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Work in Progress -- Does a Technology-Rich Transportation Engineering Experiences Increase Interest in Civil Engineering

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Work in Progress - Does a Technology-Rich Transportation Engineering Experience Increase Interest in Civil Engineering?

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Abstract - **This paper examines whether a technology-rich transportation engineering experience generates interest among college freshman students towards transportation related degrees and careers, specifically, whether it increases interest in civil engineering. Louisiana Tech's first-year engineering experience provides relevant, project-focused education for over 500 students each year and an opportunity to introduce transportation-related projects. The six semester-hour, three-course sequence, called "Living with the Lab," boosts experiential learning through student ownership of inexpensive laboratory equipment. In one section of the Living with the Lab course, a transportation engineer visited the class and the students were led through a technology-rich transportation engineering activity. They used an ultrasonic distance sensor to build a device to measure traffic speed. At the end of the term, students were asked to rate their interest level in 22 fields of study (one of which is civil engineering) from "not at all interested" (1) to "extremely interested" (7). Asking for interest level in each field provides finer resolution than only looking at which major a student selects. Interest levels in civil engineering of the section that did the transportation engineering activity were slightly higher than those of the other sections, but the difference was not statistically significant.**

Index Terms – Career choice, Interest, Technology, Transportation

INTRODUCTION

In recent decades, the student enrollments in civil engineering and, especially, transportation engineering have fallen relative to engineering majors which appear to be more technology-weighted. This paper will examine whether a technology-rich transportation engineering experience generates interest among college freshman students towards transportation-related degrees and careers, specifically, whether it will increase interest in civil engineering.

According to Social Cognitive Career Theory, learning experiences lead to interest, which leads to choice goals and then choice actions [1]. In this study, a transportation engineering activity is introduced in a freshmen engineering course and then interest in civil engineering is measured using an end-of-term survey via SurveyMonkey.

BACKGROUND: LIVING WITH THE LAB

Living with the Lab is the integrated curriculum in place at Louisiana Tech University. First-year integrated courses are scheduled to be taken in "blocks" so that classes of 40 students take the same section of each mathematics, science, and engineering course during each quarter. Topics presented in the mathematics and science courses are coordinated to some degree with the topics presented in the engineering courses as a way to facilitate student learning [2]. Although Louisiana Tech uses a quarter calendar, credits are awarded on a semester credit hour (SCH) basis, meaning that each course meets for the same total number of hours as on a semester system, but on a condensed schedule. The academic year therefore consists of 10-week Fall, Winter, and Spring quarters. A 2-credit hour engineering course is scheduled for each quarter. In Engineering Problem Solving I, students are introduced to circuits and programming as they build a robot and a small pump. This prepares them for Engineering Problem Solving II, where they use the pump to monitor and control the temperature and salinity of a small "fishtank." In the third course, Engineering Problem Solving III, after having worked with a variety of sensors, students are free to choose any "smart" product to design for their final project. The purpose of this exploratory study is to see if introducing a technology-rich transportation engineering experience increases interest in its parent field, civil engineering.

Although students declare a major upon enrollment, all engineering majors take the Engineering Problem Solving sequence and can very easily change majors before beginning their sophomore classes.

TRANSPORTATION ENGINEERING ACTIVITY

In one section of the Living with the Lab course, a transportation engineer led the students through a technology-rich transportation project. The students used an ultrasonic distance sensor to build a device to measure traffic speed. The transportation engineer visited the freshman engineering class after students had conducted a

small traffic speed study using the ultrasonic sensor in which they had taken approximately 20 total readings of vehicle speeds near campus. He and the course instructor led a discussion on these results. He then transitioned to reporting the results from a recent speed study conducted by a senior-level transportation engineering class on a section of roadway where the posted speed limit appeared to be significantly lower than the actual speeds. The study used radar technology to obtain vehicle speeds and showed that the actual average speed was 11 mph higher than the posted speed. The engineer led the class in exploring what this finding might mean and how it might be addressed.

Additionally, the engineer briefly discussed the field of transportation more broadly and introduced the students to work activities in which a transportation engineer might be involved in his or her career. He finished his visit with a brief description of the future of the transportation field, including intelligent vehicles and highways, virtual traffic control systems, and smart materials.

