

Overview of a Multi-Disciplinary Online Engagement Model for Female Hispanic Students in Pre-College STEM-Oriented Programs (Work in Progress)

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Victor Garcia is completing his doctoral degree in Civil Engineering from The University of Texas at El Paso (UTEP). Victor's doctoral dissertation contributed to the development of performance-engineered mix design specifications to produce balanced mix designs. For more than seven years, he has conducted research projects sponsored by the Texas Department of Transportation in the areas of transportation engineering, highway design, and pavement materials. He has published more than fifteen journal articles and presented more than ten technical presentations in these research topics. He is currently a research associate of the Yes SHE Can program sponsored by the US Department of Education, and the H-AGEP program sponsored by the National Science Foundation. His research interests are in the areas of transportation infrastructure and pavement materials, civil engineering applications in Smart Cities, advancement of STEM education, and career opportunities for underrepresented minority groups. Upon graduation, he will continue his professional career as a civil engineer and researcher at the Airfield and Pavements Branch of the Geotechnical and Structures Laboratory from the US Department of Defense.

Work in Progress: Overview of an Interdisciplinary Online Education Workshop for Female Hispanic Pre-College Students to Enroll in STEM Academic Programs.

Abstract

This work in progress (WIP) paper presents an overview of a recently implemented STEM Education Workshop to support the career decision-making of female Hispanic pre-college students. The STEM Education Workshop was carried out in collaboration with the UB program from the U.S. Department of Education, which focuses on increasing the rates of post-secondary education attendance of first-generation low-income students. The STEM Education Workshops were conducted through an online engagement environment that exposed students to educational activities and technical presentations. The educational activities and technical presentation were developed to cover several topics such as financial literacy, standardized testing, resume writing, and time management. Pre-college students also participated in individual mentoring sessions to allow for a one-on-one learning environment. Online surveys were formulated and distributed to the participants at different stages of the STEM Education Workshop during the summer of 2020. The information collected was preliminarily analyzed to generate conclusions about the STEM Education Workshop and draw recommendations to improve the material content, presentation methods and communication technology for use in upcoming STEM Education Workshops.

Introduction

Schools and colleges have discontinued in-person teaching practices for safety and health considerations. Since social distancing is currently preeminent, the teaching and learning environments might become a challenge for faculty and students. Online mode of education is not new at the college level and has become a ubiquitous practice because of the spread of the internet [1], [2], [3]. However, online education can be unengaging due to many reasons including personal attention, lack of social interaction, and excess of theory-based course content [4].

Recently, more studies of online education have focused on student engagement given its importance to education and learning quality [4], [5], [6]. Student engagement is typically defined as the time and effort that students devote to their academic responsibilities [7]. Student engagement in online teaching-learning environments can be considered a great challenge for remote education, from both teacher and student perspectives. Understanding instructional goals and coursework expectations are examples of barriers for online education [8]. Increasing students' interest to learning and engaging in online academic programs is indispensable.

Several intervention programs have been funded and implemented to support students' career-decision making, specifically for underrepresented minority (URM) students. As an example, the Advancement Via Individual Determination (AVID) is a nonprofit college-readiness program that focuses on growing writing, critical thinking, teamwork, organization and reading skills for pre-college students [9]. The federal TRIO programs are other examples of resources available to support school leaders and educators in preparing students for postsecondary education [10]. Similarly, the GEAR UP project supports low-income, minority students to go on to postsecondary education [11]. Such education-intervention programs should continue to be conducted even in a virtual setting. With the increasing use of education and communication technologies, the way students are engaging in their studies can be positively impacted [12]. This paper presents an overview of a STEM Education Workshop that was implemented during the summer of 2020 by a new university intervention program to support the career decision making of Hispanic female pre-college students interested on STEM professional and academic programs.

Main Goal and Objectives

A new university intervention program called “Yes, SHE Can!” partnered with the Upward Bound program, both from the University of Texas at El Paso, to support the career decision-making of Hispanic female pre-college students through a STEM Education Workshop. The STEM Education Workshop consisted of educational activities and technical presentations conducted by an interdisciplinary team. The objective of this paper is to provide an overview of the following two items: 1) the initial framework of the STEM Education Workshop, and 2) the preliminary feedback and observations collected during the summer of 2020.

