

Attracting Noyce students to become STEM teachers

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ABSTRACT

There are concerns that teacher shortages in the STEM field will lead to a downfall in the U.S. economy and security of the nation. The internship program was created to provide the STEM majors in Texas A & M University-Kingsville (TAMUK) and its partner community colleges an opportunity to observe and participate in STEM education and possibly future recruitment. The theoretical framework underlying this study was based on whether active learning teaching strategies will effect student satisfaction. This study took place in Southern Texas with a predominantly Hispanic male sample. Research questions central to the design were as follows: (1) Overall, how satisfied were the Noyce Interns with the STEM Teaching Boot Camp and (2) Overall, how satisfied were the Noyce interns with the Noyce Summer Internship? Descriptive statistics were utilized. The findings from the surveys indicated that the interns were satisfied with both the STEM Teaching Boot Camp and the Noyce Summer Internship Program. Because of the experience, some STEM majors or Noyce Interns have decided to pursue a teaching certificate to become a high school STEM teacher.

Keywords: NSF Robert Noyce Teacher Scholarship Program, STEM, summer internship, high school teachers, program satisfaction survey

Introduction

There are concerns according to the report for Congress in the United States that many secondary school students are failing to achieve math and science proficiency which may be due to teachers' lack of adequate knowledge of the subject matter (Kuenzi 2008). In 2009 the United States placed 23rd in science and 30th in math out of 65 countries (OECD, 2010). Students in the United States are performing poorly in international mathematical assessments (Kastberg, Chan & Murray 2016). In 2015 National Assessment of Educational Practice (NAEP) showed a lack of growth in mathematics, and gaps still remained among the sub-groups including the Hispanics (The Nation's Report Card 2015). In addition, the following percentages of students enter the science field: 28% chemistry, 11% biological/life sciences, 2 - 3% mathematics and physical sciences, and 9% computer science (Ingersoll & Perda 2009). However, 48% of these bachelor's degree students left these fields. These academic performances have been tied to teacher shortages in both mathematics and science fields. There is concern that these shortages will lead to the downfall in the U.S. economy and security of the nation (Ingersoll & Perda 2009).

To alleviate the shortage of certified secondary math, technology, and science teachers, the faculty members from the Colleges of Arts & Sciences, Engineering, and Education in Texas A&M University-Kingsville (TAMUK) collaborated and submitted a grant proposal to the National Science Foundation Robert Noyce Teacher Scholarship Program in the spring semester of 2014. The proposal was accepted. TAMUK was awarded about \$1.2 million for 5 years from 2014 to 2019. The grant project was titled "Future STEM Teachers in South Texas [F(ST)]²."

F(ST)² of TAMUK encourages the talented STEM majors (Computer Science, Math, Chemistry, Biology, Geosciences, and Physics) at the university and the partner community colleges to become highly qualified secondary STEM teachers. The scholarship program provides financial support of \$15,000 per year to help the Noyce scholars pursue their teaching certification.

Purpose

One of the ways to recruit Noyce Scholars for the Teacher Scholarship Program was through the Robert Noyce Summer Internship Program, which was a 4-week program organized during the summers of 2015 to 2018. The purpose of the internship program was to provide the STEM majors at TAMUK and its partner community colleges an opportunity to observe and participate in STEM education. The focus of this research was to investigate how effective the NSF Robert Noyce Summer Internship was in recruiting Noyce Scholars.

Conceptual Framework

STEM, the acronym used for the Science, Technology, Engineering, and Mathematics fields, is the basis of this conceptual framework. There is concern that shortages in workers trained in STEM will lead to the breakdown in the U.S. economy and a decrease in the security of the nation, and thus we need to propose plans for how schools could solve this shortage (Ingersoll & Perda 2009; Zollman 2012). This study targeted students from the Biological Sciences, Chemistry, Mathematics, Physics, and Engineering areas.

The theoretical framework underlying this study was based on whether active learning teaching strategies will effect student satisfaction. Lecture-based instruction was kept to a

minimum of 3-1/2 days with hands-on activities for the rest of the month. Hands-on activities provide students with opportunities to problem solve, to develop critical thinking skills, and to collaborate with mentors and peers.

