consideration in future efforts. A number of these threats relate in particular to the characteristics of architectural education: e-learning may affect the culture and nature of architectural education, and e-courses may have a relatively negative influence on the

instructors' teaching skills and their personal styles of teaching. Traditional architectural education still dominates and provides more interactive learning, although blended learning is notably spreading in architectural education. This competition between pedagogical methods relates to global competitiveness for local programs and requires further investigation, especially on the benefits and best practices of blended learning in architectural education.

Acknowledgments

The author would like to extend his sincere appreciation to the Deanship of Scientific Research at King Saud University for supporting this research.

7. References

ADL. "SCORM Users Guide for Instructional Designers". Advanced Distributed Learning, (2011). https://adlnet.gov/wp-content/uploads/2011/12/SCORM_Users_Guide_for_ISDs.pdf. Accessed 23/1/2016.

Al-Asmari, A., & Khan, M. "E-learning in Saudi Arabia: Past, present and future". Near and Middle Eastern Journal of Research in Education, vol. 2, no. 1, (2014), pp. 1-11.

Al-Gahtani, A. Evaluating the Effectiveness of the E-learning Experience in Some Universities in Saudi Arabia. Ph.D. Thesis, Durham University, (2011).

Al-Shorbaji, N., Atun, R., Car, J., Majeed, A., & Wheeler, E. E-Learning for Undergraduate Health Professional Education: A Systematic Review Informing a Radical Transformation of Health Workforce Development. London, World Health Organization, (2015).

Arkorful, V., & Abaidoo, N. "The Role of E-Learning: The Advantages and Disadvantages of its Adoption in Higher Education". International Journal of Education and Research, vol. 2, no. 12, (2014), pp. 397-410.

Bianco, A., Marsico, M., & Tempirini, M. Standards for E-Learning. White Paper. QUIS - Quality, Interoperability and Standards in E-Learning, (2005). http://www2.tisip.no/quis/public_files/wp5-standards-for-elearning.pdf, Accessed 25/1/2016.

Branch, R. Instructional Design: The ADDIE Approach. New York, Springer, (2009).

Chao, T., Saj, T., & Tessier, F. "Establishing a Quality Review for Online Courses". Educause Quarterly, vol. 29, no. 3, (2006) pp. 32-39.

DED. "About Deanship". Deanship of E-Learning and D-Learning at KSU (2015). http://elearning.ksu.edu.sa/en. Accessed 1/2/2016.

Goodman, V. Keeping the User in Mind: Instructional Design and the Modern Library. London, Chandos Publishing, (2009).

FAO. E-learning Methodologies: A Guide for Designing and Developing E-learning Courses. Rome, Food and Agriculture Organization of the United Nations, (2011).

Fee, K. Delivering E-learning. London, Kogan Page Limited, (2009).

Hrastinski, S. "A study of asynchronous and synchronous e-learning methods discovered that each supports different purposes". Educause Quarterly, vol. 31, no. 4 (2008), pp. 51-55.

iNACOL. National Standards for Quality Online Courses. Vienna, International Association for K–12 Online Learning, (2011).

Iskander, M. Innovative Techniques in Instruction Technology: E-learning, E-assessment, and Education. New York, Springer, (2008).

Jayal, A., & Shepperd, M. "An Evaluation of E-Learning Standards". Proceedings of the 5th International Conference on E-Governance, Hyderabad, India, 28-30 December (2007), pp. 539-543.

Keengwe, J. (Ed.) Handbook of Research on Educational Technology Integration and Active Learning. Hershey, IGI Global, (2015).

Kruse, K. "The Benefits and Drawbacks of E-learning". ITpreneurs. (2002). http://www.itsmcampus.com/downloads/The_Benefits_and_Drawbacks_of_e.doc. Accessed 25/12/2015.

Littlejohn, A., & Pegler, C. Preparing for Blended E-learning. New York, Routledge, (2007).

McGriff, S. "Instructional System Design (ISD): Using the ADDIE Model". Purdue University. (2000). https://www.lib.purdue.edu/sites/default/files/directory/butler38/ADDIE.pdf. Accessed 25/12/2015.

Mizban, N., & Roberts, A. "The Place of E-learning. In: Architectural Education: A Critical Review". Proceedings of the 24th eCAADe Conference: Communicating Space(s), Greece, 24-26 August (2006), pp. 494-501.

NAAB. "FAQs". NAAB. (n.d.). From http://www.naab.org/r/faq/results.aspx, Accessed 30/11/2015.

