

IMPACT OF AN ALTERNATIVE TEACHING METHOD: PERSPECTIVES OF MINORITY FEMALE ENGINEERING STUDENTS

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ABSTRACT

Computers have not only revolutionized the way classes can be taught or laboratory experiments run, but computers make it possible to provide increasingly fuller pictures about concepts that can aid the engineers' judgement (2).

As we enter the next millennium, more computer-based teaching methods will be used to enhance the educational process for engineering students. Research indicates that the interactive multimedia instructional method, which is one of the most effective state-of-the-art methods, have the greatest potential to function as a standard for professional learning (1 and 4).

During the 1994-95 academic year, this method, which uses the personal computer along with an assortment of media aids, was introduced to junior and senior level minority female students enrolled in an undergraduate Transportation Engineering course. The performance of these students compared to non-female students was measured and a significant improvement in their visualization of theoretical concepts was realized as well as documented.

Therefore, the purpose of this paper is to discuss a non-traditional teaching method of the future, describe the receptiveness of minority female engineering students toward this new form of instruction, and how this method enhances the transportation subject area.

INTRODUCTION

Generically speaking, "multimedia" is the presentation of an assortment of concepts converted to graphics, images, and animated video clips through the use of audio, video, and computer technology. As we enter the 21st century, more multimedia instructional presentations are bound to find their way into the classroom of many engineering professors. By doing so, the traditional instructional methods will be complemented with an improved quality of instructional material, provided we don't lose sight of the pedagogical intent of one's instruction.

The objective of this paper is two-fold: (1) incorporate the use of multimedia courseware materials into the CE 382 - Transportation Engineering II class; and (2) evaluate the impact this instructional material had on minority female engineering students enrolled in the class.

BACKGROUND OF CUSTOMER AND USER

Customer

During 1994-95, the Civil Engineering Department at Southern University consisted of 7.5 full-time equivalent faculty members and approximately 120 undergraduate students. All students enter the College of Engineering and the Department after completing 24 semester hours of general requirements in the Junior Division. However, students are allowed to affiliate with a department and take courses in that department prior to their official admittance into a college. All students who meet the Junior Division's requirements for transfer are accepted into the College of Engineering. The University is required to accept all students with high school diplomas into any field of study.

The Department made major revisions to the civil engineering curriculum during 1992-94. These changes were inspired by the desire to reduce the number of credits required for graduation and the lack of flexibility in specialty course offerings. The current program consist of 142 hours. Students are required to take two specified courses in transportation, water resources, and environmental engineering. Five structural engineering courses are required along with single course requirements in geotechnical, statistics, engineering economy and surveying. Students may use three technical elective courses and a senior design course to specialize in transportation, structures, water resources or environmental engineering. Southern has also developed a series of courses leading to a specialization in safety of dams.

User

The course CE 382 - Transportation Engineering II is offered to all seniors, but is required for second semester juniors. The composition of students enrolled during Spring 94' were 100 percent African-Americans, 38 percent females, 62 percent males, 50 percent juniors and 50 percent seniors. All the students enrolled were computer literate and had successfully completed the pre-requisite, CE 381 - Transportation Engineering I, which is offered once a year during the Fall semester. A course syllabus for CE 381 and CE 382 is shown during the oral presentation of this paper. Moreover, the user receptiveness toward this new form of instructional material was very positive in that it improved the user's visualization of theoretical concepts.

SUMMARY OF RESEARCH OBJECTIVES AND ACCOMPLISHMENTS

The implementation of this project was conducted through several objectives. A brief summary of each objective and its respective accomplishment is stated below:

1) to conduct a background study of the availability of transportation courseware.

After surveying the Southern University community and other local educational sources, the findings indicate that the availability of produced materials in transportation was not in existence. Therefore, the transportation courseware developed by California Polytechnic State University (Cal Poly) under the auspices of the Synthesis Coalition provided an excellent opportunity for the transferring of technology, thus providing minority students access to state-of-the-art research.

2) to develop strategies to integrate the courseware material into existing courses.

The Principal Investigator assisted by a senior undergraduate student, who completed CE 381 and CE 382, identified specific lectures that could be enhanced by the multimedia courseware obtained from Cal Poly. Approximately, 40 percent of the senior level traffic engineering courseware material and 30 percent of the sophomore level introductory transportation courseware complemented CE 382 lectures. Also, there were no additions or modifications made to Cal Poly's courseware material by the customer or users.

3) to evaluate the integration of courseware material presented in CE 382.

An evaluation of the implementation of the courseware material was conducted on the context of its use in lectures, exercises and student projects. The traditional university teacher's evaluation was conducted to assess the teaching qualities of the professor. The responses obtained from the students regarding the use of multimedia application in the transportation subject area were extremely favorable. Many students, particularly the females, felt that exposure to this kind of technology enlarged their vision about the opportunities in transportation and provided a better understanding of the concepts presented.

