The Effects of Student Success Workshops on Undergraduate Hispanic STEM Students on the U.S.-Mexico Border

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Abstract

The goal of the College of Arts & Sciences Community-aid (CASC-aid) project, a National Science Foundation grant funded study (2016-2021), is to develop, implement, and evaluate a program that fosters a community of academic success for Hispanic STEM students. This Hispanic Serving Institute continues to provide a variety of supports to safeguard success for Hispanic CASC-aid scholars through effective communication. Along with scholarships, Project CASC-aid delivers mentoring and intervention strategies related to non-cognitive behavioral practices to ensure scholars are motivated and empowered, and to support the postsecondary educational success of Hispanic students (Blackwell, Trzesniewski, & Dweck, 2007). Embedded within the research is a Formative Experiment (Reinking & Bradley, 2008), which allowed researchers to gather data on one facet of the project. CASC-aid scholars responded to surveys after Student Success Workshops held across the 2017-2019 academic years. Analysis of results demonstrated that workshops were effective in supporting students' long-term goals, career major decisions, and overall knowledge of a wider STEM field.

Keywords: Hispanic, undergraduate, STEM, supports, workshops

Introduction

Hispanic students are often disproportionately underprepared, underrepresented, and underserved in science, technology, engineering, and mathematical (STEM) fields. Data from a variety of sources indicate that Hispanic students are often far below their white counterparts in reading and STEM areas on national and international assessments (DeSilver, 2017; NAEP, 2017). Likewise, a report in *New Scientist*, citing the United States Department of Education, revealed that: "Hispanics occupy only 2% of the STEM workforce in the United States. Additionally, only 10% of college and university degrees awarded in the STEM field are given to Hispanics" (2016, para. 4). The goal of the College of Arts & Sciences Community-aid (CASC-aid) project, a National Science Foundation (NSF) grant funded study, is to develop, implement, and evaluate a program that fosters a community of academic success for Hispanic students majoring in a STEM field. Students selected for inclusion as CASC-aid scholars receive academic and student mentoring services during mathematics courses. The purpose of this project is to support Hispanic students with a variety of interventions to ensure they can successfully navigate towards an undergraduate degree in a STEM field.

Project CASC-aid provides scholars by: (a) enhancing the first courses in the mathematics sequence, to include college algebra and calculus 1-3; (b) incorporating Learning Support in coursework, which is an alternative to traditional recitation in that learners engage in real-world applications and anticipate common misconceptions; (c) offering professor-led Community Tutoring for scholars; (d) providing Success Workshops that cultivate mentoring and yield research and service learning opportunities; and, (e) providing extensive educational experiences, events, and resources (e.g., career guidance, advising, and field trips) to all participants. In this manuscript, researchers will describe the findings of one of the support mechanisms put into place to enhance CASC-aid students' awareness of career trajectories available post-graduation. Success Workshops allow for communication and connections between CASC-aid student scholars, faculty, and invited speakers across a range of topics directly related to career paths.

The project team designed these provisions to support and foster a community of Hispanic STEM students as they enter and exit college, completing an undergraduate degree in a STEM field. Many CASC-aid scholars are first generation college students, thus it is vital to ensure they receive effective communication about support opportunities available to them. Project CASC-aid scholars all receive sustained attention beyond that provided by the university, and key in this is the inclusion of communication at all levels to build a community of practice for scholars (Lave & Wenger, 1991; Tinto & Goodsell-Love, 1998).

The first author and co-principal investigator (co-PI) developed a survey instrument to assess the effectiveness of Success Workshops in supporting students in the CASC-aid program. The second author and Principal Investigator (PI) invited guest speakers/scholars working in STEM fields to make presentations in a series of lectures across three semesters between the 2017-2019 academic years. The project team collected data on students' perceptions of these workshops after multiple presentations. Likewise, the PI developed Success Workshops to include presenters who are intellectuals in their respective fields. Results from data analysis revealed that the workshops had a positive impact on CASC-aid scholars' major, job knowledge, job prospects, and career fields. Likewise, respondents demonstrated a high degree of belief in the workshops and Project CASC-aid in supporting their needs as STEM students.