RESEARCH METHODS

A cross-sectional approach was used to answer the question, "Does a technology-rich transportation engineering experience increases interest in civil engineering?" Students in sections with and without the technology-rich transportation engineering experience were surveyed about their interest in a list of fields corresponding to a variety of majors offered at Louisiana Tech. Asking students to report interest level in each field should give better resolution than simply asking them which they intend to pursue or which is their major.

I. Participants

In the Spring of 2015, a total of 236 students enrolled in nine sections (four regular sections of 25-35 students totaling 124, five honors sections of 16-26 students totaling 112) of Engineering Problem Solving III. All consented to the study although not all completed the survey. The above-mentioned activity was completed in one honors section with 26 students enrolled. For consistency, survey results are compared to honors sections that did not do a transportation engineering activity. Overall, 105 of the 112 honors students completed the survey (94%), although one response set was discarded because the student marked all fields as level 5.

Although students declare a major upon enrollment, all engineering majors take the Engineering Problem Solving sequence and can very easily change majors before beginning their sophomore classes. At the start of the Spring quarter, the 105 students had the following majors:

TABLE I
MAJOR DISTRIBUTION AMONG PARTICIPANTS

Major	N
Mechanical Engineering	37
Chemical Engineering	25
Biomedical Engineering	16
Cyber Engineering	9
Electrical Engineering	6
Civil Engineering	5
Industrial Engineering	3
Nanosystems Engineering	3

II. Instrument and Procedure

At the end of each quarter, students are surveyed about their experience in the Engineering Problem Solving course in which they are currently enrolled. The survey is distributed to students via email using SurveyMonkey online survey software. Each student receives a unique link tied to their email address; this allows the software to track whether a student has responded or not, making it possible to send reminder emails to students who have not yet completed the survey. The survey questions used for this study were as follows:

How interested are you in the following fields?

	Not at all						Extremely Interested
Arts	1	2	3	4	5	6	7
Biology	1	2	3	4	5	6	7
Business	1	2	3	4	5	6	7
Chemistry	1	2	3	4	5	6	7
Civil Engineering	1	2	3	4	5	6	7
Computer Science	1	2	3	4	5	6	7
Education	1	2	3	4	5	6	7
History	1	2	3	4	5	6	7
Language	1	2	3	4	5	6	7
Mathematics/Statistics	1	2	3	4	5	6	7
Health/Medical	1	2	3	4	5	6	7
Physics	1	2	3	4	5	6	7
Social Sciences	1	2	3	4	5	6	7

How interested are you in the following engineering fields?

	Not at all						Extremely Interested
Biomedical	1	2	3	4	5	6	7
Chemical	1	2	3	4	5	6	7
Civil	1	2	3	4	5	6	7
Cyber	1	2	3	4	5	6	7
Electrical	1	2	3	4	5	6	7
Industrial	1	2	3	4	5	6	7
Mechanical	1	2	3	4	5	6	7
Nanosystems	1	2	3	4	5	6	7
Construction Engineering Technology	1	2	3	4	5	6	7
Electrical Engineering Technology	1	2	3	4	5	6	7

FINDINGS AND DISCUSSION

Since the purpose of the activity is to generate new interest in Civil Engineering, the five students who were already enrolled in civil engineering were excluded.

TABLE II
INTEREST LEVEL IN CIVIL ENGINEERING

Section	N	Interest Level	Standard Deviation
Transportation Engineering Activity (TRA)	26	2.85	1.74
All sections without TRA	73	2.62	1.53
No TRA1	24	2.75	1.65
No TRA2	13	2.69	1.44
No TRA3	20	2.60	1.47
No TRA4	16	2.38	1.63

Table II shows the average interest level in civil engineering of the section that did the transportation engineering activity, as well as the total and individual averages of the other four sections. While the results are not dramatic and certainly not statistically significant, it is promising that the section that did the activity shows the highest interest in civil engineering. Ideally, students would be exposed to transportation engineering on multiple occasions, facilitating the development of their interest over time. Future work will increase the sample size and refine the activity.

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