Population and Sampling

The population includes South Texas, which is a predominately Hispanic region. At the start of the program, students at TAMUK came from a variety of ethnic backgrounds. Most of TAMUK's students came from South Texas, but there was a wide diversity in the population, with students from more than 35 states and more than 43 countries. The student body was split almost equally between men (53%) and women (47%). 82% of students are undergraduates. Ethnically, the campus reflects the demographics of the area, with 62% of the students Hispanic, 27% white, and 5% African American. About 6% were international students

The sample of candidates included undergraduate STEM majors from TAMUK & partner community colleges, preferably freshmen and sophomores. The colleges included: Partner Community Colleges, Del Mar Community College, South Texas College, Texas State Technical College. Partner School Districts that were involved in the summer programs were Kingsville ISD, Corpus Christi ISD, and Pharr-San Juan-Alamo ISD.

Between the years of 2015-2018, there were 16 Noyce Interns comprised of 3 Whites, 11 Hispanics, 1 African-American, and 1 Asian; 11 males and 5 females. Of these 2 males and 1 female were returned interns. In 2018 two Hispanic and one Asian student were welcomed into the program; however we need to search for females as well for better variety. Engineering is a first this semester (data found in Table 1).

Process

The coordinator and the supervisor of the Robert Noyce Summer Internship Program was one of the Co-PIs of the grant. She was also a faculty member of the College of Education. Each summer internship program lasted 4 weeks. Each intern received a stipend of \$2,000 and free room & board on the TAMUK campus. The interns were placed with TAMUK Special Programs through the Associate Vice President for Student Access & Program Directors. The programs include Upward Bound, Upward Bound – Math & Science, and Upward Bound--Urban. Because of the summer component of the Upward Bound programs, where the high school students from the neighboring school districts came to the TAMUK campus in June to learn a variety of academic skills, the interns could be placed in the STEM classrooms.

During the first week, the interns attended a 2-1/2-day STEM Teaching Boot Camp. The interns were introduced to the educators' code of ethics in Texas, STEM instruction, and some teaching strategies and tutoring skills. After they had successfully passed the post-test, they were assigned in different STEM classrooms as teaching assistants. They shadowed and assisted their mentor teachers, who were certified teachers and/or graduate STEM students at the university.

Methodology

Research questions central to the design were:

1. Overall, how satisfied were the Noyce Interns with the STEM Teaching Boot Camp?

2. Overall, how satisfied were the Noyce interns with the Noyce Summer Internship Program?

Satisfaction of the Noyce Interns with the STEM Teaching Boot Camp was measured utilizing an online Post-Boot Camp Survey which had 15 items. Satisfaction of the Noyce interns with the Noyce Summer Internship Program was measured utilizing an online Noyce Summer Internship Program Survey which had 8 items. Interns were asked to give their satisfaction rating using a Likert scale from 1 to 10, with 10 being the highest. The interns showed high satisfaction with the Boot Camp activities (9.38 out of 10). Their overall satisfaction rate toward the STEM Teaching Boot Camp was 9.43 out of 10.

In 2015 the highest satisfaction ratings were in the peer group, the handouts and the information in them, and the presenters' knowledge. In 2016, this group was satisfied with everything. In 2017 the interns were most satisfied that the materials covered in the orientation sessions were helpful, handouts were distributed to provide sufficient information, the information provided in the handouts was helpful, and the facilities were adequate. In 2018, the interns scored the following items 10 out of a possible 10: satisfaction with instructors, engagement in sessions led by Boot Camp Instructors, helpful materials covered and handouts, adequate time spent, and knowledgeable presenters. Overall satisfaction received a 9.5 out of 10 as did the activities, engagement with activities, sufficient handouts, and facilities. Excitement to attend the Boot Camp made a 9, and the peers had the lowest point of 8.5. Over the years the only dissatisfaction noted was that there was too much material covered in the sessions (data found in Table 2).

Post-Noyce Summer Internship Program Survey

The Post-Internship Program Survey was administered at the conclusion of the summer internship program. The interns were overall highly satisfied with the Noyce Summer Internship Program. The findings indicated that the interns felt excited to work with the high school students and their mentor teachers (9 out of 10).

The results showed that over the length of the program, 13 out of 16 interns responded that they had perceived an increase in their interest in teaching in the STEM area. In 2015, two of them perceived a decrease and two perceived an increase in their interest in teaching in the STEM area during the summer. In 2016 all three perceived an increase as did all six in 2017. Then in 2018 two perceived an increase, one stayed the same.

In 2016 and 2017, 2 participants, respectively, gained an interest in teaching in the STEM area; all the rest had an interest beforehand.

