

AC 2008-385: MULTI-MEDIA INTERACTIVE SELF-DIRECTED CAD APPLICATIONS LEARNING MODULES FOR THE CONSTRUCTION MANAGEMENT STUDENTS.

Hussein Abaza, Southern Polytechnic State University

Javier Irizarry, SPSU

Zuhair Itr, Southern Polytechnic State University

Multi-Media Interactive Self-directed CAD Applications learning Modules for the Construction Management Students.

Abstract

This paper discusses multi-media, online, Interactive, self-explanatory Computer Aided Design (CAD) course instructions. These instructions were designed to assist the students in utilizing CAD applications related to the construction industry. Most of these course instructions were used in the “Fundamentals to Construction” which is an introductory course for basic construction and CAD skills, as well as to prepare the students for other building construction courses. The new course instructions included video-clips, screen captures, written interactive instructions, as well as self explanatory assignments which allow each student to work independently. This course also includes list-serve for all construction management students to post questions related to CAD in construction.

In order to provide up-to-date CAD related resources and continuous support, all construction management students maintained access to the CAD instructions after completing the Fundamentals to Construction course. The students’ response to this teaching method was outstanding, and the score of the Students’ Opinion of Instructors’ Survey (SOIS) for this course was the highest at the university level.

Introduction

Computer Aided Design has become an integral part of any construction project. Traditional paper blueprints are quickly becoming too primitive to meet the needs of the current building industry. Architects now share CAD drawings to expedite the design development and review cycles in order to increase construction productivity. In addition, researchers suggest that using CAD increases the students’ creativity and problem solving [3].

Familiarity with the development and exchange of CAD drawings is now a necessary skill in most engineering fields in general, and particularly in the construction industry. Most high schools in the United States and Canada now offer Auto CAD and other CAD software classes for their students [7]. Many Construction Management programs in the US offer CAD training as part of their curriculum.

Teaching CAD applications is especially challenging when there is a large gap in the students’ backgrounds. Many attempts were made to make CAD instructions practical and enjoyable to students with different backgrounds [1], [2]. While students with previous knowledge of CAD obtained in high school expect advanced CAD instructions related to the construction management, students with no previous CAD experience expect basic CAD instructions at first, and before advanced CAD applications can be offered. In addition, some students come to the Construction Management programs with little knowledge in computer applications compared to their peers which put them in a hard position. This is especially true for students from countries where computer applications are not taught in high schools. Under these circumstances, a lecture only delivery method might not be the best teaching practice. Therefore, individual instructions were sought as a solution to bridge the gap in the students’ CAD experience.

CAD teaching Modules;

The “Fundamentals of Construction” is a required course for all the Construction Management students at East Carolina University. This course is offered in three to four sections each

semester with an approximate annual enrollment of 200 students. The course prepares the Construction Management students to effectively utilize the new CAD tools in their future careers.

The researcher has obtained a teaching grant to produce the multi-media, Interactive, self-explanatory CAD course learning modules for the Construction Management students.

The goal of these learning modules is: 1- to teach the Construction Management students how to use the lab time effectively during and after the class hours, 2- encourage useful interactions among the students themselves, 3- allow the students to work independently and in teams, 4- address the different students capabilities and needs, and 5- to encourage students to build skills related to reading and following instructions without having direct training and supervision.

The CAD learning modules were incorporated with lectures and other learning modules. The course content of the Fundamentals to Construction consists of the following;

1. Detailed multi-media online interactive self-learning instructions; these instructions consist of 17 teaching modules. The first module includes introduction to Windows® operating system, and saving and handling computer files. The next eight modules guide the students through very detailed step by step instructions in using CAD for building construction. Each module requires the students to finish one or more assignments to demonstrate mastering the required skills in that module. The written instructions (Figure 1) are also supported by video clips and screen captures which was produced using the Camtasia® software (Figure 2). These tutorials also include 3D animations, interactive instructions and trouble shooting instructions. All these instructions are posted on the course Blackboard© course management system.

In addition to the formal computer lab sessions, the students were asked to install AutoCAD on their personal computers to be able to work at home. At the beginning of each lab session, the teacher gives 10-15 minute quick review of the assignment, shows the main features of the software that should be utilized, clarify the main objectives, and set the timetable to finish the assignments. Then, each student follows the written instructions, and completes the assignment. Students were encouraged to work together, and the teacher is available to answer questions related to the assignments. After successfully finishing an assignment, the student can start working on the next assignment without waiting for his peers to finish the same assignment. Thus, students with previous CAD experience advance more quickly in the course, and do not have to wait for the other students that have less experience to finish certain learning modules in order to proceed to the next module. When a common question arises during the lab, the teacher gathers the students that faces the same problem, and explains that problem to them while the other students continue to work without interruption.