Area of Concern

The percentage of Hispanic students graduating with college degrees from undergraduate programs is lower than their white counterparts for a variety of reasons (Baylor, 2016; Kao & Thompson, 2003; Viadero & Johnston, 2000), but when considering minority students' attainment of a STEM undergraduate degree, there is cause for concern (Carpi, Ronan, Falconer, & Lents, 2017; ed.gov, 2012; Leonard, 2016). In a report on Hispanics and STEM education, it was determined that "Hispanic students are more likely to be taught science by teachers who did not major in that field or by inexperienced teachers" (Crisp & Nora, 2012, p. 5). Based on empirical data, Hispanic students along the South Texas border region are disproportionately underprepared, underrepresented, and underserved in STEM fields. This under-preparation begins early in students' educational endeavors in K-12 settings. Recent data from NAEP (2017) indicated that from "1992 through 2017, the average reading score for White 8th-graders was higher than the scores of their Black and Hispanic peers" (p.7) The Committee on STEM Education noted that on international mathematics and science assessments, "Hispanic U.S. eighth graders had scores equivalent to those of students in countries ranked in the bottom third of the 45 countries that participated in the 8th grade science assessment" (2013, p.2), while white U.S. eighth graders ranked fourth behind Singapore, Chinese Taipei, and Korea.

Hispanic students entering college are already behind their white, college bound peers. As noted previously, Hispanic students lag behind their eighth-grade peers across the globe on international science assessments (Committee on STEM Education). Furthermore, on the 2015 Program for International Student Assessment, in science and reading, U.S. 15-year-olds ranked 24th, and in math, U.S. 15-year-olds ranked 39th (DeSilver, 2017). Thus, it is essential to ensure that positive outcomes at the college level are possible for minorities and females, two underrepresented groups in STEM careers; and these outcomes include undergraduate graduation from a STEM field. In addition to under-preparation, Baylor (2016) noted 21% of black students and 16% of Hispanic students have an undergraduate degree, while 43% of their white peers have graduate from college. Likewise, some universities have closed door policies for minorities (Baylor, 2016). These factors all pose additional barriers for Hispanic students seeking a STEM degree.

Along with under-preparation in K-12 schooling, acquiring an undergraduate degree, and potential difficulty getting into college, there are other general roadblocks to STEM retention and completion for Hispanic students in undergraduate bachelor's programs. One roadblock includes mathematics. Researchers have demonstrated that mathematics attainment is a cornerstone to college access, degree completion, and specifically to successful STEM pursuit (Kredell, 2017; uschamberfoundation.org). Likewise, a strong academic math program through completion of higher-level math in high school is important to success in college (Adelman, 2006). McCormick and Lucas (2011) noted that mathematics preparation at the high school level plays a prominent role in students' "hopes and dreams for a college degree" (p. 1). However, researchers are unsure of the added benefit pre-Calculus and other developmental math courses at the college level have on students' later success in college-level Calculus (Bressoud, 2016). Additionally, girls' self-efficacy in math is a strong predictor of declaring a STEM major (Brookshire, 2017).

In addition, an important barrier to enhanced college graduation rates from underrepresented students in STEM fields is a lack of college knowledge (Brooks-Terry, 1988; Horn & Nuñez, 2000; Ishanti & DesJardins, 2002; Ishanti, 2006; Moschetti & Hudley, 2014). There is a high correlation between low socioeconomic status and college graduation, and this has led

researchers to extend beyond content knowledge in search of obstacles to college graduation (Estep, 2016; Rheinschmidt & Mendoza-Denton, 2014). One common area identified was the misunderstanding of college readiness. Conley (2007) defines college readiness as consisting of four concentric ideas: (a) key cognitive strategies, (b) key content, (c) academic behaviors, and (d) contextual skills and awareness. This underscores the idea that students need more than content knowledge to be successful in college. Research conducted through the American College Testing (ACT) agency revealed that underserved students, that is, first generation college students, often fail to achieve benchmarks, and this can lead to "progressively lower college and career readiness rates" 2018, p. 9). In addition, there is an affective component related to a student's STEM college identity and high-achieving high school STEM students do not identify with: (a) feelings of low self-confidence and/or self-efficacy, (b) a lack time management and test taking skills, or, (c) ideas of low motivation and determination (Huguenin, 2014). This is often not the case for their underprepared minority counterparts.

Hispanic students may lack college knowledge, but they may also lack an understanding of job opportunities that align with specific STEM degrees. The Student Success workshops provided through Project CASC-aid may support student understanding and learning, as well as fill a knowledge gap for scholars.

