

TEACHING 3D SOFTWARE IN A BIG CLASS: THE METHOD AND THE STATISTICAL ANALYSIS IN 3D EDUCATION

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Abstract

This paper introduces an experimental course to teach 3D software for more than 200 students at the same time in a semester, and discusses about the quality of results and the statistical analysis. The results are shown as the 3D rendered images made by the students in the general education course. Based on the statistical data from the course, the correlations between the score of students and several factors, such as, access number to online discussion board, gender, software-purchased, degree program, etc. are analyzed.

1. Introduction

Currently the visualization using 3D computer graphics (CG) is not a special skill but a common one, not only in architecture but also in many other fields. Though the courses of 3D modeling and rendering were offered only to graduate students ten years ago in academics, the CAD and CG courses are now usually offered in the undergraduate programs. Especially in the architectural programs, many schools offer 3D CG courses for freshman and sophomore, because the skill is very useful in design studios. In short, it is important to provide the course for as many students as possible, and the students should learn the skills as early as possible.

However, the most of 3D CG courses are usually designed for a small group of 20 ~ 30 student because of the limitation of space and computers. Therefore, it has been necessary to find good methods of teaching 3D CG for a large number of students with limited resources. In addition, in order to evaluate and compare the methods, it is important to understand how well the current students can demonstrate their skills with some sample results in the situation.

2. Background

Our school accepts more than 300 freshmen in the architectural program every year. There is a selection between the 2nd year and 3rd year, and only 50 students

can go to the upper division program in Architecture. Since it is too late to start teaching 3D CG skills after the selection, a CG course is offered to the students of lower division program once a year.

FormZ (Auto-des-sys 2005), which is a product from Auto-des-sys Inc. and one of the most popular application packages of 3D CG, is used in the course, because they offer a good program called “Form –Z Joint Study Program” for academic use (Yessios 2004). Though our school provides several elective courses to teach CAD and 2D CG with AutoCAD (AutoDesk 2005), Photoshop (Abode 2005), etc. for the students of lower division but it is not mandatory. The most of students learn FormZ without any experiences of them. Unfortunately, this is the only course for 3D CG in our school and the instructor must teach from the beginning level to the professional level.

3. Method

This section explains the course details briefly.

3.1. Course structure

The course is a 3-unit course in which the students attend the lecture and laboratory for 3 hours per week. The course consists of three sessions: Lecture Session, Lab Session, and Online Session. Lecture session is one-hour lecture per week, and it is held in a big lecture room with

capacity of 300 people. The instructor demonstrates the process of modeling and rendering using two projector screens at the same time. One screen is used for showing slides, and another is for running the software. The slide show files are downloadable from the course website. The room does not have any PC for students, but they can bring laptop computers and access to Internet using wireless network cards.

The Lab session is one-hour hands-on workshop, but it is held in a small computer laboratory whose capacity is 48. The room has 24 PCs, so some of the students need to share one PC. One exercise is assigned per Lab session, but the exercise is not available before. If the exercise is not completed on time in the session, the students lose the some points. Therefore the students are supposed to do some examples shown in the Lecture session before. Each session is prepared by a teaching assistant (TA). At the beginning of the session TA hands out one page assignment sheet showing today's exercise. The sheet shows only the final output image of exercise without showing the process step by step.

The last session is held online using Blackboard system (Blackboard 2005). Discussion board is used to help the students for completing the assignments. All of the course materials and information are downloadable on the system.

3.2. Resource

The students can use PCs in public space from 7:00am to 12:00pm. One of the biggest computer room have 205 PCs (Dell OPTiPlex GX270 3.0GHz) and 50 Macs (Flat Panel iMac 700Mhz) The information of other spaces is available at the following site (<http://www.asu.edu/it/tempe/sites/>). We have 102 Form-Z (version 4.0 in 2004) licenses so that 102 packages can be run at the same time from any computers at University.

