

Development of a Reconfigurable Construction Engineering Classroom / Laboratory

Charles McIntyre, Associate Professor
Gary Smith, Professor
Construction Management and Engineering
North Dakota State University
charles.mcintyre@ndsu.nodak.edu

Abstract

Engineering education requires a combination of classroom training, hands-on experience, and industry participation. In addition, students must become fairly well versed in the use of the technological tools of the trade. In order to accomplish these goals, engineering programs must develop innovation use of space and provide state-of-the-art technologies that can be used by both the students and the instructional staff. The contents of this paper describe: 1) the overall conceptual plan of the CCL, 2) the proposed use of the CCL (use analysis), 3) the equipment and technologies for the CCL, 4) the phased construction schedule, and 5) a summary of the work completed.

Introduction

Traditional classrooms (i.e., fixed seating and small desks/work area) are usually configured for lecture-based instruction and are limited in their functionality for group work. The Division of Construction Management and Engineering (CME) at North Dakota State University (NDSU) has developed a reconfigurable multi-use classroom / laboratory that is the primary meeting space for most CME courses. The Department of Civil Engineering and Construction at North Dakota State University consists of two divisions, the Division of Construction Management and Engineering and the Division of Civil Engineering. The Construction Management and Engineering (CME) Division has accredited degree programs in construction engineering and construction management. Based on recent Accreditation Board for Engineering and Technology (ABET) and the American Council for Construction Education (ACCE) accreditation reviews, it was recommended that the CME Division acquire additional space dedicated primarily for construction education, i.e., a construction classroom / laboratory (CCL). Based on this recommendation, a plan was developed to acquire additional space for the dedicated CCL.

Conceptual Plan and Use Analysis

After consulting with the Vice President of Academic Affairs, representatives from Informational Technology Services (ITS), and various Department Heads, it was decided that the existing classroom designated as CIE (Civil and Industrial Engineering) 102 should be the space dedicated to the CCL. At that time CIE 102 was designated as a university classroom which could be used for any class from any department or college. The room consisted of permanently floor-mounted tables with fixed chairs. Seating capacity was listed at 60. Our conceptual plan called for a complete remodel of the entire room. This renovation would include new reconfigurable furniture, instructional technologies (computer, projection system, Internet access, document camera, etc.), VCR, storage facilities (for maps and plans), and portable wireless computer technologies (Figure 1). After creating the conceptual plan, a "use plan" was developed that would and could be used to justify the costs associated with the conceptual plan (Figure 2). The primary user of the CCL is the Division of Construction Management and Engineering (CME), however, as indicated in the tables other Departments have access to the CCL, as part of the agreement between the CME Division and the Provost. The use analysis is needed in order to develop a CCL budget and to justify costs.

Equipment and Technologies

The CME Division developed a three-phase plan for renovating and updating CIE 102 into the CCL. Most CME courses will be offered in the CCL, however, the room will be designated and used as a general education class room, as indicated in the use analysis. This three-phase effort is outlined as follows:

Phase 1 (\$20,169 - funded by CME Division)

Removal of existing blackboards, fixed furniture, and front platform; cleaning & painting; installation of dry boards; installation of modular furniture. Summer 2002.

Phase 2 (\$13,362 - funded by the Provost)

Install classroom technology: ceiling mounted projector, computer, laptop connection, document camera, VCR, Personal Response System, etc. Summer 2002.

Phase 3 (\$25,000 - funded by Student Activity Fees)

Purchase and install portable computer system and a wireless network installation (15 laptop computers with a recharging storage cabinet, a wireless network for printing and Internet connection). Summer 2003.

Summary

By the end the 2002 Fall Semester, CLL Phases 1 and 2 were completed. All moveable furniture and accessories have been purchased, as well as, the installation of the classroom instrumentation station. All applicable software programs have been installed on the Windows XP operating system (M.S. applications: Word, Excel, Media Player, etc.; Internet options: IE Explorer, Netscape, access to Blackboard, etc., and all Construction related software: Primavera, Project, Expedition, etc.). Figure 3 provides an overview of the CCL. Phase 3, which is the installation of the Laptop Cluster, has yet to be completed. This phase consists of the purchase and installation of the laptop computers, wireless network, and charging station. Quotes were obtained during the summer of 2003.

The basic rationale for the CCL was: 1.) to provide students with exposure to the technological tools currently used within the industry, 2.) to offer faculty state-of-the-art teaching tools that will promote student learning, and 3.) to provide a classroom/laboratory environment that is physically flexible and reconfigurable. Valuable input was collected from students, faculty, and the CME Industry Advisory Council in order to determine the final requirements for equipment and software purchases.

Contained within the course evaluations that are completed each semester, we have added some questions that specifically address the physical classroom environment (as well as instructor ratings). Student feedback concerning the equipment and technologies in the CCL has received very high ratings (4.7 on a 5-point scale). The undergraduate students use the CCL for many of the group presentations and many graduate students use the technologies to present their research work to faculty and students (for the seminar class). The few negative comments were focused mainly on the furniture, specifically the chairs. The plastic stackable chairs are just not as comfortable as the cushioned auditorium seats (this in one of the trade offs). Industry input concerning the CCL was obtained during the "peer review" process (the CME Division requires industry peer evaluators to visit all CME classes at least once per semester - to comment on the syllabus, teaching style, etc.). Industry reviewers were very impressed with the work accomplished in Phase 1 and 2. In addition, most industry presenters (guest speakers) were impressed with the array of technologies available and their ease of use.

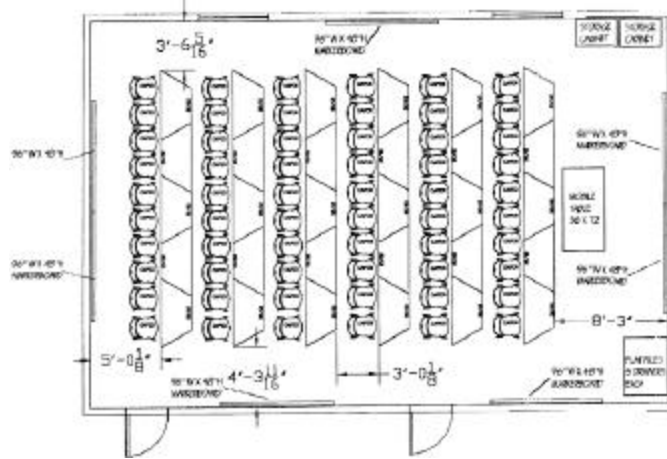


Figure 1 Conceptual Plan

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:00 - 9:00	CME 325		CME 325		CME 325
9:00 - 10:00	CME 205		CME 205		CME 205
10:00 - 11:00	CE 445/645		CE 445/645		CE 445/645
11:00 - 12:00		CME 453		CME 453	
12:00 - 1:00	ME 352		ME 352		ME 352
1:00 - 2:00	CME 409 16	CSCI 374	CME 409 16	CSCI 374	
2:00 - 3:00	CME 385	CAPSTONE	CME 385	CAPSTONE	
3:00 - 4:00	CME 301 CE 796	CME 301 35 CE 796 1	CME 301 CE 796		CME 301 CE 796
4:00 - 5:00	CME 411/611		CME 411/611		
5:00 - 6:00	CME 412	CME 412	CME 412	CME 412	

Figure 2 Use Analysis - 2003 Spring Semester



Figure 3 Conceptual Plan