

A Pilot Study Measuring Student Attitude Changes Resulting From Participating in Workforce Development Training Program in Green and Technology Practices

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Abstract

Many agree that one of the main challenges to increasing the number of science, technology, engineering, and math (STEM) career seeking individuals and increasing the retention of students preparing for these fields, is the lack of information and therefore low student motivation toward these careers. Students may also hold misconceptions regarding the nature of technological careers and this may also dissuade them from participating. Exposing students to green energy and sustainability topics as a STEM context may be a motivating approach and when coupled with clarifying career information, it may sharpen much of the generally ambiguous knowledge on these topics. The understanding students gain might then change their attitudes regarding STEM careers and lead to pursuit of academic studies leading to these careers. The Re-Energize program is a multi-university intervention program aimed at increasing and retaining the number of historically underserved and underrepresented minority students seeking STEM degrees at four community colleges. Re-Energize offers cutting-edge workforce development training programs in green technology and practices (GTP). The GTP training programs are introduced into existing college science and engineering courses as a means to broaden the scope of students' exposure to these topics. The impact on students' attitudes towards topics in sustainability, green energy, career interests and their desire to pursue a higher education is analyzed using pre and post survey data. This is a preliminary phase of the project, however, findings indicate that students' attitude and concerns are influenced positively and follow-up data collection will confirm what academic and career choices these students make.

Introduction

According to the President's Council of Advisors on Science and Technology 2012 report, predictions of the lack of Science, Technology, Engineering and Mathematics (STEM)

graduates will lead to a workforce shortage of one million individuals in the STEM field [1]. Data collected from 2004 through 2009 show unsettling results: enrollment of students seeking a bachelor's degree in the STEM fields was about 28 percent of the total in the whole U.S. [2]. Not only are enrollment rates in STEM majors a big problem, student retention rates for STEM majors are low, at only 52 percent. Students that are dropping out are doing so by either switching to a non-STEM major or by withdrawing from their college altogether [3]. Many students seem to enter college with less interest in STEM academic study than other fields. The lack of attraction towards STEM degrees can be seen when considering that 23 percent of incoming freshmen did not have a declared major. From this group of freshman, other non-STEM fields were able to attract most of the undeclared students to select non-STEM fields. In contrast, STEM disciplines, as a whole, don't seem to attract undeclared students [4]. This would imply that if the student did not already have an inclination to pursue STEM studies, there is little success in attracting them once they arrive to college.

The goal of this pilot study is to empower not only STEM majors but non-STEM majors as well with an introduction to green energy and technology topics. Exposing students to these topics can broaden their knowledge, which might lead to a change in attitudes and increase interest in pursuing STEM fields of study and thus increase enrollment and retention for STEM degrees [5].

Background

The Re-Energize program was formed in 2014 with the initial partnerships of Texas State University and four minority serving institutions San Antonio College, Huston-Tillotson University, Coastal Bend College and Southwest Texas Junior College. Throughout its lifespan, the Re-Energize program has had a good deal of success and is now currently in its third year and has added additional minority institution partners in the process. The purpose of the Re-Energize program is to empower higher education institutions who prepare student in engineering and engineering technology studies, and provide focused and enhanced knowledge, facilities, and student programs for surrounding two-year institutions as well as strengthening the recruitment and retention rates of STEM majors through targeted training in green technology, renewable energy and sustainable topics.

Intervention Program

The GTP (green technology and practices) programs are cutting-edge development training programs in green technology and topics offered to faculty in the Re-Energize network for them to learn and adopt modules focusing on green energy into their class rooms. The GTP training is a weeklong training seminar located at Texas State University. It consists of a detailed overview of the program, faculty responsibilities, and instructions and walkthroughs of green energy technologies. Giving the participating faculty the knowledge to teach these topics, and developing educational modules and activates to be used in the classroom to improve student awareness in sustainability and renewable energy. The scope of the survey sample is broadened by the incorporation of the GTP modules into a variety of faculty members' curricula from different departments. The GTP modules are also inserted into freshman level courses and introductory courses, making the courses accessible to many non-STEM majors.

Data Collection

A survey was created to collect student opinions, career interests, self-perception and such. This survey was based on other instruments used in the field for similar research but is unique in that it captures different kinds of perspectives, both content and affective. Student pre-surveys were administered at the beginning of the semester before the faculty started their GTP lessons and activities. The post-surveys were administered via email through a third-party data collection application. It was administered at the end of the GTP lessons. Questions covered the topics of student self-perceptions, future careers, and personal characteristics and content awareness.

Survey

A survey was designed to include the following parameters:

- Self-Perceptions: students provide opinions of how they expect to perform in science and math courses, plans for future course taking, and expectations for future career plans.
- Envisioning Future: Students provide their interest level in various career fields using a Likert scale.
- Attitudes about STEM: Student self-perceptions and attitudes about STEM.
- Personal Characteristics and Engineering: Student self-perceptions and attitudes about engineering & technology.
- Awareness of Sustainability & Green Energy: Student self-perceptions and attitudes about sustainability and green energy.

Survey Procedures

All students and their professors were provided an overview of the research protocol. The student surveys were administered as soon as possible at the beginning of the semester to collect pre-program data and these same surveys were administered soon after the GTP lessons finished to collect post-program data.

Discussions and Conclusions

Through the pilot study, participating students explored a variety of GTP topics that would otherwise have not been covered through their degree. Although the GTP topics mentioned in the courses are not generally able to explore them into greater detail, exposure to the topics can increase interest and promote positive attitude as well as clearing ambiguity regarding to student knowledge. The lack of exposure or unfamiliarity to these topics can lead to students even considering pursuing a STEM degree [4]. Pre and post survey analysis reveals that student's awareness of renewable energy topics and interest in environmental issues is altered, showing an increase in such topics, but a further data analysis for the study can help bring forward more quantitative data results. The Re-Energize program and many other similar programs are creating the foundation for the future of STEM education,

This report outlines research work that is still in process. Additional data will be analyzed and presented to demonstrate changes in student attitudes and content knowledge gains in the Green Technologies presented.

References

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