Introduction of Yes SHE Can

To increase the enrollment of Hispanic female students into STEM academic programs, the “Yes SHE Can” program was recently initiated with the support of the U.S. Department of Education. The Yes SHE Can program consists of six major intervention components including education workshops, mentorship community, research component, recruitment activities, professional network, and curricula development. Ultimately, the Yes SHE Can program aims to develop and implement new education programs, engagement techniques, mentoring approaches, professional development opportunities, and career pathways to leverage the education, transition and success of female students in academic programs to a professional career in STEM fields.

Overview of STEM Education Workshop Initiative

The STEM Education Workshop is a major component of the Yes SHE Can program. The STEM Education Workshop is designed to prepare pre-college students to transition from pre-college to higher education while learning essential STEM related skills. The first implementation of the STEM Education Workshop was done during the summer of 2020 in a virtual manner to comply with COVID-19 restrictions. Twenty female Hispanic pre-college students of the UB program participated during the 2020 Summer STEM Education Workshop.

Initial Framework for STEM Education Workshop

The main goal of the STEM Education Workshop is to provide an educational space for Hispanic female students to learn about STEM-related topics that can support their career decision-making as they navigate through their academic programs. As shown in Figure 1, the program was designed with three main services including the STEM Education Workshop, a mentoring training for workshop facilitators, and individual mentoring sessions for pre-college students. The direction of the arrows represents the interaction between the participants and services.

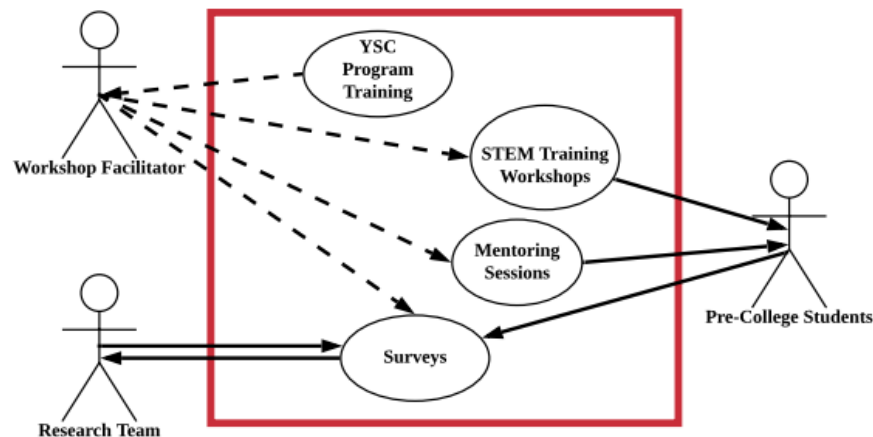


Figure 1: Interaction of Participants and Services of 2020 Summer STEM Education Workshop

The STEM Education Workshop was designed to be taught virtually during the summer of 2020. The educational activities and technical presentations were disseminated through a commercially available communication software. The selected communication technology provided video telephony and online chat services through a cloud-based peer-to-peer software platform. During the summer of 2020, the STEM Education Workshop lasted six weeks. To complement the STEM Education Workshop, the Mentoring Community component of the Yes SHE Can program was incorporated into the summer program. The pre-college students met individually with their assigned mentors during individual mentoring sessions to reinforce their learning.

Assessing Challenges to Implement STEM Education Workshops

Every URM student group may face different challenges that impede them to continue their academic careers in higher education. A pre-workshop survey was distributed to the pre-college students to identify the major challenges that might prevent them from pursuing an academic career at a college or university program. The pre-college students were asked: *What are the top three personal challenges you need help with to continue your academic career?* The most voted challenge was money, which can be interpreted as the lack of financial support during their academic careers. The pre-college students also highlighted challenges such as transportation, interpersonal skills, social skills, family support, language barriers, and time management. Based on this information, the STEM Education Workshop focused on the following eight topics: 1) *STEM Programs*, 2) *Self-Discovery*, 3) *Confidence Building*, 4) *Mental Health*, 5) *Communication*, 6) *Time Management*, 7) *Writing College Ready Resumes*, and 8) *Financial Literacy*.