In 2015, the participants were most satisfied in the areas: "Overall, how satisfied were you with the mentors?" and "I felt excited to work with students/mentor during Noyce Summer Internship Program." In 2016, satisfaction came from all areas with a perfect score in 4 areas. They were satisfied and engaged in the summer internship program and were engaged and excited to work with students and mentors. In 2017, the participants were highly satisfied with the program and with their mentors. In 2018, the participants perceived a perfect score in the following: "I felt that the information learned through the Summer Boot Camp was adequate for my Noyce Summer Internship Program experience." They also had high scores in the areas of working with students and mentors sharing the program and working on different activities with students and mentors (data found in Table 3).

Discussion & Conclusion

Each summer, since 2015, the NSF Robert Noyce Summer Internship Program has become the interns' training ground for STEM education. The findings from the surveys indicated that the interns were satisfied with both the STEM Teaching Boot Camp and the Noyce Summer Internship Program. Because of the experience, some STEM majors or Noyce Interns have decided to pursue a teaching certificate to become a high school STEM teacher. They then apply for the scholarship from the Noyce Teacher Scholarship Program, which provides \$15,000 per year to support their academic pursuits. In Fall 2018, there were 7 Noyce Scholars in the Noyce Teacher Scholarship Program. Among these 7 scholars, 6 of them were from the Internship Program. Two of them graduated in December 2018. The success of the internship program has been drawing STEM majors into the teaching profession.

The school system could learn from these programs. It would be expeditious for school administrators to conduct a boot camp for their new teachers at the beginning of the year. Also, it was found that mentors were an important consideration that could be used for both new and experienced teachers to increase their satisfaction with their teaching.

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Appendix**Table 1**

Demographics				
	2015	2016	2017	2018
Age				
19-21	3	1	3	2
22-24	1	1	1	1
25-27	0	1	2	0
Gender				
Male	2	2	4	3
Female	2	1	2	0
Race/Ethnicity				
White	1		2	
Hispanic	2	3	4	2
Hispanic/Black	1			
Asian				1
Undergrad Status				
Sophomore	2	1	1	1
Junior	2	2	2	1
Senior			3	1
Major				
Biological Sciences	1		2	
Chemistry		1	1	
Mathematics	2		2	1
Physics			1	
Engineering	1	2		2

Table 2 - Post Boot Camp Survey

Question	Mean			
	2015	2016	2017	2018
Overall, how satisfied were you with the STEM Teachers Boot Camp?	9.00	10.00	9.20	9.50
Overall, how satisfied were you with the instructors?	9.00	10.00	9.40	10.0
Overall, how satisfied are you with the group of fellow students who participated?	9.67	10.00	9.60	8.50
Overall, how satisfied are you with the STEM Teachers Boot Camp activities?	9.00	10.00	9.00	9.50
I felt excited to attend the STEM Teachers Boot Camp sessions.	9.33	10.00	9.00	9.00
I felt excited to work with my peers during STEM Teachers Boot Camp	9.33	10.00	9.60	8.50
I felt engaged during the STEM Teachers Boot Camp sessions led by instructors.	9.00	10.00	9.60	10.00
I felt engaged when I worked on different activities with my peers.	9.00	10.00	9.60	9.50
The materials covered in the orientation sessions were helpful.	9.00	10.00	9.80	10.00
Handouts were distributed to provide sufficient information.	9.67	10.00	9.80	9.50
The information provided in the handouts were helpful.	9.67	10.00	9.80	10.00
The time allowed for the sessions were adequate.	9.00	10.00	9.80	10.00
There was too much material covered in the sessions.	3.33	9.50	3.40	1.50
The presenters were knowledgeable.	9.67	10.00	9.60	10.00
The facilities were adequate.	9.33	10.00	9.80	9.50

Table 3 - Noyce Summer Internship Program Survey

Question	Mean			
	2015	2016	2017	2018
Overall, how satisfied were you with the Noyce Summer Internship Program?	7.50	10.00	9.00	8.00
Overall, how satisfied were you with the mentors?	9.25	9.67	9.17	8.67
Overall, how satisfied are you with the Noyce Summer Internship Program activities?	7.25	9.67	8.33	8.33
I felt excited to work with students/mentor during Noyce Summer Internship Program.	9.00	10.00	8.00	9.00
I felt engaged during Noyce Summer Internship Program.	7.75	10.00	7.83	7.67
I felt engaged when I worked on different activities with my students/mentor.	8.50	10.00	7.83	9.67
I felt that the information learned through the Summer Boot Camp was adequate for my Noyce Summer Internship Program experience.	6.00	9.67	7.33	10.00
This experience clarified or affirmed my career goal.	8.50	9.33	7.83	8.33

