

Nuclear Engineering 24/7 via Distance Learning: Course Development and Management Experiences

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Abstract

This article summarizes a few lessons learned in our early experiences in developing, delivering and implementing a series of distance learning classes for full-time undergraduate students enrolled in the combined-degree BS Mechanical + MS Nuclear Engineering 5-year and co-op based “MNE-ACCEND” program at the University of Cincinnati. This program is in its third year since inception and currently hosts approximately 35 undergraduate students enrolled in the graduating classes of 2008, 2009, and 2010, which is when these students are expected to complete their BS Mechanical and MS Nuclear Engineering degrees. In addition, 20+ newly confirmed students are expected to enter this program in the fall quarter of 2006 to become our Class of 2011. Therefore, the successful “follow through” of the DL component of this program continues to be increasingly crucial as this student pipeline reaches a targeted steady-state of about 10 to 15 graduates per class.

KEYWORDS: *Distance Learning, Nuclear Engineering, BSME, MSNE*

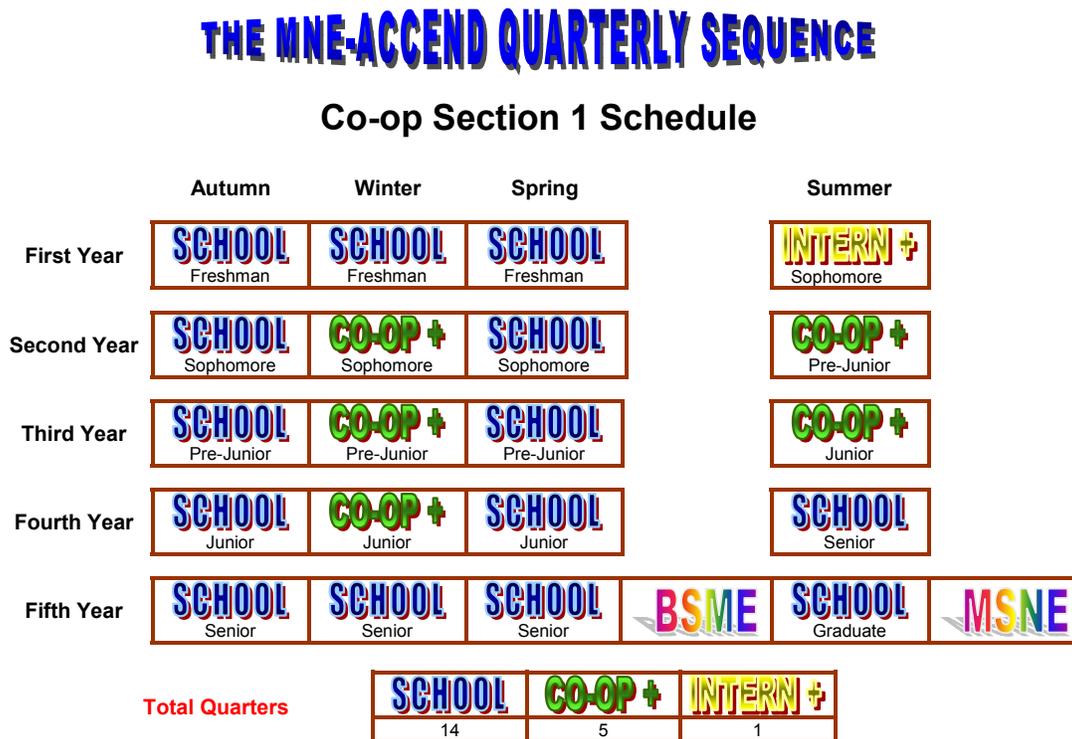
1. Introduction

In this paper we summarize a few lessons learned during our early experience of developing, delivering and implementing a series of distance learning (DL) classes for full-time undergraduate students enrolled in the combined-degree BS Mechanical + MS Nuclear Engineering 5-year and co-op based “MNE-ACCEND” (Mechanical and Nuclear Engineering Accelerated Engineering Degrees) program at the University of Cincinnati [1-2]. This program is currently in its third year since inception and currently hosts approximately 35 undergraduate students enrolled throughout the graduating classes of 2008, 2009, and 2010, which is when these students are expected to complete their BS Mechanical and MS Nuclear Engineering degrees. In addition, 20+ newly confirmed students are expected to enter this program in the fall quarter of 2006 to become our Class of 2011. Therefore, the successful “follow through” of the DL component of this program continues to be increasingly crucial as the student pipeline reaches a targeted steady-state of about 10 to 15 graduates per class.