The Yes SHE Can program implemented a unique engagement approach for the 2020 Summer STEM Education Workshops. The workshop facilitators and mentors were primarily female individuals with a wide variety of academic and professional careers and backgrounds. This approach allowed the pre-college students to have access to role models and mentors with a similar demographic background. As stated on [13], role-model mentoring sessions is a promising method that reduces gender stereotypes and strengthens expectancies of success on girls' STEM choices. In addition, several workshop facilitators were current college students. By having college students serving as the workshop facilitators, a stronger bond between workshop facilitators and pre-college students was aimed as previously documented by [14]. A general program training was provided for the workshop facilitators before participating in the STEM Education Workshop. Twenty-seven members of the university intervention program participated in the program training.

First Impact of STEM Education Workshop on 2020 Summer Pre-College Student Cohort

A post-workshop survey was distributed among the pre-college students to collect feedback on the impact and effectiveness of the STEM Education Workshop and related activities. In this section, four of the questions included in the post-workshop survey are discussed and documented. Figure 2 represents an example of the feedback provided by the pre-college students. The collected information is being analyzed following a thematic analysis approach. From the preliminary results, pre-college students suggested to include more discussion topics such as creating professional relationship with professors, dealing with classmates with different personalities, and the application process for specific STEM academic programs. They also recommended to have more discussion sessions during the technical presentations, different presentation methods and educational activities to increase students' engagement and participation and the flexibility to select the topics for technical presentations. The individual mentoring sessions were one specific aspect that the pre-college students participated the most during the Summer 2020 STEM

Educational Workshops, and provided positive feedback that will be further analyzed and discussed as more information is collected from upcoming STEM Education Workshops.

<p>Is there a topic that should be included in the workshops?</p> <ul style="list-style-type: none"> - <i>"How to develop relationships with professors"</i> - <i>"How to deal with people with different perspectives"</i> - <i>"How the college application process works"</i> 	<p>How can this summer workshop be improved?</p> <ul style="list-style-type: none"> - <i>"Design workshops with more conversation sessions"</i> - <i>"Allow students to choose workshop topics"</i> - <i>"Use other teaching methods to increase session participation"</i>
<p>What did you most enjoy about the mentoring experience?</p> <ul style="list-style-type: none"> - <i>"The opportunity to build a relationship with someone with college experience"</i> - <i>"My mentor made me feel comfortable to talk about personal issues"</i> 	<p>Would you recommend the summer workshop?</p> <ul style="list-style-type: none"> - <i>"Yes, it was versatile and enjoyable"</i> - <i>"Yes, it should be extended to all levels of high-school students"</i> - <i>"Yes, I was able to learn from many different perspectives and experiences of professionals"</i>

Figure 2: Example of Feedback from Post-Workshop Survey to Pre-college Students

Summary and Conclusions

The Yes SHE Can program implemented a STEM Education Workshop in an online engagement environment during the summer of 2020. The STEM Education Workshop was strategically designed for Hispanic female students in a pre-college program. The following preliminary observations are offered:

1. The topics covered during the STEM Education Workshop were indirectly selected by the pre-college students based on their responses to a pre-workshop survey. After developing the educational activities, technical presentations and discussion sessions, the creation of a new training model is desirable to not only consider STEM concepts and programs, but incorporate complementary topics that can potentially strengthen the professional, personal, employability and soft skills of pre-college students.
2. As reported in [13], minimizing the gender stereotype in a teaching and learning environment enables a sense of belonging and an increases engagement. The use of female role models was actively adopted by this program to mitigate the gender stereotype and increase the engagement of Hispanic female pre-college students. The workshop facilitators and mentors were female individuals from either academia or industry. From the post-workshop survey for pre-college students, having female role models and mentors contributed to increasing the confidence of pre-college students to actively participate in the activities and discussions.
3. College female students of different classifications (e.g., sophomores, juniors, and seniors) actively participated during the STEM Education Workshops as workshop facilitators and presenters. The presence of college female students also boosted the participation and confidence of female pre-college students and allowed them to develop a stronger bond between workshop facilitators and pre-college students. A similar outcome was observed from [14] where mentoring activities conducted by peers and graduate students were provided to pre-college students to increase their interest in STEM programs.
4. The individual mentoring sessions, which were another intervention component of this new university intervention program, were incorporated into the STEM Education Workshops

and is recommended to continue being implemented to provide individual support to pre-college students regarding personal issues, material content, and additional questions.

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