In order to make sure that the students will achieve certain learning bench marks, deadlines are assigned for bundles of learning modules. For example, the assignments in the first four CAD learning modules would be due at the end of the fourth week of the semester. Students are required to submit their assignments for review before the deadline in order to receive feedback and credits for these assignments. Since the course is based on structured assignments, the students can not skip any assignment even if they could not finish it within the time frame.

2. After mastering the basic CAD skills, the students are required to finish eight more CAD learning modules, which cover advanced CAD techniques used in the construction industry. These modules include using paper space and model space, attributes, external references,

sharing CAD files applications, using CAD in manufacturing building components, and using CAD for scheduling and estimating.

3. Due to the different CAD backgrounds of the students as explained before, some students might be ahead in completing their CAD assignments. So, other advanced CAD learning modules are offered in the form of electives and bonuses. These modules include using CAD in civil engineering, 3D modeling, 3D printing, incorporates CAD with other measurement tools for building documentation, using CAD with GIS, and using advanced CAD techniques to produce shop drawings. All these learning modules are available for the students online.

4. The Fundamentals to Construction course is not dedicated to CAD applications only. This course includes other technical skills such solving orthographic projections problems, assignments in manual drafting of plans and construction details. These assignments are given concurrently with the CAD assignments. So, students who need extra help in CAD can work on the other assignments at home and dedicate more class time for the CAD modules.

5. In order to provide a continuous CAD support, a list-serve which includes all the Construction Management students at East Carolina University was dedicated to the discussions of CAD related issues in construction, and to provide continuous education for all Construction Management students. The students were also encouraged to post questions, and provide feedback about their experience in the class.

Evaluation Plan;

In order to test the effectiveness of these teaching modules, an evaluation plan was developed. This evaluation plan included: 1-peer reviews by the Construction Management faculty, assessment and testing samples of the CAD instructions by former students, monitor the frequency of accessing the online CAD application tools, as well as monitoring the students' participations in the list-serve discussions. The evaluation plan also included a questionnaire to measures the efficiency of the proposed instructions, the convenience of using the lab tools, the students participation and interaction, and the students achievements. In addition, University SOIS, and the survey of graduated students were used to evaluate the effectiveness of this course delivery method.

Results;

This paper discussed implementing 17 multi-media interactive self-directed cad applications teaching modules in a construction management class. After implementing the CAD teaching modules, the students' performance has increased dramatically. The students had the opportunity to work independently on their CAD assignments and on their own speed. More class time was available for lecturing, addressing other course contents, and provide one-to-one support for students. The amount of work in this course was significantly increased. The students were challenged and started to spend more time in the lab after the end of the official lab time. The Construction Management students also started to work together, and improve their inter-personal relationships. The class atmosphere became informal and more enjoyable for both the students and the teacher.

After Implementing these learning modules in the Fundamentals to Construction course, the score of the SOIS for this class reached 6.98 out of 7, and it was the highest at the university level (Figure 3), (Figure 4). Some of the students comments in the survey says; “I learned a lot in this class”, “I loved this course”, “ I like the on your own speed”, “ This is the best class I have ever had so far”, “ you learn skills that lasts with you”. The positive impact from implementing these teaching modules encouraged other faculty to offer similar course instructions in other classes.

Reference:

- 1- BENNETT, Ray, 2003; “Teaching AutoCAD to sing”, Architectural Record; Jun2003, Vol. 191 Issue 6, p59, 1/2p, 1c.
- 2- Chester, Ivan, 2007; “Teaching for CAD expertise” International Journal of Technology & Design Education, 23(13).
- 3- Robertson, Brett F. 2007: “Creativity and the Use of CAD Tools: Lessons for Engineering Design Education From Industry. Journal of Mechanical Design, Jul2007, Vol. 129 Issue 7, p753-760.
- 4- Garc, Rubio, 2005: “Present state of CAD teaching in Spanish Universities”. Computers & Education .
- 5- García, Ramón Rubio ,2007; “Teaching CAD at the university: Specifically written or commercial software?” Computers & Education; Nov2007, Vol. 49 Issue 3, p763-780.
- 6- Hollowell, Martha, 2006; “Offering AutoCad Training Online” Community College Week; 3/13/2006, Vol. 18 Issue 16, Special section p13-13, 1/3p.
- 7- Willms, 2007; “CAD/CAM” Tech Directions, May2007, Vol. 66 Issue 10, p13-16.