Potential Solution: Supports for CASC-aid Scholars

In our ever-changing technological society, there is a growing need for a substantive call to increasing the number of Hispanic and other minority students graduating from undergraduate STEM programs. Multiple studies have determined that undergraduate research opportunities can support and increase retention of minority students in STEM majors (Carpi & Lents, 2013; Junge, Quinones, Kakietek, Teodorescu, & Marsteller, 2010; Kardash, 2000; Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998). However, not all colleges and universities offer research opportunities at the undergraduate level. Thus, it is imperative to provide interventions that ensure Hispanic and other minority students are successful in completing undergraduate degrees, particularly STEM degrees.

Notably, a Report from the Committee on STEM Education National Science and Technology Council (2013), and the follow-up progress report from the Office of Science and Technology Policy (OSTP, 2016), highlighted the following need: "Increase the number of underrepresented groups that graduate with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented" (2016, p. 12). As new technologies advance daily, it is important to support Hispanic STEM students in graduating with an undergraduate STEM degree, particularly female students.

Additionally, the House of Representatives (H.R.) Bill 2653: STEM Opportunities Act (2017) noted that "In 2015, underrepresented minority groups comprised 39 percent of the college-age population of the United States, but only 17 percent of students earning bachelor's degrees in STEM fields" (p. 3, lines 1-4). The STEM Opportunities Act (II.c.1) aims to increase "implementation or expansion of innovative, research-based approaches to broaden participation of underrepresented minority groups in STEM fields" (p. 32, lines 6-9). Project CASC-aid is an innovative, NSF grant funded study that aims to increase underrepresented students into STEM fields. The Student Success Workshops are just one support provided for Hispanic students, many of whom are first-generation college students;

and these workshops showcased an invited speaker to provide information about different career choices students might consider upon graduation.

Project CASC-aid.
This project addresses two general issues interfering with our nation's STEM progress. First, the project team developed multiple elements to support Hispanic students toward a college degree in a STEM field, including a variety of success mechanisms, one of which is the aforementioned Student Success Workshops. The outcomes of the Student Success Workshops will be addressed in this paper. However, there are a host of other supports provided to CASC-aid scholars. To address support for students' lack of college knowledge, student mentoring is key.

Enriquez (2011) noted that first-generation Hispanic college students need to know about college readiness and attainability. Presently, first-generation college students remain far behind their peers in college readiness (act.org, 2016; NAEP, 2016; Viadero & Johnston, 2000). Hispanic students face many barriers when considering college, including difficulties in: (a) navigating through college applications, (b) filling out financial aid packets, and (c) overcoming cultural barriers. Individuals who have lived those experiences can best address these complications. The South Texas borderland region is rich in mentoring potential. Successful college graduates who reside in the area can often be the best mentors for first-generation college students (Enriquez, 2011). CASC-aid experts in the field have enlisted a network of mentors who will guide students into post-secondary, academic success.

Next, a strategic directive at retaining students was also key for Project CASC-aid. Retention strategies for CASC-aid scholars are holistic and layered. Primarily, the project will build community among and across each cohort of scholars. Research on Residential Colleges supports the potential success of the College Algebra Course (Tinto, 2012). And, this particular aspect has been proven successful under the direction of the third author/co-PI in 2011, with a central Texas high school group. In addition, cohorts will be defined by the mathematics courses, as enrollment in a CASC-aid mathematics course is a requirement of scholars. Other aspects of Project CASC-aid rely on Communities of Practice (Lave & Wenger, 1991) that are built by Community Tutoring and Success Workshops. All CASC-aid scholars, regardless of which mathematics course they are in, will be able to attend Community Tutoring, which includes regularly scheduled tutoring time facilitated by the PI and fourth-author/co-PI.

Finally, the project team designed the Student Success Workshops to support college knowledge (Conley, 2007) and STEM job knowledge for CASC-aid scholars. Examples of workshop topics supplying students with college knowledge included: (a) "Building and Writing a Resume"; (b) "Understanding the GRE"; and, (c) "Panel: Hispanics in STEM Professions". University and CASC-aid representatives were on hand to provide updates on advising, internships, and financial aid deadlines to further support scholars. To enhance students' job knowledge in STEM fields, the PI invited STEM Researchers/Intellectuals in their respective fields to present career opportunities that students may be unaware of as a long-term job goal. These workshops focused on a variety of strategies to support scholars, and all workshops included mentoring activities and opportunities.

The elements of Project CASC-aid have cultivated a positive, synergistic STEM community with clear lines of communication to ensure CASC-aid scholars are supported in all

endeavors they undertake. Communication is a key function of this project, and it is necessary to ensure CASC-aids scholars receive full benefit of the supports available to them.