3.3. Assignments and grading

Four main projects are assigned in the course. The first project, to create a scene of garden with trees and walls, was assigned in 4th week. The second project, to model a building around our campus, was assigned in

8th week, and the third one, to present an interior space using Radiosity rendering, was assigned in 12th week. The last assignment is to create a portfolio including the assignment 1, 2, 3 and additional CG images. The 47% of grade was evaluated from these 4 projects, 42% from Lab session, 4% from Online session, and 6% from three small quizzes.

4. Student works

This section shows the output images of each grade. The top 5 students got A+. The numbers of students, who secured A, A-, B+, B, B-, C+, C, D and E, were 26, 23, 18, 39, 22, 18, 19, 12, and 8 respectively. The grade "A+" was given to the students with more than 90% of full score, "A" with more than 80%, "B" with more than 70%, "C" with more than 50%, "D" with more than 37%, and "E" with less than 30%. Finally 190 students got the final grades, and about 30 students dropped the course during the semesters. Each figure has two images of assignment 2 and 3 for each grade. All assignments of students were graded by 3 teaching assistants (TA) and the instructor in order to keep fair grading.

5. Analysis

The statistical data in the course is explained and analyzed here.

5.1. Data

Table 1 shows the summary of the data about gender, software purchase, degree program, and selection results. Each category describes the number of students as Number, the average score as Ave, and the standard deviation as SD in the table header. The average score was 72.3 and the standard deviation was 16.6 among 190 students. The gender category shows the difference between male and female. The second category shows the difference between the students who purchased the software and those who did not. The third one is about the difference between the students of Architectural program and those from other degree programs. The last category shows the selection results among 151 students in



Figure 1: Output images of grade A+ (plus)



Figure 2: Output images of grade A



Figure 3: Output images of grade B



Figure 4: Output images of grade C

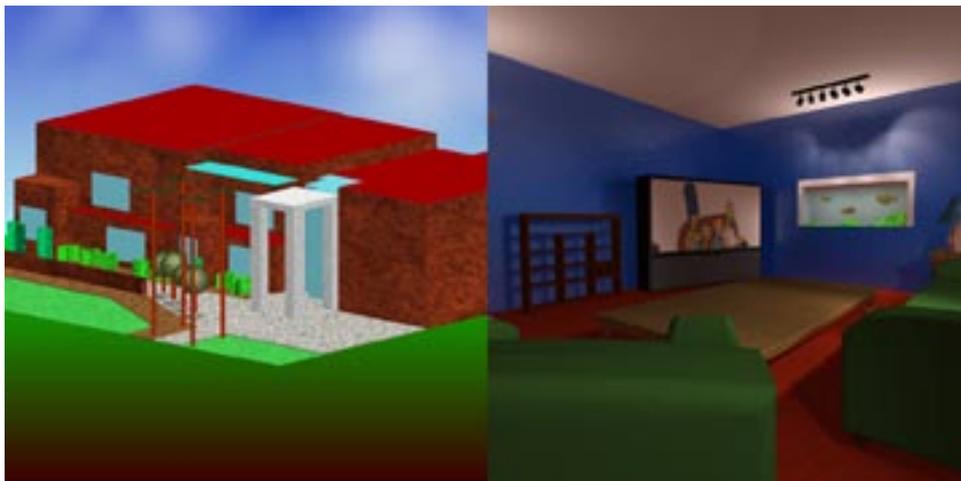


Figure 5: Output images of grade D

Architectural program. 52 students could go to the upper division program of Architecture, and 25 of Landscape Architecture. The other 74 students were not allowed to go to upper division program at our school. Figure 6 presents the detailed information of each category above as a histogram, and the correlation between the score and the access number to Online Discussion Board is presented in the last graph.

5.2. Consideration

As described above, the students, who secured high grades, have accessed online discussion board more often. The equation is defined as $\langle \text{Score} \rangle = 0.12 \times \langle \text{Access} \rangle$

Number \rangle . In short, the students who got one better grade accessed to the board 7 more times a week. The female students got a little higher average score than the male, but the standard deviation of female students was smaller than those of male. The students who purchased the software got lower average scores than those who did not. Therefore, they do not necessarily purchase the software in order to get better grades. In other words, our school provides good resources for learning 3D software. The students in Architectural program got much better grades than those in other programs. The reason can be considered that they had more opportunities to learn 3D software skills from each other in design studio courses

Table 1: Summary of data.