It should be noted that the University of Cincinnati (UC) is the global birthplace of cooperative education, dating back to 1906, when 27 engineering students at UC piloted a program that combined school with professional work experience [3]. One hundred years later, co-op rotations are still an embedded and compulsory aspect of all UC engineering curricula. The MNE-ACCEND program is no exception, so students in this program currently co-op at a variety locations around the US, such as nuclear utilities (FENOC, Exelon Nuclear), vendors like Westinghouse, private companies such as WSMS (Aiken, SC) and Ohmart Vega (Cincinnati, OH), as well as government and other type laboratories (Y12, Battelle).

Figure 1 illustrates the typical quarter-by-quarter schedule that a student in the program must follow during a “Section 1” Winter/Summer alternating co-op sequence. Not shown in the figure is the “Section 2” sequence, for students on a Spring/Autumn alternating co-op sequence. In either section, the students in the MNE-ACCEND program are required to co-op a minimum of 5 rotations in industry, typically in nuclear and/or mechanical engineering opportunities as dictated by supply and demand within the job market. While on co-op rotations, MNE-ACCEND students are required to take 5 distance learning (DL) nuclear and radiological engineering courses as part of their degree requirements.

Figure 1: Typical Section 1 (Winter/Summer Co-Op) Quarterly Sequence



1.1 Distance Learning Course Development

In the autumn of their sophomore year, students in this program take their first course to nuclear engineering on campus: “Fundamentals of Nuclear and Radiological Engineering” which is a prerequisite to all DL courses to follow. So far, UC Nuclear and Radiological Engineering faculty members have developed the first three DL courses for the MNE-ACCEND students advancing through the program. These courses are:

- Fundamental of Nuclear Reactor Theory (John Christenson)
- Fundamentals of Nuclear Fuel Cycles (G. Ivan Maldonado)
- Nuclear Concepts for Engineers (Henry Spitz)

2. Implementation

Developing DL classes doesn't take rocket [or nuclear] scientists, but it does require a sustained and focused effort over an extended period of time. In an academic setting, this effort is often [usually] self-paced and self-directed, with some advice from DL experts and support from DL technicians. However, there are always many more urgent and demanding tasks on the "to do" list of most faculty – including the routine necessity of teaching and managing on campus classes, research, and service tasks. Therefore, the combination of various circumstances can make it difficult to maintain a pre-set schedule for the development of a DL class [i.e., easy to fall behind]. Therefore, in our experience, it is highly recommended that a professor be given release time equivalent to at least an on campus class "buy out" during the development of a DL class. In practice, we've found that developing a DL class requires considerable more time and effort than developing or teaching an on campus class, requiring quite a bit of self-discipline.

Note that it might be much less difficult for an instructor to simply tape [video-record] his regular class room presentations. Unfortunately, at UC we currently do not have that luxury because we are developing a new set of undergraduate classes that will serve as technical electives for ME undergraduate students and thus we have tailored these courses in accordance to their academic background at the time they take a given course. For example, students do not take fluid flow or heat transfer until the third year of the curriculum.

2.1 Web-based Platform

At UC we've already adopted the Blackboard Academic Suite platform for all of our courses. This system provides the primary electronic interface between students and instructors. Each course taught at UC is automatically assigned a Blackboard website where the instructor can publish the syllabus, lectures, announcements, online tests, grades, etc., all in an electronic format that is easily accessible to the students.

For our distance learning classes, we've simply extended this same concept to include multimedia (video streaming) lectures that can be available as "course documents." Figure 2 shows a typical web-view of what a student might see when interfacing through Blackboard, much of it is self explanatory. For a typical 10-week course in the quarter system, an 8 to 10 module suite is likely appropriate. Each module contains several video-streamed lectures (3 or more) and each component has its corresponding set of review, homework and online assessments.

It should be noted that in certain situations, students out on co-op may not have high-speed Internet access or their employer may not necessarily allow them to use company resources in this fashion. In such special cases, we provide the students all the material needed via CD/DVD for their convenience, and UC students are required to have a laptop computer for their studies.

