Research Paper

Rubi Perez

The University of Texas Rio Grande Valley

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Dr. Maria Diaz

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**INTRODUCTION**

The Hispanic population in the United States is expected to increase within the upcoming years. As the Hispanic population is increasing the advances in technology are also expected to increase. The increase in technology will cause a demand of workers in the STEM field. With that said, my research will focus on the underrepresentation of Hispanics in the STEM field and will highlight key factors that contribute to the issue.

Although there is a lot of articles that spotlight the underrepresentation of Hispanics in the STEM field this research project focuses on the support given to Hispanics by educators to pursue a career in the STEM field and the variety of obstacles Hispanics face when trying to pursue a career in the STEM field. There are two research questions that drive this study. Can educators help prepare Hispanic students to enter the STEM field? What are some obstacles that Hispanics face when trying to pursue the STEM field? This collection of data gives us a better idea of opportunities and challenges that Hispanics face when pursuing a career in the STEM field.

**ANNOTATED BIBLIOGRAPHY**

*Article 1*

Biswas, P., Goonatilake, R., Pinzon, G., & Khasawneh, M. (n.d.). STEM Workshops for Transfer and Retention Program at a Hispanic Serving Institution. *2015 ASEE Annual Conference and Exposition Proceedings*. doi:10.18260/p.24735

 The purpose of this article is to evaluate the success of two different programs that strive to improve the recruitment and retention of Hispanic students into the Systems and Engineering program at Texas A&M International University. The STEM - Minority Outreach and Retention Enhancement Program for Transfer and Retention (STEM-MORE-TRP) and the Serving Youth in Science, Technology, Engineering, & Mathematics Program (SYSTEM) are designed to recruit the engineering students through a number of enrichment activities, including two-week residential Engineering Workshops at a major Hispanic-Serving Institution (HSI) in southern Texas.

 After the two-week residency, 45 of the participants answered a survey to rate their experience and future plans. The results from the survey showed that students were very satisfied with the workshops and that they would recommend them to others. The workshop was successful in encouraging the participants to continue working towards a STEM degree. The data showed a 13% increase in the participant’s assertive interest in pursuing a career in the STEM field. The data also showed that 13% of the participants might or probably will continue to pursue a career in the STEM field.

The methodology for this research is quantitative. The method is considered quantitative because it evaluated surveys that participants took at the end of the workshops. There were no indications that the researchers conducted any qualitative collection of data. This research allows us to conclude that the participation of STEM related workshops increases awareness and interest for Hispanic students to pursue a degree in the STEM field. This article contributes to my research by providing me with an example of opportunities that are given to Hispanics to pursue a degree in STEM. This also serves as a good example of an increase of interest to pursue a degree in the STEM after being exposed to some STEM workshops.

*Article 2*

Khasawneh, M. T., Bachnak, R. A., Goonatilake, R., Lin, R., Biswas, P., & Maldonado, S. C.

(2014). Promoting STEM Education and Careers among Hispanics and Other Minorities through Programs, Enrichment, and other Activities. *360 of Engineering Education.*

The purpose of the article is to highlight the success of the The STEM-Minority Outreach and Retention Enhancement (STEM-MORE) project on its second year since being implemented at Texas A&M International University (TAMIU). The program aims to provide high quality education to Latinos and other minority communities. There are different components that compose the overall program. Some of the components in the program were the MORE- Education and Enrichment Program, MORE- High School Outreach Program, MORE- Internships and Research Programs,, and MORE- Professional Development Program. The various components target different areas of needs for Latinos to be supported while they pursue the STEM field. This helps my research by giving me more insight of what programs that are currently in place actually support the Latino population and push them to pursue a degree in STEM.

