Preliminary analysis of GK-12 graduate fellow classroom interactions on secondary students' attitudes toward science

Rachel Lytle, Kim Sadler, Anthony Farone, Mary Farone, Ginger Rowell
Middle Tennessee State University

Introduction

Background

The National Science Foundation has funded over 200 Graduate Fellows in K-12 Education (GK-12) Programs including Middle Tennessee State University's TRIAD. Within our program, MTSU partners graduate students and high school teachers with biotechnology companies to promote Science, Technology, Engineering, and Mathematics (STEM) learning opportunities. Graduate Fellows spend one year in high school biology classrooms mentoring student research projects.

A noted decline in secondary students' attitude toward science presents the need for intervention at this age (Bennett & Hogarth, 2009; Osborne, Simon, & Collins, 2003; George, 2000). Possibly related to the decrease in secondary students' attitudes toward science is the decrease in college STEM majors over the past 20 years (Wyss & Tai, 2012). With a predicted increase in the number of STEM careers available, there will not be enough qualified people to fill the positions (Wyss & Tai, 2012). Research shows countries with more scientists and engineers have better economies than those with less (Osborne et al., 2003), suggesting that this may have a negative effect on our economy and our country's scientific standing.

Purpose

The purpose of the study is to determine if introducing graduate fellows into high school science classrooms to engage with students during the year influences the students' attitudes toward science. We hypothesize that implementing programs such as GK-12 may generate a positive perception of science and increase interest in pursuing a science career.

Methods

Surveys

Using a pre- and post-survey design, classes with a fellow (experimental) are compared with a corresponding class taught by the same teacher (control). The Student Attitude Inventory-II (SAI-II) developed by Moore and Hill (1997) is being used to determine student perception of science and scientists with some additional questions about demographics and career choice. Survey statements are clustered into six categories with Likert scale responses ranging from strongly agree to strongly disagree. A paired t-test will compare pre- and post-survey responses between experimental and control classes. Category analysis, item analysis, and career interests will be evaluated.

Interviews

Both experimental and control students as well as graduate fellows and partner teachers will be interviewed at the time of post-assessment to gain a deeper understanding of students' attitudes toward science and the overall GK-12 experience.



Preliminary Results

Category Analysis

Preliminary analysis of the six categories show similar trends in experimental (N=143) and control classes (N=103) (Table 1).

Table 1. Response percentages for Experimental (E) and Control (C) classes for the SAI-II six categories..

Categories	E	C
	% Agree	
Laws of science may change.	90	87
Science is limited in what it can answer.	64	61
Scientists must be honest, objective, and willing to change their minds.	85	82
Public awareness of the nature of science is important.	67	64
Pursuing a science career interests me.	60	52
	% Uncertain	
The value of science is in its theoretical aspects.	59	56

Item Analysis

Student responses to specific items from the survey show that both experimental and control again were similar. However, the two groups responses also yielded some contradictory results (Table 2).

Table 2. Response percentages values for Experimental (E) and Control (C) classes on SAI-II positive and negative items.

Positive	% Agree		Negative	% Agree	
	E	C		E	C
Good scientists are willing to change their ideas.	93	86	If one scientist says an idea is true, all other scientists will believe it.	95	96
Scientists must report exactly what they observe.	92	85	Scientific work is useful only to scientists.	92	90
Scientists are always interested in better explanation of things.	87	81	When scientists have a good explanation, they do not try to make it better.	85	83

Preliminary Results

Student Career Interest

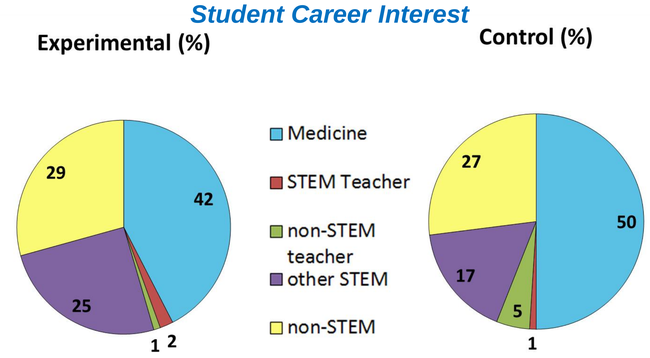

Figure 1. Percent student career interest for experimental and control classes**.** The majority of students in both groups want to pursue careers in medicine (blue) while the other STEM careers (purple) and non-STEM careers (yellow) groups are similar. Note that in this study the majority of students are freshmen or sophomores.

Discussion

Preliminary analysis of scientific attitude shows similar responses between the experimental and control classes. This validates the reliability of the study's methodology.

Post-surveys and experimental and control student interviews will be collected and analyzed at the end of the academic year. We anticipate seeing a positive difference between pre- and post- survey responses with experimental classes. These results could provide support for increased and sustained implementation of graduate scientist mentor programs in high school classrooms. Positive student attitudes about science careers could lead to more college STEM majors, more filled STEM careers, and an eventual boost in our country's scientific standing and economy.

Acknowledgements

This project is supported by the National Science Foundation (DGE-0841370). A special thanks to our research curriculum designer Jennifer Dye from Pope John Paul II High School and Dr. Leslie Lynch, director of BioTN.

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