Figure 3 shows the view as a student enters a specific Module, in which the materials corresponding to each lecture are available. So far, it's been convenient to employ Microsoft products (Media, PowerPoint, Word) as the standard format of preference.

Figure 2: Blackboard Listing of Course Modules

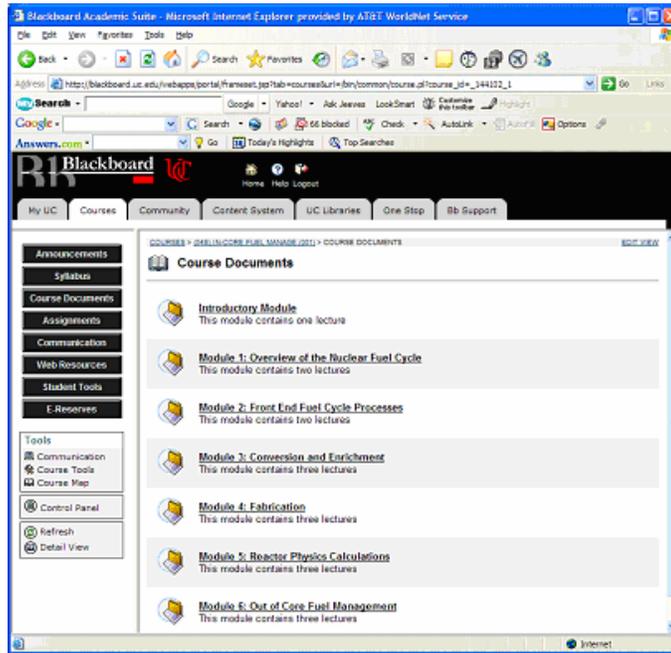
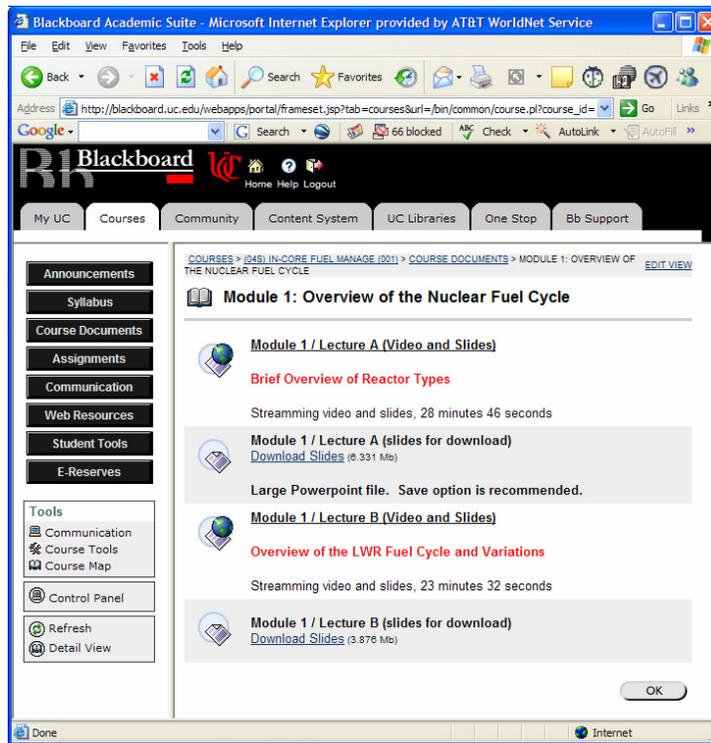