The methodology used for this article is quantitative by tracking the number of Latino students who maintained a retention in the various MORE components that later allowed them to pursue the STEM field. The results for the findings are divided by the specific MORE program. The MORE- Education and Enrichment Program aimed to improve the recruitment and preparation of Latinos through participation in summer workshops. The methodology for this specific program was qualitative as 58 participants were surveyed in regards to their experience. Overall, out of 58 students surveyed, 1% of the students thought the program was fair, 16% of students thought the program was good, 45% of the students thought the program was very good, while 38% thought it was outstanding.

The MORE High School Outreach Program focused on bi-weekly visits to each high school campus to meet with prospective students, parents, and guardians to educate them on STEM careers. It is expected that most of these mentees will join a STEM career in the near future. MORE-Internship and Research Programs (MORE-IRP) This internship program offers real-world learning experiences to STEM majors at TAMIU. This component of the program was able to employ 10 student research assistants (70% female, 30% male), 7 interns (57% female, 43% male), 5 special program aids (60% female, 40% male), and 1 graduate program aid (100% male, 0% male) during October 1, 2012 – September 30, 2013. The MORE-PDP is intended to enhance faculty teaching skills and abilities, and, therefore, improve the student retention and graduation rates in STEM majors at TAMIU. This program focused on 24 participants that expressed about a 70% overall rating for effectiveness of the program to better prepare Latinos in the STEM Field. This article contributes to my research by giving me an example of STEM related programs that have a positive impact on Hispanics pursing the STEM field.

*Article 3*

Santiago, D., & Soliz, M. (2012). Finding Your Workforce: The Top 25 Institutions Graduating Latinos in Science, Technology, Engineering, and Math (STEM) by Academic Level—2009-10. *Exelencia in Education*.

This article highlights the top institutions for graduating Latinos in the STEM field. It

highlights the institutions and what kind of degrees they are graduating with. Given Latinos are projected to account for 75 percent of the growth in the nation’s labor force between 2010 and 2020, Latinos completing certificates and degrees in STEM fields will be vital to meeting the national STEM college completion goal. This ties in with my previous article that highlights the projected increase of Latinos in the United States as well as the projected demand of STEM jobs.

They main findings for this article are the following: Latinos earned a small percentage of certificates/ degrees conferred in STEM. A small number of institutions graduated a high percentage of Latinos in STEM. Latino degree attainment in STEM is concentrated at the bachelor level. Latinos working in STEM are concentrated in lower paying jobs. Latino degree attainment in STEM is concentrated geographically. Overall, the highest graduating rates for Latinos achieving an Associate’s degree in the STEM field are concentrated in 8 schools in Texas, 12 schools in California, 1 in Puerto Rico, 1 in Florida, 1 in New Jersey, 1 in Arizona, and 1 in New York. The article breaks down the top 25 institutions for Latinos obtaining bachelors, masters, and doctorates degrees in the STEM field which always focus on the same states.

This methodology for this article is quantitative as it also follows trends for numbers of Latinos that are graduating in hopes to pursue a career in the STEM field. The numbers discussed in this article help with my research by highlighting the institutions that are mainly supporting Latinos achieve a post-secondary degree that will prepare them to enter the STEM workforce in the near future.

*Article 4*

Strayhorn, T. L., Long, L.L., Kitchen, J.A., Williams, M.S., & Stenz, M. E. (2013) Academic

and Social Barriers to Black and Latino Male Collegians’ Success in Engineering and Related STEM Fields. Retrieved July 12, 2020, from https://commons.erau.edu/publication/295

This article focuses on the social barriers that black and Latino males face when pursuing a

degree in the STEM field. Only undergraduates were recruited as participants to eliminate and

unforeseen variability in experiences between undergraduate and graduate students. Willing

participants were contacted via telephone or email by the researcher(s) to confirm their

participation, review informed consent information, and schedule a day and time for interviews.

Interviews were conducted in a private room, centrally located on campus, by the researchers.

Each interview lasted 90 to 120 minutes. The methodology for this article was qualitative as it

focused on a small group of students who shared their experiences when pursuing a degree in the

STEM field.