	Number(190)	Ave (72.3)	SD (16.6)
Female	75	74.1	14.0
Male	115	71.2	18.0
Software Purchased	40	67.5	24.4
Not Purchased	150	73.6	13.6
Arch Program	151	74.9	12.8
Non-Arch Program	39	62.4	24.5
BA in Arch	52	81.9	6.98
BA in Landscape	25	75.7	6.51
None Degree	74	69.7	15.1

than those in the other programs. Finally, the average students who passed the selection for upper division got grade A in the course, though the total design skill and GDP was evaluated in the selection. This fact proved that the students with good design skill demonstrated good ability in 3D CG.

6. Conclusion and future work

- This paper described the experimental course to teach

3D computer graphics skills in a big class where more than 200 students were enrolled.

- The method and results were explained with output images of each grade.
- The correlation between the skills of 3D computer graphics acquired in a fundamental course and the access number to the online discussion board was analyzed in order to demonstrate how much important it is to use the board for learning 3D skills.

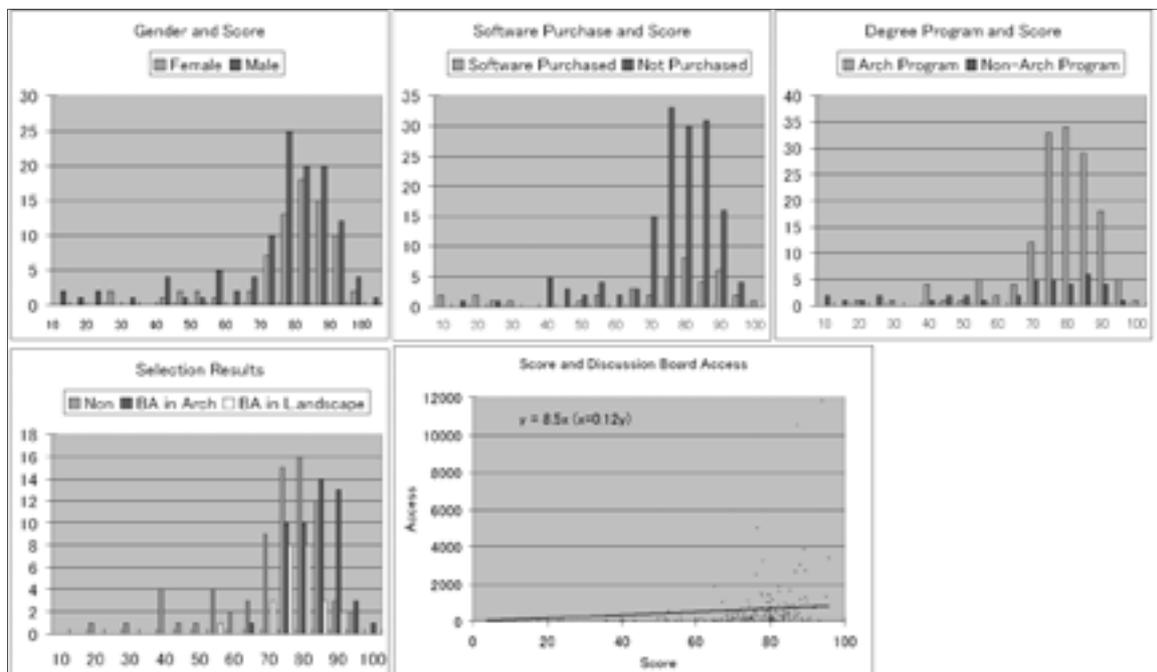


Figure 6: Histograms for categories and correlation between the score and the access number to Online Discussion Board.

- The difference in skills was also analyzed in terms of gender, software-purchased, degree program, and selection results.
- It will be a good future work to compare the results of the other schools in the world using the same analysis.

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Areas of interest: Artificial Intelligence, Soft-computing, Image Processing, City Modeling, GIS, Remote Sensing, Computer Graphics, Information Technologies