Improve the e-Learning Environment by Developing the
Bidirectional Online Courses in Engineering
تحسين بيئة التعلم الإلكتروني من خلال
تطوير المقررات الهندسية
الثنائية الإتجاه عبر الإنترنت

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Abstract

Design and implementation of online courses in engineering are not straight forward at all. Most of engineering courses have strong math basis with full conceptual contents, and some of them are attached to laboratory sessions. This will emphasize on the necessity for the face-to-face learning process. However, the bidirectional online courses can provide the learners with “two-lane highway” of information for raising/answering questions, doing/submitting assignments, and seeking/getting help. The learner will find himself inside a virtual classroom that helps him/her to understand all concepts, perform all laboratory experiments and get all the marks through Internet.

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1. Introduction

Good course design begins with a clear understanding of specific learning outcomes and ways to engage students. Simply putting content on the Web is not a proper instructional process. Some instructors have been seen post their lectures’ notes and parts of textbooks on the course site for student to read, but what they really need to do is to think about interactivity. For example, rather than posting a linear lecture, an instructor might consider including embedded links to give students the opportunities to explore certain topics more deeply if they choose to. There should be some areas of the site that the students can manoeuvre for improving their retention of the instruction, as discussed in [1]. Sometimes students have to manipulate information so they can learn it better. There should be some facets of the site that allow them to do that. Depending on the intended learning outcomes, this interactivity can extend beyond embedded links. It recommends creating activities that allow students to take some control of their learning [2]. Penn State University adapts the Seven Principles to facilitate the peer review of online courses in both undergraduate and graduate level [3]. The Seven Principles have been used as an indicator for good practice that include; encourages contact between students and faculty, develops reciprocity and cooperation among students, encourages active learning, gives prompt feedback, emphasizes time on task, communicates high expectations, and respects diverse talents and ways of learning [4]. Therefore, the bidirectional online courses should be adopted in order to fully satisfy the Seven Principles for good practice where both students and instructors practice an active and interactive learning process.

2. Bidirectional Online Courses

The University of New Brunswick currently offers few online engineering courses. Some of them use lectures that are videotaped and made available online. These videos are available to all students enrolled in the course, regardless of campus. The streaming video the student gets online is very much like what happens in a big lecture hall. Instructor usually videotapes the face-to-face lectures where he/she uses PowerPoint and video clips in his/her lectures. Students who view the lectures online get the same experience as students attend face-to-face lectures, but this requires some post production. Some of online lectures have short video clips associated with PowerPoint presentation and the quality of videos is quite good. Since students have the option of attending live lectures or viewing them online, the lines between the various sections are blurred. These
are not distance students. They all come to on-campus office hours and take exams on campus. These courses also include an online forum with all sections, and unless a student mentions it, nobody knows whether he or she attends the live lectures or views them online. However, the bidirectional online courses provide the learners with the videotaped lectures and the web-based lab experiments, as presented in [5].

![Course Layout Diagram](image)

Figure 1: The layout of the course

In addition all lectures’ notes, homework assignments, tutorials, and extra materials will be available to download and print out. Also seeking help, solving problems, writing reports, submitting work, and getting marks back can be all done online. By using the social networks such as facebook or twitter will perfect the communication tools. The bidirectional online courses are different in structure and contents as shown in Figure 1.

3. Platform Example

In general, the design of online courses provides students with an active learning experience. Online courses’ design uses BlackBoard Management System, but, in engineering, design goes beyond the basic layout, which makes the courses more user friendly than they would be otherwise. For example, in Spring 2012 the EE 1813 Electricity and Magnetism course has been offered by Department of Engineering at University of New Brunswick in Saint John. The course was classroom-based, however, the BlackBoard Management System has been used to provide the students with all information they need to pass the course, see Figures 2 to 6. The course layout is
divided into the following sections:

- **Course Tools (Figure 2):**
  - Course Content: It includes the course outline, lecture notes, videotaped lectures’ files, homework assignments, tutorials, laboratories’ sheets and other extra materials.
  - Announcements: This section includes all course’ announcements.
  - Who’s Online: It helps to show you who is online to communicate with.

![Figure 2: The layout of the course in Blackboard](image)

- **Designer Tools (Figures 3 and 4):**
  - Manage Course: It uses to design the course layout including the order of either folders or files.
  - File Manager: It uses to upload, update or delete files or folders.
  - Grading Forms: It uses to create the grading sheets and do all spread sheet computation.
  - Selective Release: It is an important tool that uses to date when this file or folder will be seen or unseen to the student.
Instructor Tools (Figures 5 and 6):

- Manage Course: It is the same feature available to the course designer. Assignment Manager: It uses to upload, update or delete files or folders.
- Assignment Dropbox: It uses to collect and ensure all homework assignments and laboratories reports.
- Grade Book: It is a virtual book combined all marks from different portions of the course and it uses to grade the students.
- Grading Forms: It is the same feature available to the course designer.
- Group Manage: It uses to manage the students groups for group projects or laboratory experiments.
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- Tracking: It uses to confirm and observe the activity of the student and how much the student is active in the course.
- Selective Release: It is the same feature available to the course designer.