 Participants shared their personal experiences for pursuing a degree in the them STEM

field and what challenges faced them throughout their process. Four major themes were

identified including: alienation and invisibility, lack of same race peers and faculty upon whom

students could depend for support, difficulty applying theory and curriculum to practice, as well

as few opportunities to do so in introductory engineering courses, and lack of pre-college

preparation for collegiate STEM coursework.

 This article really helps my research by providing me with another perspective to the

research I will be conducting. Instead of my research just focusing on statistics and trends, this

article helps me also see a qualitative side to address why there is such a low representation of

Latinos in the STEM field.

*Article 5*

Talley, K. G., & Ortiz, A. M. (2017). Women’s interest development and motivations to persist as college students in STEM: A mixed methods analysis of views and voices from a Hispanic-Serving Institution. *International Journal of STEM Education,* *4*(1). doi:10.1186/s40594-017-0059-2

The purpose for this article was to identify the factors that contributed Latinas to pursue a higher education, particularly in the STEM field. The study aimed to answer the following questions. 1. What factors contribute to the interest development and motivational drive to persist of college women in STEM? 2. In what ways, if any, do Latina and African American STEM students differ in their interest development and motivations to persist in STEM from their White female peers?

The participants included women from four departments in the College of Science and Engineering, Computer Science, Engineering Technology, Engineering and Physics at the university of Texas State. At the time of the study, the participants were either juniors, seniors, or graduate students for the 2013-2014 or 2015-2015 academic year. The women participated in both online questionnaires and participation focus groups. The methodology for this article was mixed. The quantitative method accounted involved online questionnaires while the qualitative method involved participation in various focus groups.

The findings for this article were that students identify early participation in STEM activities and family socializing behavior as ones that contributed the most towards influencing their interest in STEM and motivated them to persist in their studies and pathways as future STEM professionals. This article is helpful to my research by giving me an idea of some of the challenges that Latinas phase when pursuing a career in the STEM field.

**METHODOLOGY**

**Setting**

 I conducted my research in the area of Texas. I conducted my research by issuing out surveys and interviews to different participants that reside in different cities across Texas. The majority of the participants will be from cities across the Rio Grande Valley of Texas and the Austin area. As a Hispanic in Texas myself, I am very familiarized with the setting of the problem and will be able to represent the population of Hispanics that I have spent most of my life surrounded by. I collected the data through two different surveys that were created in google forms and interviews conducted via voice calls. Due to the COVID social measures that were in place at the time, the surveys were issued out via e-mail and asked to be completed within a week. The interviews conducted via phone were transcribed to be later analyzed.

**Participants**

The participants for this research were all Hispanics. There was a total of 30 participants in this research that gave me a good idea of trends. The participants included ten Hispanic educators, ten Hispanic non STEM field workers, and ten Hispanic STEM field workers. The STEM workers included a variety of scientists, teachers, and health care providers. Having this variety of participants gave me a good idea of opportunities and challenges that Hispanic populations go through when pursuing a degree in the STEM field.

**Methodological approach**

I used the mixed method of research in order to identify factors that lead to the underrepresentation of Hispanics in the STEM field. I thought it was important for my research to collect data that represented statistical information that portrays the involvement of Hispanics in the STEM field in different areas of Texas. This quantitative method will allow me to identify different trends that have occurred in the past and that are projected to happen in the future. Quantitative data was collected through surveys and the use of existing databases.

The other significant part of my research was collecting qualitative data. Qualitative data that was significant for my research included narratives and responses to interviews provided from different participants. Since we are living in a time where we are forced to social distance, I conducted interviews via phone calls in which I gathered quotes from the participants. This method allowed me to gather a more in depth understanding of the challenges and opportunities that Hispanics face when they are trying to pursue a career in the STEM field. I believe that both methods are very beneficial and bring a different perspective to my research.