Add the Interior Doors and Openings

All doors should be drawn on 'A-Door'

Overhead features at openings should be drawn on 'A-Flor-Ovhd'

Interior swinging doors should be located with the hinge 4" from the adjacent wall

Interior bi-fold doors should have the opening centered on the closet wall

Insert the 'DOOR_SWING' and 'DOOR_BIFOLD' blocks using the scale factors and rotations indicated

TIP: You can use the **FROM** object snap to insert the blocks at the correct locations or insert them and then **MOVE** them to the correct positions.

NOTE: The interior door blocks have been drawn in one orientation and at a size of 1" to eliminate the

need to have multiple blocks for every door size and orientation.

By using a scale equal to the door width in inches the door blocks are inserted at the correct size.

By using negative and positive scale values, and various rotation angles mirrored and rotated door orientations are possible.

Add lines on the 'A-Wall' layer to cap the interior walls on each side of each opening

Trim the interior walls out of the openings

Add lines on the 'A-Flor-Ovhd' layer for the overhead features at the Kitchen and Dining Room openings

Add identification labels for the interior doors using the 'DOOR_IDEN' block

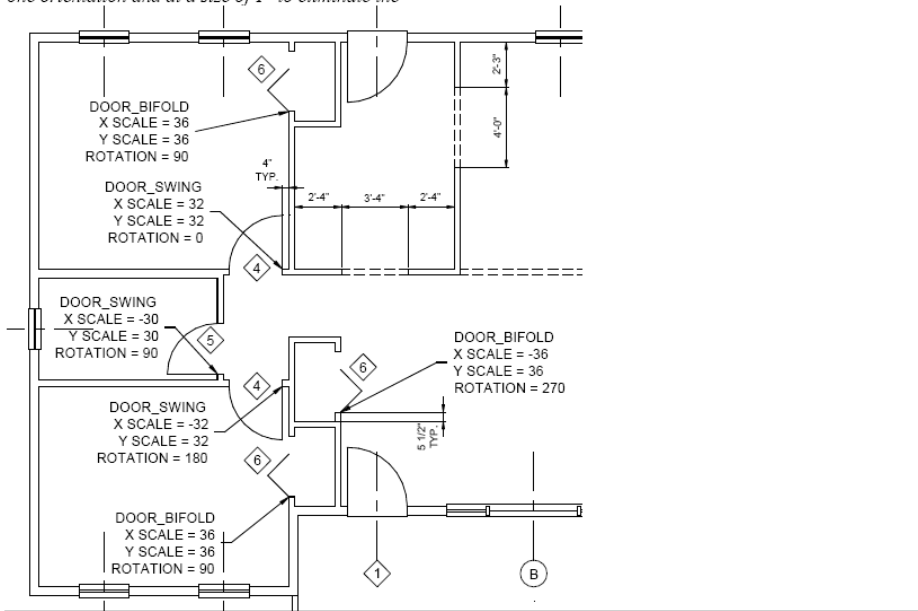


Figure C-10-09 Interior doors and openings

Figure 1: Sample of the written instructions in the CAD learning module.