Literature Review

In a search of the ERIC (EBSCO) database using the keywords Hispanic, undergraduate, STEM, and supports, 14 articles were retrieved. The number dropped to seven articles when a criterion for peer reviewed manuscripts was entered. Of those seven, several articles described successful programs with targeted interventions to retain Hispanic students toward degree completion. First, Carpi, Ronan, Falconer, Boyd, and Lents (2013) described a series of targeted supports for retaining students at Hispanic Serving Institutions (HSIs). Supports included: (a) a math and science resource center; (b) paced science courses; (c) faculty development seminars; (d) math/science curricular alignment; and, (e) department student science awards. Efforts led to increased graduation rates for Hispanic students in Forensic Science (Carpi et al., 2013).

Slovacek, Whittinghill, Flenoury, and Wiseman (2012) examined "programs funded by the National Institutes of Health Minority Opportunities in Research (MORE)" (p. 199) and determined that students supported by the MORE program graduated more quickly with higher GPAs, and many more entered a graduate program. Slovacek et al. (2012) reviewed eight years of student data from participants in MORE and non-MORE schools, comparing several models, including Tinto's (1975) and Swail's (2003) Model. Students in the MORE program were highly successful. In their discussion, Slovacek et al. (2012) noted that "results of the study then lend credence to the hypothesis that an institution, through a range of interventions aimed at supporting different aspects of the student experience, can have a dramatic impact on the outcomes of students traditionally underrepresented in the sciences with respect to graduation and the pursuit of advanced degrees" (p. 213).

Notably, a phenomenological case study by Sriram and Diaz (2016) collected data on 13 minority students' perceptions of their STEM identity as part of a Living-Learning program while attending a predominantly white university. Students' responses were positive and students felt that they were part of a family. Surprisingly, "all participants agreed that they felt more of a minority as a STEM major on campus as a whole than they did as a student of color" (Sriram & Diaz, 2016, p.14). Authors suggested more qualitative research to delve into minority students' as STEM majors. Flower (2014) described how HSI's support students in STEM areas. Likewise, Jackson, Starobin, and Laanan (2013) noted that women and underrepresented minorities must have support from colleges and universities to be successful in STEM areas, a traditionally white, male field.

Minority students often need support to be successful in college; and when considering first-generation Hispanic students majoring in a STEM field, support mechanisms to ensure successful degree completion is vital. Project CASC-aid provides multiple supports for scholars, and the Student Success Workshops provided a layer of support to ensure students were familiar with a variety of options, post-graduation, for career fields.

Method

With Internal Review Board (IRB) approval, the PI and co-PIs conducted an exploratory study from October, 2017 through October, 2018 utilizing a formative experiment (Reinking & Bradley, 2008) to determine the effects of Student Success Workshops on CASC-aid

scholars' awareness of prospective jobs, post-graduation. Formative experiments align with design-based research (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). The first author/co-PI selected a framework outlined by Reinking and Bradley (2008) that included six components to guide the project team toward achieving the selected goal of increasing CASC-aid scholars' knowledge of jobs in STEM fields prior to graduation through Success Workshops. The project team followed these six components when beginning this exploratory study:

(1) select an important goal undergirded with theory and prior research;
(2) identify research and theory to assist with achieving the goal;
(3) collect data on aspects that enhance and/or diminish achievement of the goal;
(4) modify the intervention to make it more appealing to all stakeholders;
(5) anticipate positive and negative changes that the intervention produces; and,
(6) identify changes that have occurred as a result of the intervention.

The goal identified in this formative experiment was to increase STEM majors' understanding of career opportunities, post-graduation, through Student Success Workshops. Unlike other methodologies, which identify a research question or hypothesis, a formative experiment sets a desired goal that if achieved, will have consequential validity (Gravemeijer & Cobb, 2006). It was important to the project team that future job prospects were clearly and effectively articulated to CASC-aid scholars while still enrolled in college. In this manner, students might choose to: (a) streamline a degree; (b) change a major from engineering to math, or math to science, and other; and/or, (c) intern with a professor or employer in an area that interests them as a future job.

To determine the effectiveness of the Student Success Workshops geared toward job knowledge, the first author developed a Likert survey (Figure 1) consisting of 18 questions. Students had five options when responding to survey statements: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). After analysis of survey instruments, it was determined that the Student Success Workshops were well-received by scholars and are an effective support for students as they move closer toward their goal of graduating with an undergraduate degree in a STEM field.