Pappas, C. "Post-Course Evaluation: 15 Aspects to Check in Post-Course Evaluation". ELearning Industry. (2015). http://elearningindustry.com/post-course-evaluation-15-aspects-that-elearning-professionals-need-to-check. Accessed 30/1/2016.

Pollock, D. "Designing and Teaching Online Courses". Bainbridge State College. (2013). http://fsweb.bainbridge.edu/QEP/Docs/DesigningandTeachingOnlineCourses.pdf. Accessed 25/1/2016.

Rice, M., Campbell, C., & Mousley, J. "Using Online Environments to Promote Assessment as a Learning Enhancement Process". Enhancing Teaching and Learning through Assessment: Deriving an Appropriate Model. Ed. Frankland, S. Netherlands, Springer, (2007), pp. 409-433.

Rothwell, W., & Kazanas, H. Mastering the Instructional Design Process: A Systematic Approach. San Francisco, John Wiley & Sons, (2016).

Sidawi, B. "The Tutors' Views on the Utilization of E-Learning System in Architectural Education". European Journal of Open, Distance and e-Learning, vol. 16, no. 2, (2013), pp. 1-12.

Sidawi, B., Kubbara, F., Mahmud, S., & Duman, E. Problems Associated with the Use of E-Learning System and Potential Solutions. Brief Report, University of Dammam, (2015).

Singh, H. "Building Effective Blended Learning Programs". Educational Technology, vol. 43, (2003), pp. 51-54.

Strauss, V. "Three fears about blended learning". The Washington Post. (2012). https://www.washingtonpost.com /blogs/answer-sheet/post/three-fears-about-blended-learning. Accessed 2/2/2016.

Tayebinik, M., & Puteh, M. "Blended learning or e-learning?" International Magazine on Advances in Computer Science, vol. 3, no. 1, (2012), pp.103-110.

Thomas, P. Towards Developing a Web-based Blended Learning Environment at the University of Botswana. Ph.D. Thesis, University of South Africa, (2010).

Veeramani, M. "E-Learning: A Conceptual Framework". International Journal of Educational Research and Technology, vol. 1, no. 2, (2010), pp. 20-24.

Watkins, K. "Free Online Architecture and Design Courses". Arch Daily. (2015). http://www.archdaily.com/605979/free-online-architecture-and-design-courses. Accessed 12/1/2016.

Wright, C. "Criteria for Evaluating the Quality of Online Courses". The Learned Man. (n.d.). http://elearning.typepad.com/thelearnedman/ID/evaluatingcourses.pdf. Accessed 1/1/2016.

تقييم تجربة تطوير واستخدام المحتوى الإلكتروني لمقررات تشييد المباني في التعليم المعماري

محمد نبيل غنيم

أستاذ مشارك

قسم العمارة وعلوم البناء، جامعة الملك سعود ، قسم الهندسة المعمارية، جامعة القاهرة

mohammed_ghonim@yahoo.com

قدم للنشر في ٢٤/ ٨/ ١٤٣٧هـ ؛ وقبل للنشر في ٣/ ٢/ ١٤٣٨هـ

ملخص البحث. على الرغم من انتشارها النسبي في الآونة الأخيرة، لا تزال تطبيقات التعلم الإلكتروني محدودة في التعليم المعماري، كما أن التجارب التي تم توثيقها حول هذا الموضوع تعد قليلة. لذلك تسعى هذه الدراسة إلى المشاركة في تقليل هذه الفجوة والإسهام في استقراء أثر التعلم الإلكتروني على التعليم المعماري وذلك عن طريق تقييم تجربة تطوير واستخدام المحتوى الإلكتروني لمقررات تشييد المباني في التعليم المعماري. ولتحقيق هذا الهدف اتبع البحث المنهج التحليلي، وقد قُسم البحث إلى أربعة أجزاء: الأول يراجع الخلفية النظرية لموضوع التعلم الإلكتروني، والثاني يحلل معايير الجودة الخاصة بالتعلم الإلكتروني والمقررات الإلكترونية، أما الثالث فيوثق دراسة الحالة التي تمثل المحتوى الرقمي لمقررين من مقررات تشييد المباني، وأخيراً الجزء الرابع يقدم تقييماً شاملاً للتجربة ويستعرض تحليلاً رباعياً لأهم إيجابياتها وسلبياتها.

الكلمات المفتاحية: التعليم المعماري، تشييد المباني، المقررات الإلكترونية، التعلم الممزوج، التعلم الإلكتروني.