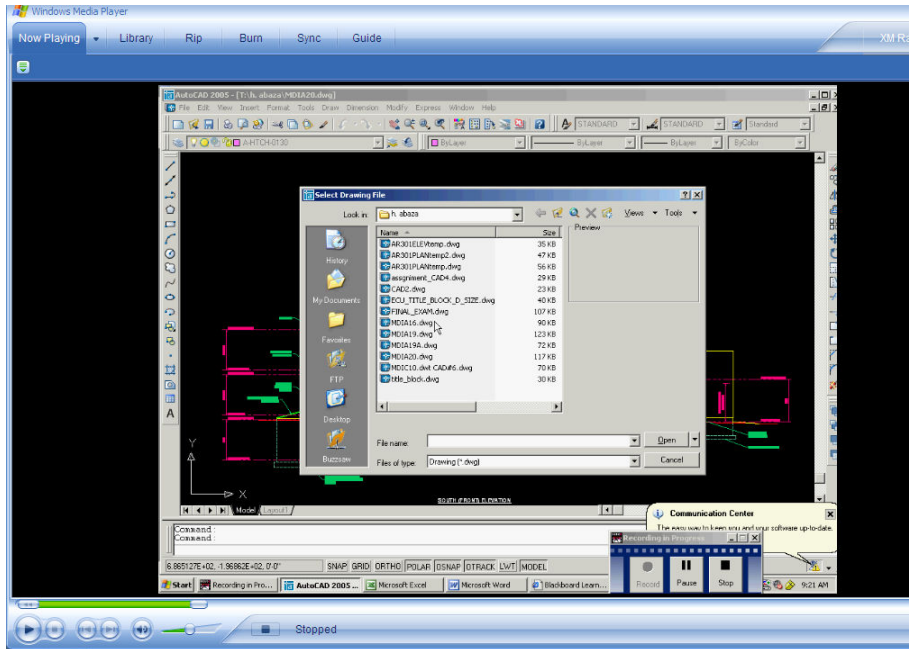


Figure 2 ; Sample of a video clip used in CAD learning Modules.

Course: FOUND OF CONSTRUCT		(CMGT 2E00, section 001)		Student Opinion of Instruction Survey												
Instructor: ABAZA, HUSSEIN		class size: 18		Spring: 2006												
Department: CONSTRUCTION MANAGEMENT (32-CMGT)				Campus: Main Campus												
(Rate: 16/ 18=88.9%)		Frequency Distribution of Responses														
Question	#	Strongly Disagree					Strongly Agree					NR	N	Mean	Median	Std
		1	2	3	4	5	6	7	8	9	10					
Helpful	2	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Grade Criteria	3	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Objectives Clear	3	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Preparation	4	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Enthusiasm	5	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Evaluation Methods	6	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Textbooks	7	0	0	0	0	0	1	12	1	2	13	6.92	7.00	0.28		
Challenging	8	0	0	0	0	0	1	13	0	1	14	6.93	7.00	0.27		
Syllabus	9	0	0	0	0	0	1	14	0	1	15	6.93	7.00	0.26		
Questions	10	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Understanding	11	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Availability	12	0	0	0	0	0	2	12	1	1	14	6.86	7.00	0.36		
Feedback	13	0	0	0	0	0	0	14	0	1	15	6.93	7.00	0.26		
Respect	14	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Points of View	15	0	0	0	0	0	0	14	1	1	14	7.00	7.00	0.00		
Tested on Materials	16	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
Course Content	17	0	1	2	5	7	0	0	0	1	15	4.20	4.00	0.94		
Amt. of Work	18	0	2	1	7	4	1	0	0	1	15	4.07	4.00	1.10		
Overall, Effective	19	0	0	0	0	0	0	15	0	1	15	7.00	7.00	0.00		
20	0	0	0	0	0	0	0	0	0	16	0	.	.	.		
21	0	0	0	0	0	0	0	0	0	16	0	.	.	.		
22	0	0	0	0	0	0	0	0	0	16	0	.	.	.		
23	0	0	0	0	0	0	0	0	0	16	0	.	.	.		
24	0	0	0	0	0	0	0	0	0	16	0	.	.	.		
Hours Spent	25	0-2 hours:13	3-4 hours:1	5-6 hours:0	7-8 hours:0	9 or more:0	no response:2									
Class	26	Freshman:11	Sophomore:3	Junior:1	Senior:0	Graduate:0	Other:0	no response:1								
Reason for Course	27	elective:0	choice among required:0	no other options:0	required:14	no response:2										
Expected Grade	28	A:15	B:0	C:0	D:0	F:0	I:0	no response:1								
Summed Scales Statistical Information:		This course				Unit Norm*				University Norm**						
Questions 1-16 (except item 7)	12	104.67	105.00	1.15	153	93.27	102.00	18.28	10572	94.02	100.00	14.64				
Based on individual summed scores																
Based on individual mean scores	15	6.98	7.00	0.07	177	6.13	6.73	1.24	12923	6.21	6.55	0.99				
Questions 17-18 (summed scores basis)	15	8.27	8.00	1.83	171	9.21	9.00	2.43	12488	9.08	9.00	2.76				
Question 19 (mean scores basis)	15	7.00	7.00	0.00	172	6.05	7.00	1.31	12652	6.14	7.00	1.32				
* Unit Norm reflects the mean, median, and standard deviation for all courses in this unit at this course level.																
** University Norm reflects the mean, median, and standard deviation for all courses at ECU at this course level.																
Note: Numerator for response rate may include students who only made comments; rate may not reflect late adds/drops.																