A) This workshop was beneficial.
B) The speaker was motivating.
C) I learned about a new career option.
D) This was a mandatory workshop.
E) I want more workshops like this one.
F) Other CASC-aid scholars would benefit from this workshop.
G) Workshops offered through CASC-aid support my learning as a STEM student.
H) After this workshop, I am thinking about other career options.
I) The CASC-aid program is supportive.
J) I attend every workshop offered to CASC-aid scholars.
K) I attend every study session with the graduate assistants.
L) I am being prepared for a career in a STEM field as a CASC-aid scholar.
M) This workshop was not beneficial to me.
N) Upon graduation, I will seek a job in a math related field.
O) Upon graduation, I will seek a job in a science related field.
P) Upon graduation, I will seek a job in an engineering field.
Q) I need to meet with my advisor more often.
R) This workshop was directly related to a career I am considering after graduation.

Figure 1: Researcher-developed survey instrument

Participants and Setting

Across 2017-2019 academic years, CASC-aid scholars attended multiple Success Workshops to hear guest speakers describe their STEM research and/or area of expertise. CASC-aid scholars attended workshops on campus in rooms where they regularly attend STEM classes. The number of participants attending each of the workshop varied in size, with a range from 6 participants to 32 participants. Student participants' gender, major, class standing, and anticipated graduation date varied with each workshop (Table 1).

Table 1: Information on workshop participants

Date	October, 2017	November, 2017	January, 2018	February, 2018	October 3, 2018	October 18, 2018
Participants in attendance	32	14	16	12	6	8
Male	80%	78%	80%	75%	66.7%	50%
Female	20%	22%	20%	25%	33.3%	50%
Freshman	0%	7%	0%	0%	0%	0%
Sophomore	6%	29%	18%	0%	16.7%	25%
Junior	19%	43%	32%	30%	0%	12.5%
Senior	75%	21%	50%	70%	83.3%	62.5%
Engineering	81%	64%	75%	63.6%	100%	50%
Math	12%	14.3%	25%	36.4%	0%	50%
Science	6%	21.4%	0%	0%	0%	0%
Hispanic participation	100%	100%	93.8%	91.7%	100%	100%

The six Student Success Workshops were entitled: (1) "System Dynamics Simulation Modeling"; (2) "Drilling Optimization and Drill Stem Vibration Modeling"; (3) "Vectorborne Diseases and Prevalence in South Texas Region"; (4) "The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement"; (5) "Current Memory Technology Trends; and, (6) "Weak Galerkin Finite Element Method with Mixed Boundary Conditions". Sessions lasted approximately one hour and included a question and answer session at the end to support effective communication for scholars. Students filled out Likert-scale surveys based on their experience with the speakers and/or content of workshop.

At all workshops, 100% of students identified as Hispanic/Latino except for the third and fourth workshops, with one student identifying as Asian/Pacific Islander at each session.

Materials and Procedure

The PI and co-PIs working on this project are committed to ensuring that scholars attain maximum benefit from all supports provided through Project CASC-aid and the survey instrument developed by the first author was an attempt to better understand whether information provided by invited speakers at Student Success Workshops was helpful and meaningful for scholars as they move forward in the program. The PI/second author wanted to ensure students learned about a variety of career fields that might be unfamiliar at this stage in their academic careers and the first author/co-PI wanted to determine if scholars were, in fact, unfamiliar with a potential career option. CASC-aid scholars received information, handouts, and contacts to further support effective communication. At the end of each workshop, scholars received a survey to fill out. All surveys were anonymous, and no identifying markers to match a particular student with the information he/she provided was available during analysis of data. The first author was not present at workshops or when students filled out surveys. The PI handed out and collected all surveys, and subsequently sent them to the co-PI after they had been completed. Surveys were developed by the first author, and validity and reliability of the survey instrument is ongoing. Controlling variables such as location, length or workshop, and presentation style of workshops is one component used to increase validity. Increasing randomization of sample of CASC-aid participants is done through changing the time of the workshop to ensure participants' schedules don't interfere with their ability to participate in workshop.

Results

After data analysis from six sets of surveys, researchers determined that Student Success Workshops provided an effective support to build job knowledge for CASC-aid scholars. Responses to survey items were positive (Table 2), although there was some confusion among scholars as to whether the workshops were mandatory.