4. Bidirectional Online Courses’ Outcomes

Online courses are just as different from each other as classroom-based courses, but some online learners make assumptions that can lead to unnecessary frustration. When learners know in advance how the course works, they can make informed decisions about enrolling. For example, the EE 1813 course involved numerous small deliverables each week and lab group work biweekly. It wasn’t a good fit for learners who needed to travel for work or be out of touch for a few weeks during the semester, because the course process was fairly inflexible. This is different with another online course in the program that was flexible and primarily self-paced. Some instructors don’t provide adequate detail about course expectations to prospective learners because they need a certain number of learners to enroll. By adding a list of course realities and expectations to course descriptions, the prospective learners can determine before enrolling if they are likely to be able to meet them. Frustrations for learners commonly turn into frustrations for instructors and higher education institutions. In order to reduce unnecessary frustrations and help

Figure 5: Release files/folders to be seen by the students

Figure 6: Tracking the activity of the students
new online learners succeed, the bidirectional online courses create un-frustrated online learners and assist online learners. The main outcomes of online courses at large, as mentioned in [6] where several studies have been conducted, however the outcomes of bidirectional online courses, in spite of overlapping with normal online courses, can be concluded as follows.

- Basically the students are happy to have the option of accessing the course materials online!
- Fear of missing something is the main reason why students attend live lectures as opposed to viewing them online. However, the bidirectional web-based courses will help the student not to miss any tiny details.
- Those who view and interactive with course materials online are more secure and don’t mind learning independently.
- Students who view the course materials online tend to be more open to novelty.
- Students who like to use rehearsal as a learning strategy tend to prefer to view the lectures online, where they can pause/rewind, and watch the lecture multiple times.
- Harder courses are more popular online because of the advantage of being able to view the course materials multiple times.

This concludes that there is no significant difference in learning outcomes between the face-to-face and bidirectional web-based formats.

5. Development of Bidirectional Online Courses

The idea of bidirectional online courses is the future of all online courses. However, the course’s expansion and retention are needed. The following will be considered in order to improve the model design of online courses by creating more communication tools that are interested to both the learners and the instructors:

1- Use facebook, twitter, and other social networks: Although many students may have used Internet Messengers (IM), they probably have not used it for academic purposes. The syllabus should explain how to set up students’ facebook/twitter accounts and encourage them to sign-in the course’s facebook/twitter page. Also, remind students to add each other to their buddy lists.

2- Offer discussion groups at different days and times: Facebook/twitter can be used a discussion media. In order to keep the discussion manageable, limit them to eight students per session and offer them at different days and times, so students can find a session that is convenient for them.

3- Ask for students’ undivided attention: Online learners often balance many responsibilities
and can get distracted during lab work. Ask that they focus exclusively on their experiments. This will improve the quality of the interaction and help students get the most out of the lab sessions.

4- Form study groups: Group chats are an excellent way for students to make connections with each other. Encourage them to continue their chats in groups or one on one.

5- Message or tweet the students: Isolation is one of the dangers of online learning. Simple, synchronous messages from the instructor can open up communication and encourage students.

6- Invite students to instructor’s facebook/twitter: Students will be able to tell when the instructor is online (as long as instructor’s facebook/twitter application open). This open line of synchronous communication can be an excellent way of holding online office hours.

7- Establish realistic expectations: Increased access to the instructor can foster unrealistic expectations. For example, just because students are able to communicate with instructor synchronously does not mean that they will get their graded assignments back any sooner. Explain the communication policies clearly in course’ syllabus.

8- Don’t micromanage: Like the private conversations that take place among students before and after face-to-face classes, facebook/twitter can be an informal form of communication that can help students learn and provide social connections that might not otherwise be available in the course.

9- Keep a post log: Not everyone can be available for synchronous sessions, but they can still benefit from transcripts of the communication that occurs in facebook.

10- Form virtual office hours: Online learners ask for help and need it on time, virtual office hours in facebook/twitter will provide the learners with direct help without delay.

6. Conclusion

In this paper a design and implementation of bidirectional online courses in engineering are presented. The course example, EE 1813 Electricity and Magnetism, that has a strong conceptual contents and laboratory sessions, was demonstrated and discussed. As a closing point, the bidirectional online courses can provide the learners with a virtual classroom that helps him/her to understand all concepts, perform all laboratory experiments and get all the marks back.
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