**Data instruments for data collection and analysis**

 I analyzed different collections of data gathered from surveys and interviews conducted in English. There were two different surveys that went out to a total number of 20 participants and 10 interviews that were conducted via voice calls. The first survey went out to Hispanic non-educators or STEM workers. This survey asked them questions about their involvement in STEM related programs throughout their pre-K through 12 years in school. The questions that were asked in the survey are below.

* While in school, did you ever find an interest in the STEM field?
* While in school, did you ever join a STEM program?
* While in school, did your teachers encourage you to engage in STEM?
* On a scale from 1-10 how interested were you in science, technology, engineering, or mathematics?
* How involved were your parents in school?
* Did your parents ever encourage you to pursue a career in the STEM field?
* Did you find STEM classes challenging?
* How much support did you receive in STEM classes?

On a separate survey, I targeted Hispanic educators that were asked a combination of multiple choice and open ended questions. The questions that were asked in the survey are stated below.

* How many STEM programs are in place at your current school?
* How many times does your school participate in field trips to STEM related locations?
* Do you ever encourage your students to pursue a career in the STEM field?
* What are some current obstacles you see students facing when pursuing a career in the STEM field?

Lastly, I targeted ten Hispanic STEM field workers that participated in voice call interviews. The questions that were asked in the interview are stated below.

* When did you first spark an interest in the STEM field?
* What obstacles did you face when pursuing a career in the STEM field?
* What opportunities were given to you that lead to a career in the STEM field?
* Did you have any mentors that guided you through a career in the STEM field?
* How supportive were your parents of your involvement in a STEM related career?

**CONCLUSION**

The underrepresentation of Hispanics in the STEM field is attributed to the different opportunities and challenges that Hispanics face when pursuing a career in the STEM field. On the non-educator’s survey that attributed to their pre-K through 12th grade years, 80% of the participants expressed that they found STEM classes challenging, 50% of the participants had an interest in the STEM field while in grade school, and 40% of participants shared that they had teachers encourage them to engage in the STEM field.

The ten educators that participated in a different survey contributed to the findings for this research. Six out of the ten educators expressed that there was at least one program in their school that exposed students to the STEM field. Five of the ten teachers shared that their school expressed an interest for having STEM related field trips that their students could participate in. When asked what they thought were some of the obstacles they see their students facing, five teachers expressed the lack of parent involvement and three out of the ten teachers expressed that the student’s family might find money a factor to pursuing a career in the STEM field.

Lastly, the interviews with the STEM workers shared a more in depth insight for the opportunities and challenges faced by Hispanic students. Five out of the ten participants shared that they participated in programs that introduced them to the STEM field. These programs included summer camps, boy scout’s organizations, the Math and Science Upward Bound program, and the Math and Science Academy at The University of Texas of Brownsville. When asked about potential challenges the most popular answer amongst them was that they were 1st generation students that had no mentors or guidance from family members. Another challenge that came up more than once was the language barrier and unawareness to paying for school.

Based on the responses given by the 30 participants there is three key findings that help answer the two initial research questions. Educators play a huge role in exposing students to the STEM field. This is through tutoring, guidance, and recommendation of programs outside of school. Some of the main obstacles that Hispanics face are the lack of mentorship, financial literacy, and exposure to the STEM field. These are barriers that contribute to the overall underrepresentation of Hispanics in the STEM field.

There were three possible limitations that contributed to my research. One of the limitations was the short number of participants. Another limitation was the setting for my research. A more specific setting such a particular district, school, or city would have given me a better idea of a given population. Lastly, the questions for the surveys and interviews could have been phrased differently in order to have more clarity and defined answers.

Implications for a future research include a more centered population and more participants included in the study. A great idea for a more in depth research is the underrepresentation of female vs. male Hispanics in the STEM field. Another implication would be to include different settings throughout the United States in which there is predominately Hispanic populations. These implications could give us a better idea explaining the reasons for the underrepresentation of Hispanics in the STEM field.

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