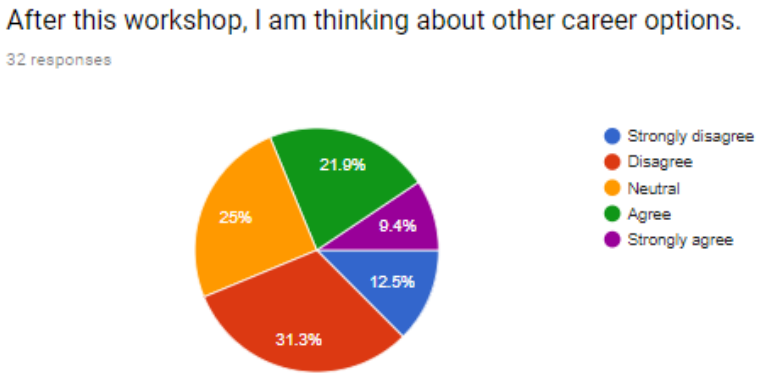
Table 2: Student-participants' responses to survey items one, two, and three

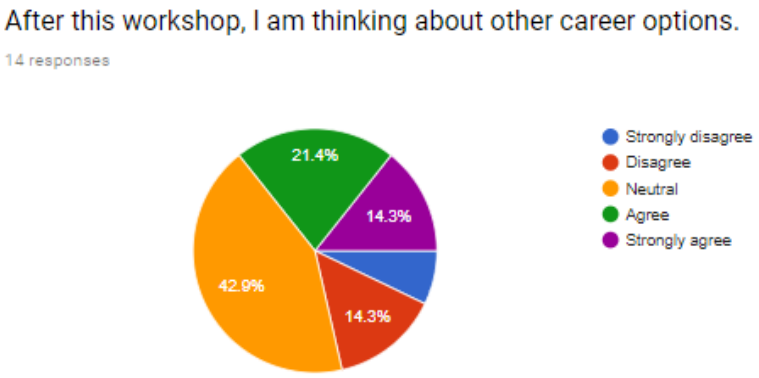
Survey Question One: This workshop was beneficial.					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	29%	39%	19%	9%	3%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	57%	36%	0%	0%	7%

Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	50%	31%	0%	0%	19%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	25%	33.3%	33.3%	0%	8.3%
Workshop Five: Current Memory Technology Trends	50%	50%	0%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	50%	37.5%	12.5%	0%	0%
Survey Question Two: The speaker was motivating					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	34%	19%	31%	13%	3%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	36%	50%	7%	7%	7%
Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	25%	56%	12%	6%	0%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	50%	16.7%	33.3%	0%	0%
Workshop Five: Current Memory Technology Trends	66.7%	33.3%	0%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	25%	50%	25%	0%	0%
Survey Question Three: I learned about a new career option					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Workshop One: System Dynamics Simulation Modeling	16%	34%	25%	20%	6%
Workshop Two: Drilling Optimization and Drill Stem Vibration Modeling	29%	64%	0%	0%	7%
Workshop Three: Vectorborne Diseases and Prevalence in South Texas Region	12%	25%	31%	19%	13%
Workshop Four: The Action of the Kauffman Bracket Skein Algebra of the Torus on the Skein Module of the 3-twist Knot Complement	16.7%	41.7%	25%	8/3%	8.3%
Workshop Five: Current Memory Technology Trends	33.3%	33.3%	33.3%	0%	0%
Workshop Six: Weak Galerkin Finite Element Method with Mixed Boundary Conditions	25%	12.5%	50%	0%	12.5%

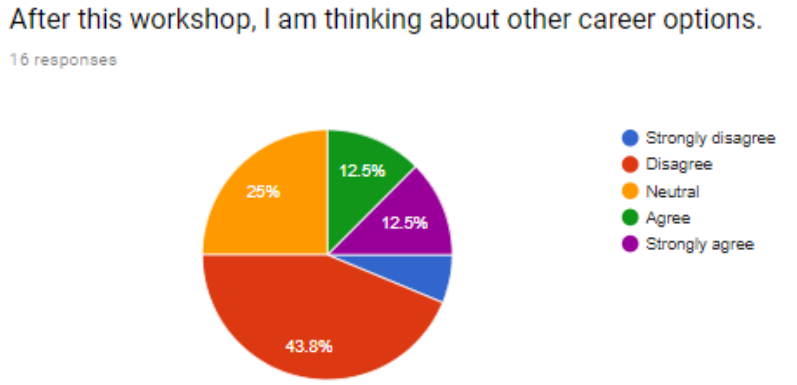
Survey results based on question one demonstrate that most students believed workshops were beneficial, with more than half of scholars selecting agree or strongly agree across all speakers. The second, third, and fifth workshops had the highest percent of students being motivated by the speaker. As a result, the PI and co-PIs would recommend speakers with knowledge on Drilling Optimization, Vectorborne Diseases, and Technology Trends as more beneficial for STEM students. The third item, "I learned about a new career option" provided an immediate response for the research team. This survey item, in particular, will aid the project team in identifying STEM scholars to speak at workshops.