Figure 3: Blackboard Sample of a Module and Lectures



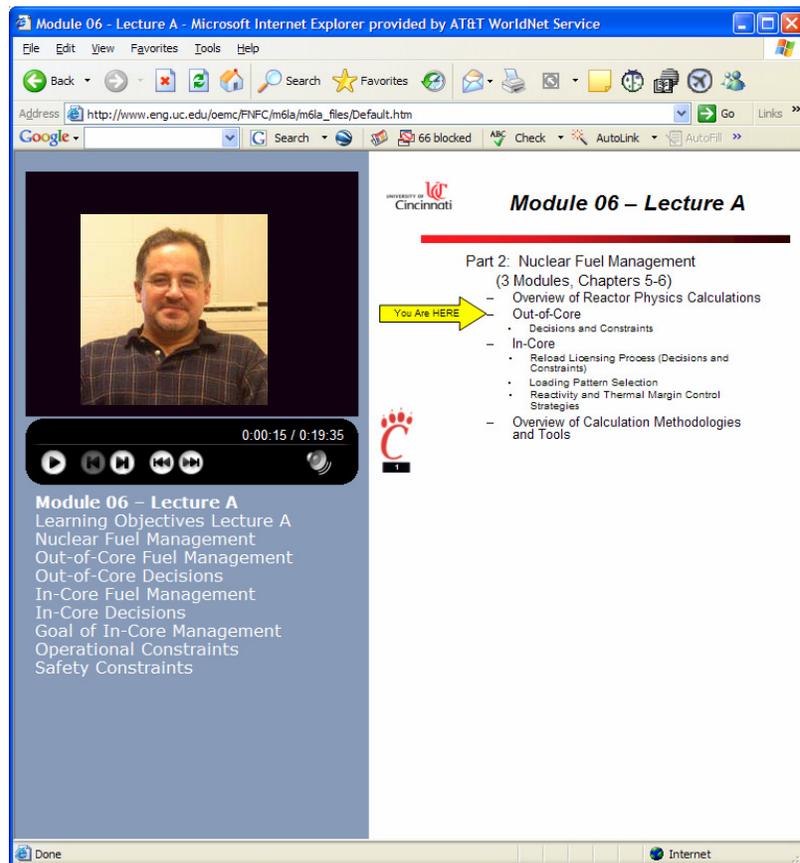
4. Course Management Experience – Growing Pains

In theory, all steps have been taken to launch this series of DL courses. The infrastructure is there and the courses have been developed and are available, etc. In practice, we've encountered a number of small issues that can quickly accumulate into major problems if not dealt with carefully and timely. In this section we'll attempt to outline a few of these key issues.

4.1 The Talking Head Syndrome

For example, DL courses as shown may not be particularly exciting to the students. In particular, what we sometimes humorously refer to as the "talking head," illustrated in Figure 4 by a clip of a lecture in progress, may be considered the most important aspect of the course from the instructor's perspective. After all, this is where we hope to carry forward the key points of each module. However, from the student's perspective, after regular work hours or during a weekend, this may well be the most boring and grueling stretch to survive through (and easy to put off). Therefore, we've come to realize that keeping these lectures short has its merits. In fact, more effort should go into applying interactive assessment and self-assessment tools (already available within Blackboard), assignments, take home tests, and other activities outside the lecture. These ideas, of course, also generally apply to on-campus courses, as well.

Figure 4: Blackboard Sample of a Lecture



4.1 Flexibility as a Double-Edge Sword and Lack of Personal Touch

The concept of a distance learning course immediately brings with it a welcome air of “flexibility” to the students. In principle, within a 10-week co-op assignment, it is up to the student to decide when and how march through the modules, lectures, and assignments. Consequently, in practice, it is no surprise that the more independent, self disciplined and more mature students tend to pace themselves much better through these experiences. However, the average students have had a rude awakening by what’s truly required to succeed in these DL courses. In fact, the early results have been bi-modal in nature, in which the top students keep pace and complete the course on time, but the more average students tend to return from their co-op assignment with a small fraction of the course completed.

As a result of these early findings, it has been deemed necessary to enroll graduate teaching assistants into the process to help keep track of the progress of each student. Also, instead of providing complete freedom, we’ve realized that a detailed timetable with specific milestones needs to be an essential part of the process. For example, “two modules every two weeks,” provides some flexibility, but also requires the students to complete their work in a timely fashion.

A further challenge is to preserve the degree of personal interaction and supervision that students who are taking engineering classes come to expect. For instance, a DL class is taken in nearly complete isolation without classmate contacts, whereby the interaction with the instructor nearly entirely via email, telephone or fax, something which is very different from the typical on-campus experience. Thus, understanding these adjustments and being sensitive to the changes the students are experiencing are key elements of the process. At this time, we’re considering to implement “on campus” sessions for students returning from their co-op rotations before they take their final exam (on campus) for each DL course, to give them the opportunity to iron out specific areas of trouble, or to simply play a little “catch up.”

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References

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