Figure 3 : Results of the Students' opinion of Instructors' Survey after applying the new CAD learning modules.

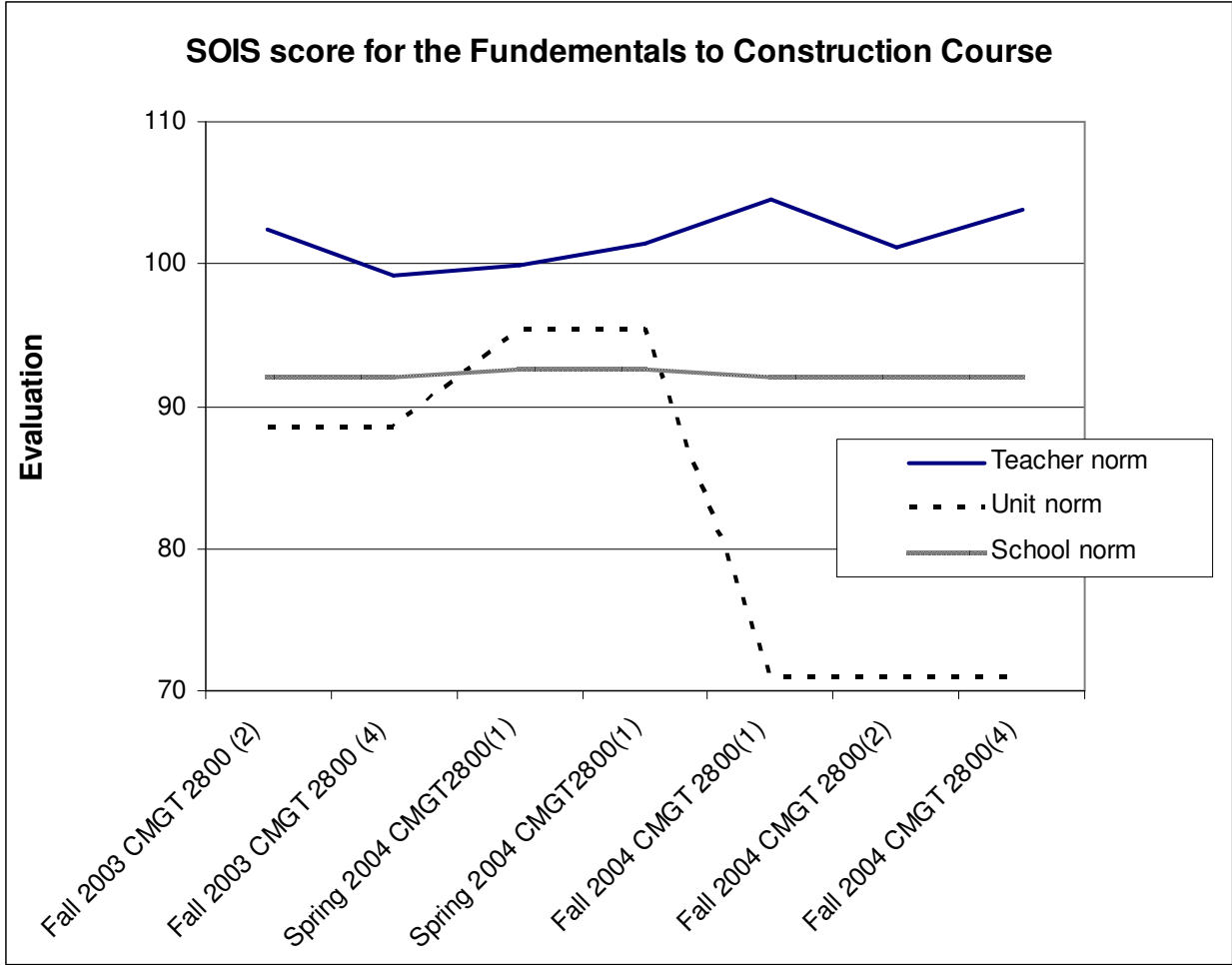


Figure 4 : Summary of the Students' Opinion of Instructors' Survey after applying the new CAD learning modules. Each section has 20 – 22 students.