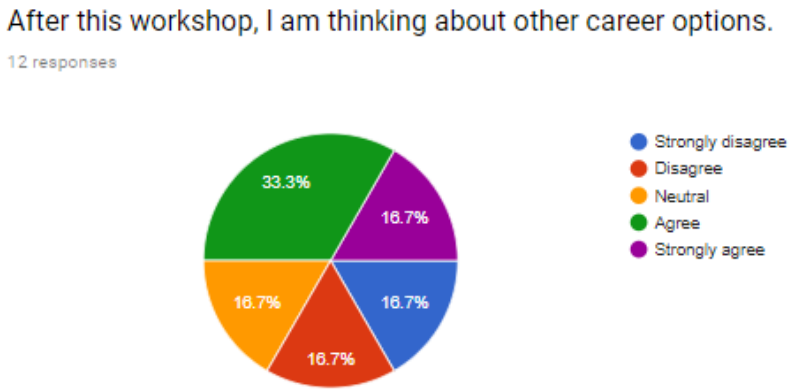
When students' responses on the first three questions were compared, the most successful workshop in terms of guest speaker was the second workshop, in which students were introduced to "Drilling Optimization and Drill Stem Vibration Modeling". Likewise, the second workshop introduced 93% of CASC-aid scholars to a new career option. This study took place in south Texas, and oil is a big industry in the state so this guest speaker effectively communicated potential career options to students that they may not have been aware of and/or considering. However, question eight, "After this workshop, I am thinking about other career options", provided mixed results. Students across all six workshops were considering other career options after listening to invited speakers (Figures 2, 3, 4, 5, 6, & 7); but, it was after the fourth and fifth workshops that the largest percentage of students attending the presentation were considering a career change.



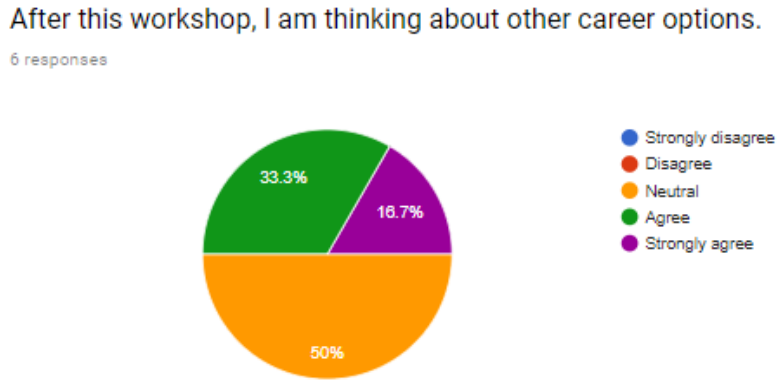


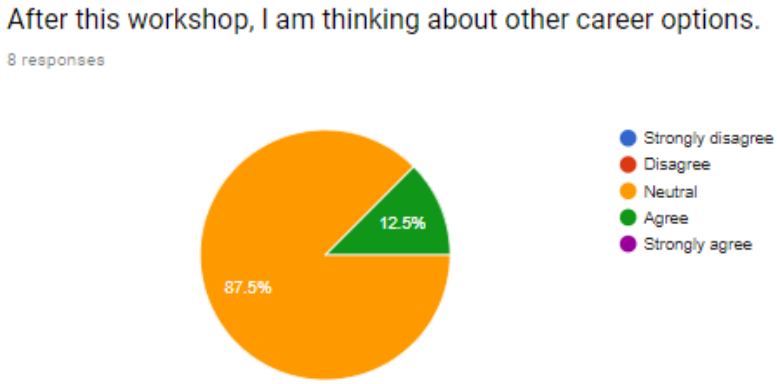
Figures 2 and 3: Students considered a career path change-Workshops one and two.





Figures 4 and 5: Students considered a career path change -Workshops three and four.