The Synthesis pre- and post-questionnaires were also utilized. The goal here was to assess the impact this instructional material had on the learning process of those students involved in this project. It was determined that there was significant improvement in instructional delivery and student performance (i.e., better retention of information). A general comment made by all students (both male and female) was that they were exceptionally impressed with the "different" instructional delivery because it easily captured their attention and improved their visualization of complex theoretical concepts presented. The results of their questionnaire responses are shown in Table 1.

Table 1. PRE- AND POST-QUESTIONNAIRE RESPONSES

Q1: Conceptual problem formulation was integrated with analytic problem solving

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20 %	60%	20%
Post (M)	0	0	0	60%	40%
Post (F)	0	0	0	100%	0

Q2: Interdisciplinary perspectives were integrated in problem formulation and solving

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	60%	20%
Post (M)	0	0	0	60%	40%
Post (F)	0	0	0	100%	0

Q3: The instructor gave attention to the learning process and showed good teaching skills

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	0	40%	60%
Post (M)	0	0	0	20%	80%
Post (F)	0	0	0	0	100%

Q4: Theory and practice were integrated through hands on skill development

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	0	60%	40%
Post (M)	0	0	0	20%	80%
Post (F)	0	0	0	0	100%

Q5: Examples of contemporary industry practice were integrated into class

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	0	60%	40%
Post (M)	0	0	0	60%	40%
Post (F)	0	0	0	80%	20%

Q6: Team participation and management skills included in class

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	80%	0
Post (M)	0	0	0	100%	0
Post (F)	0	0	0	100%	0

Q7: Economic and Social implications of technical issues were integrated into class

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	60%	20%
Post (M)	0	0	0	40%	60%
Post (F)	0	0	0	40%	60%

Table 1. PRE- AND POST-QUESTIONNAIRE RESPONSES (cont'd)

Q8: The instruction allowed and encouraged different ways to learn

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	60%	20%
Post (M)	0	0	20%	40%	40%
Post (F)	0	0	0	80%	20%

Q9: Instruction integrated textual, visual, and physical presentations of material

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	40%	40%
Post (M)	0	0	0	40%	60%
Post (F)	0	0	0	0	100%

Q10: has been an attractive model of professional engineering

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	80%	0
Post (M)	0	0	0	80%	20%
Post (F)	0	0	0	0	100%

Q11: has given you a deep commitment to a professional engineering career

	Very Poor	Poorly	Fairly Well	Very Well	Superbly
Pre	0	0	20%	60%	20%
Post (M)	0	0	0	40%	60%
Post (F)	0	0	0	0	100%

Moreover, Table 1 reveals that there was a positive impact on minority female engineering students involved in this project. The improvements are implied by the female students response to questions 1, 4, and 8-9. As it relates to "team participation" and the "integration of economic/social implication of technical issues", questions 6 and 7 respectively, both male and female students had the same post-test response. However, for question #5, 20 percent more female responded "very well" to the use of industry related practices in this class. This difference could be associated with the fact that on average more female Civil Engineering students at Southern gain industrial experience prior to their junior year compared to their male counterparts. Finally, the female students felt "superbly" about this non-traditional teaching method. All of them concluded that they gained a deeper commitment toward a professional civil engineering career and enjoyed being actively involved in the learning process, thus clearing the lines between the lecture and textbook.

AREAS OF IMPACT STATEMENTS

Infrastructure

This project serves as a demonstration that the transfer of technology (e.g., courseware material) between schools that differ in the types of enrollment (large *vs.* small), class sizes (larger *vs.* smaller); student composition (predominate majority with limited mixture of other ethnic groups *vs.* predominate minority with limited mixture of other ethnic groups); and physical facilities (state-of-the-art *vs.* limited physical resources) can influence the learning capacity of students regardless of their educational environment.

Curricular Reform

The results obtained from this project indicate an improvement in the quality of instructions which ultimately provides strength to newly reformed curriculums aimed at mainstreaming minority institutions into a posture where they will always have access to advanced technological information.

Retention

The project's major focus was to enhance a junior level transportation course. However, given the existing opportunities, motivation and interest students have toward transportation at Southern University, I foresee this project serving as a vehicle to attract more minority engineering students, particularly females, to pursue a career in transportation.

Assessment

This method, which uses the personal computer along with an assortment of media aids (i.e., graphics, pictures, video clips, sound, animation and text), help foster a development of new teaching material from traditional theoretical concepts. In other words, subject matter that was considered tedious to study is now presented with computer generated images complemented by multimedia techniques. Additionally, students have the opportunity to preview and review the lecture and class exercise materials at their own pace.

CONCLUSIONS

Through funding received from the National Engineering Education Synthesis Coalition CICEE Metaproject Group, this project on multimedia applications in transportation was the first of its kind to be implemented at Southern University. The performance of the minority female engineering students who participated in this project was measured and a significant improvement was realized as well as documented. On the other hand, because there was only one section of CE 382 offered during the Spring 95' semester at Southern,

there was no comparative analysis done on students not exposed to the material. Therefore, it is recommended that a study of this nature be conducted in the future.

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