

INNOVATION IS THE NAME OF THE GAME: A CASE STUDY OF AN ONLINE COURSE IN ENGINEERING AND TECHNOLOGY

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Abstract

In an evolving online education environment, innovation is a key factor in advancing the state-of-the-art. The advantages of distance learning and online education are well established. Many institutions of higher and continuing education in the United States and around the world have online systems and mechanisms in place, delivering effective and robust online education to the learners. Here is discussed a case study of an online engineering course that required innovation in the structure of the course content and in the course presentation to accommodate all learners, including well-prepared and underprepared ones. This has been a three-phase online course, undergone three phases of revisions and improvement in three semesters using the students' feedback. The course is well delivered and received, based on the feedback and anecdotal evidence. The overall assessment provided evidence that in the current distance learning environment, innovation is the name of the game.

Introduction

For the purposes of clarity and ease of reference, it is essential to keep the goal of the innovation in distance learning, referred to here as “e-learning” in mind: The innovation is to make the learning more guided, structured, and robust in both content delivery and in the instructional methods.

For effective as opposed to less effective learning in engineering and technology, learners should not be left alone to work on and to study different parts of the course without any guidance and mentoring from the instructor throughout the course duration. That is analogous to a student taking a “live” course in which he or she attends the lectures, reads the textbook chapter-by-chapter, solving the problems at the end of the chapters, taking the assignment and other required

course material, and taking the quizzes and examinations. So the real question here would be if his/her learning would be more effective if there were guidance and mentoring available throughout the course. Effective e-learning is best achieved by a structured approach to learning in which every step leads to the next, more concrete step, and so on. In this context, effective e-learning may maximize the learning experience by increasing clarity, transparencies, ease-of-access, and guided repetition. It will make the learning environment less confusing and more agile, and it helps with ascending the majority of the students in learning in the course. Effective e-learning is based on a common sense approach to the course.

The Case

Energy Systems is a senior-level course offered since 2010 at Daytona State College in Daytona Beach, FL. Course topics include both renewable and non-renewable energy systems, including fossil fuels, electricity generation from fossil fuels and non-fossil fuels, and co-generation of electricity. The course includes an introduction to energy and its resources, work, and thermal systems and processes. Fundamentals of thermodynamics, electricity and nuclear principles and applications, renewable energy and efficiency of energy resources and effects on the environment are also covered in this course. The course learning objectives are not listed here for brevity. However, the course learning objectives are synchronous with the course topics.

In phase I of the course, the e-learning environment included pre-recorded lectures released according to a 15-weeks course schedule, assignments, timed quizzes, and three examinations including two mid-terms and a comprehensive final examination, all conducted according to the schedule. While the textbook readings and assignments were assigned according to the course schedule and the covered topics, all examinations were conducted online during a time slot. Important information for the course was disseminated through the news section of the course website, and the discussions board was used extensively for the course-related discussions. Using this methodology, learning is achieved successfully by most of the prepared students that had experience and proficiency with taking online courses and were fully prepared. As such 70 percent or more students achieved 70 percent or more as their overall score on a scale of 0 to 100. It is noted that feedback from the students was mostly positive and encouraging. However, the drawback was that some students new to e-learning were not clear as to where to start and how to proceed in the course, making the method “unguided.” At the conclusion of phase I of the course, the instructor conducted a self-evaluation study and it was determined that some plan of action was necessary for learning improvements.

In phase II of the course conducted the following semester, instructions in the form of written documents for each module have been added covering the modules topic in the form of written documents, providing specific instructions on the learning structure. An example of a phase II written module is provided in Figure 1. As shown, the module topics and tasks are prescribed and specified, making learning “guided” and transparent.

A written module also specifies the assigning tasks such as reading related chapters of the textbook. It may also include the assignments assigned according to the course schedule and the covered topics using the modular instructions. Unlike phase I, all examinations included specific

written modules. Using this methodology, 80 percent or more students achieved 75 percent or more as their overall score on a scale of 0 to 100. It is noted that feedback from the students were substantially improved and the added modules received favorably as it clarified expectations and added valued transparencies.

Module 06 Instructions

**ETM 4220: Energy Systems
Spring 2012**

This module covers energy from fossil fuels and the related systems.

Your tasks are:

1. Watch L07-1, L07-2, L07-3, and L07-Rig Animation found under lectures in course content.
2. Review related chapters from your textbook. Make sure to solve as many problems as possible from the end of the related chapters.
3. In less than 300 words suggest three ways for reducing our dependency on "foreign oil." *Think "outside the box."* Itemize your suggestions as 1, 2, and 3. Title this paragraph as "Suggestions for Reducing Foreign Oil Dependency."
4. In 300 words or so, describe a rig system. On the same document as item 3 above, mark this paragraph as "Rig System."
5. Submit one document as instructed above in the dropbox under M06.

Fig. 1. Sample Module Instructions

Building on the successes of phase II, the next set of improvements to the course modules were achieved in phase III of this case where the written modules have been revised to synchronize with topic-specific sets rather than chapter-specific sets. This has been achieved with the goal of moving towards a textbook independency of the learning in this course.

Discussion

Learning in engineering and technology requires love of learning and hands-on activities, intense studying, agile and robust study habits, and self-discipline and determination, analytical skills, and critical thinking, among many other parameters that can contribute to success. Engineering and technology students should empower themselves with strong mathematical and physics and science prerequisites. Traditional engineering learning was conducted in live and traditional classrooms where students were present in body and mind. For taking advantage of many benefits that e-learning and distance learning have to offer in engineering and technology education, case studies needed were presented and discussed [2, 3, 6]. All benefits aside, not all

courses may be offered online since working with real laboratory equipment and materials requires hands-on practical experience. Virtual laboratories work for some courses while it may not be applied to all engineering technology courses and curriculums [1].

The presented case here is an example of a course that can be offered online since it covers the theoretical foundations of energy and its many systems. The case provided yet another example of simple innovation for a more agile and efficient learning in the form of the module instructions and the structure of the course conduction. It is noteworthy to mention that these modules shall be developed and applied as the faculty see them fit, and it is not fit-for-all modules. A faculty is the focal point of delivering an e-learning course as he/she should be the expert in the subject matter. As such, discussions and presentations on e-learning and the related case studies should not be interpreted or argued as an attempt to undermine the role of the faculty in the learning process.

Summary and Conclusion

Here is discussed a case study of an online engineering course that required innovation in the structure of the course content and in the course presentation to accommodate all learners, including well-prepared and underprepared ones. This includes course modules, recorded lectures, reading assignments, practice problems, assignments, quizzes, examinations, learning resources, and so on. In three online phases, the contents have been revised and improved in three semesters using the students' feedback, some of which are also presented and discussed. The overall assessment provided evidence that in the current distance learning environment, it is essential to keep the goal of the innovation in mind: The innovation is to make the learning more guided and robust in both content delivery and in the instructional methods.

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