Figures 6 and 7: Students considered a career path change-Workshops five and six.

Questions five through seven (Figure 1) were developed to determine students' beliefs about supports CASC-aid scholars received from workshops. Students' responses on statements five through seven were higher for some workshops. For example, for the statement "I want more workshops like this one", workshops two and five received the strongest number of students selecting A or SA: 56.3%, 92.8%, 87.6%, 54.6%, 100%, & 62.5% with scores across all six workshops mostly positive respectively. On the statement "other CASC-aid scholars would benefit from workshops", students again responded SA or A in moderate to high percentages: 75%, 78.5%, 81.3%, 58.3%. 83.4%, & 62.5%. Finally, on the statement "workshops support my learning as a STEM student", students who selected A or SA was high across all six workshops respectively: 81.3%, 78.6%, 75.1%, 91.7%, 100%, & 100%.

Students selected A or SA that the "CASC-aid program is supportive" (90%, 78.6%, 100%, 83.4%, 100%, & 100%) and that they are "being prepared for a career in a STEM field as a CASC-aid scholar" (65.7%, 50%, 93.6%, 91.6%, 100%, & 87.5%) across the six workshops respectively. Notably, after workshop two, half of students did not believe they were being prepared for a STEM career; this might be explained because the guest speaker and topic were new for the majority of students. Furthermore, students may have felt underprepared after listening to a speaker talk about a career with which they were unfamiliar. Students may need additional support to ensure they feel they are being prepared for a career in a STEM field, especially if speakers are presenting new and possibly challenging career options that overwhelm undergraduate students.

Discussion and Recommendations

The use of Student Success Workshops to support Hispanic students majoring in a STEM area at the undergraduate level demonstrated a positive effect on student participants' learning. This formative experiment (Reinking and Bradley, 2008) was an exploratory study that is part of a larger research study to determine the effectiveness of interventions provided by Project CASC-aid to support Hispanic students majoring in STEM fields. During success workshops, students: (a) learned new information, (b) considered new career options they were unfamiliar with prior to invited speakers, and (c) received effective communication and supports from researchers/intellectuals in STEM career fields.

Recommendations include replication of Student Success Workshops to add to the knowledge base. More qualitative data would be beneficial; and data should include interviews with students before they have attended any workshops, and interviews after they have attended three or more workshops. Interviews might provide more relevant data about students' responses to workshops and benefits they believed they received by attending. Similarly, students might provide researchers with their thoughts on drawbacks of the workshops or provide input for future speakers/topics. Overall, the workshops were seen to be beneficial.

Conclusions

Analysis of results were encouraging, but there are several limitations in this study. First, the survey instrument itself is a limitation. The instrument was developed by the first author and multiple CASC-aid scholars were taking the survey on one, two, or more occasions. A second limitation was time involved. This data was collected via researcher-developed surveys, and although data collection and analysis took place over twelve months, the cumulative time students spent in workshops was approximately six hours. A third limitation was the

difference in the number of students attending and/or taking the survey after each workshop. The first workshop was heavily attended. Several of the other workshops were not so well attended. Nevertheless, collecting data on students' attitude toward speakers and topics is relevant. Overall, results demonstrated a level of success that was desired; and the positive outcomes brought about by the workshops as demonstrated by students' responses on the instrument is important. Students felt that they were being supported by the workshops. Likewise, data analysis determined that multiple students were exposed to career choices that they were unfamiliar with prior to listening to invited speakers.

For this investigation, students' responses to the developed Likert survey provided the project team with vital information in planning for future workshops, including: (a) guest speakers' area of expertise, (b) when to offer workshops, and (c) supporting students' long-term career choices. Furthermore, the goal of this formative experiment, to "Increase STEM majors' understanding of career opportunities, post-graduation, through Student Success Workshops" was achieved; and many of the workshops provided CASC-aid scholars with new knowledge for a potential career choice. Furthermore, the developed survey instrument provided information that will guide the project team in selecting speakers for future workshops. Although these workshops were one of multiple, on-going support mechanisms provided to Hispanic students majoring in a STEM field, results demonstrated that the Student Success Workshops were largely successful. PI and co-PIs on Project CASC-aid will continue to gather data from all support services to ascertain which supports are most beneficial in supporting first-generation, Hispanic students in completing an undergraduate degree in a STEM field. This is especially important for this student population. Overall, it is vital to identify speakers for success workshops who will effectively communicate and engage college students considering career options post-graduation from a STEM field.

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