The Absence of People of Color within STEM fields:
An Exploration of the Social Barriers Affecting Latin@ Communities

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ABSTRACT

More and more Latin@ students are not graduating with majors in the Science, Technology, Engineering and Mathematic (STEM) fields. This research proposal focuses on the disadvantages that discourage young Latin@s from pursuing majors in STEM fields. The problems affecting this demographic group that will be discussed include socioeconomic status, the role of family influence, the lack of mentorship and role models, as well as nature science programs. The objective of this project is to develop a research method that will examine the influencing factors that both Latin@ and non-Latin@ college students experience when choosing a major in respective to STEM fields. Also, an observation of elementary students will be conducted in order to determine if early exposure to the sciences has any influence on their future careers.
INTRODUCTION

It is critical to prepare Latin@ (the @ symbol is utilized throughout the paper as an inclusive tool in reference to Latinos, Latinas and Hispanics unless otherwise noted) adults as educated professionals, especially in a state such as California where this group makes up 38.4% of the total population (U.S. Census Bureau, 2010). In addition, Latin@ are now the largest ethnic minority in the United States, making up 16.7% of the total population (Motel and Patten, 2011) and the Latin@ population is projected to triple in size by the year 2050 (Cohn and Passel, 2008). Furthermore, over the next decade, labor predictions indicate a gap of more than a million jobs requiring science, technology, engineering, and math (STEM) skills in the United States (Martinez, 2013), highlighting a critical situation in a globally competitive STEM work force (Gates, 2010). Unfortunately, our educational system is not on schedule to provide this nation with workers versed in STEM skills and thus will fall short by about one million prepared individuals (Martinez, 2013). It is therefore crucial to understand that because Latin@ will represent a large percentage of the population within California, as well as the nation, they will have the numbers, but not necessarily the ability and opportunity to fill STEM positions.

Professions that would benefit California the most economically are those that fall within the STEM fields. Expertise in these areas of study will be particularly important for maintaining a thriving economy and in developing innovative solutions to global challenges (Hrabowski, 2014). Latin@s, therefore, are in a unique position where they have the numbers to fill critical labor groups, but lack the necessary educational training to ensure this outcome.

Many American students initially interested in STEM areas select other fields after they begin college: only 33 percent of Caucasian students, 42 percent of Asian American students, and about 20 percent of African American, Latino, and Native American students who aspire to
complete a STEM major succeed (Hrabowski, 2014). Moreover, only 6 percent of 24-year-olds in the United States hold first degrees in these fields, placing the country 20th in a comparison to a group of 24 industrialized countries (Hrabowski, 2014). Yet, even with opportunities opening up to this ethnic group, another obstacle stands in the way of Latin@ students filling STEM positions: completing a college education in a STEM field. Knowing that Latin@s play a pivotal role in the future of this nation, it is imperative to be aware of the numerous hurdles that stand in the way of their success in higher education. Some examples of these problems include family influence, a lack of mentorship/role models, socioeconomic status, and nature/science programs.

Only limited research exists that directly examines the reasons for the low number of Latin@ students in STEM fields. This paper proposes a research protocol that will focus primarily on the question: are Latin@ students who come from communities that lack nature or science programs, mentorship, and positive role models more likely to neglect STEM fields of study when they reach college?

**LITERATURE REVIEW**

**Role of Family Influence**

Latin@ youth are not likely to attend higher institutions of education due to factors such as the influence of a Latino cultural norm referred to as *familismo* (Clark et al., 2013). *Familismo* involves the strong identification and attachment to immediate and extended family. *Familismo* is a family value that embodies strong feelings of loyalty, responsibility, and solidarity within the Latino family unit (Saenz and Ponjuan, 2009). With such strong feelings of loyalty, this norm can leave Latin@s with the desire and pressure to provide immediate support for their respective families. This urgent need for support channels young Latin@s into the workforce and makes
higher education a low priority, not knowing that greater support for Latin@ families can result from attending a university.

Although familismo can be described as a problem facing Latin@s from reaching a university it is also considered an aid. Scholars have noted that familismo can serve as a strong social network and form a social capital that can facilitate lifelong educational success (Saenz and Ponjuan, 2009). Specifically, familismo can work as a socio-cultural asset to assist young Latin@s in navigating the educational system. For Latino males, the value of familismo can be an asset because of its correlation with strong social and family networks, which can ultimately be accessed to support their academic achievement (Saenz and Ponjuan, 2009).

Familismo can be labeled a cultural custom that hinders the chances of Latin@ from attending a university in that this norm contributes not only to the general low numbers of Latin@ students attending colleges or universities, but STEM programs as well.

**Role of Mentorship/Role Models**

The lack of mentorship or positive role models in the lives of Latin@ youth is another example of an obstacle that blocks the avenue for youth from participating in postsecondary levels of education. The aid that mentors and positive role models can offer students varies from financial and educational support to emotional support. One study in particular, which focuses on Chicana female students and their struggles through academia in STEM, shows how important and influential a mentor can be. When academic preparation may have been lacking, mentors and teachers provided support that often supplemented and enhanced the poor preparation that under-funded or limited schools offered (Cantú, 2012). For example, Niebla, who is a participant of the study, recalls the story of a dedicated high school mathematics teacher, Mr. Summers, who taught her calculus after school hours. Montoya, another participant, remembers Lynn
Hindemann, a professor who advised that she be easier on herself when she was going through a rough time that was only made worse due to the passing of her grandmother (Cantú, 2012). In the foreign environment of higher education where Latin@ students are likely first generation college students, having a mentor can mean the difference between graduating or dropping out. The role that mentorship plays can be stressed as pivotal in the success of Latin@ students.

**Socioeconomic Status**

Socioeconomic status also affects Latin@ students’ success in college. Interviewed high school principals, mentioned that early entry into the job market to assist with family support was a reason for Latin@s not to go on to postsecondary education (Clark et al., 2014). Likewise in another survey, data revealed that Hispanic parents place high value on going to college; however, a large number of their children tend to drop out of school depicting a paradox that may be attributed to poor socioeconomic conditions (Gates, 2010).

One study executed by the Dept. of Geosciences at University of Arizona found that of all the science, technology, engineering, and math (STEM) fields, geoscience has the least racial and ethnic diversity (Stokes et al., 2014). The findings from this study illustrate the issues behind and ways to improve the low number of minority students, like Hispanics, majoring in geoscience. For example, because Hispanic students encounter more skepticism when explaining their choice of a major to their family, it would serve geosciences well to provide prospective geoscience majors with information useful in their family discussions (Stokes et al., 2014). Also, the sharing of information on employment opportunities, job security, and starting salaries in geoscience fields should help to convince families that geoscience is a worthwhile degree (Stokes et al., 2014).

These improvements within the Department of Geoscience can help ease the hold
that *familismo* norms have on Latin@ educational aspirations as well as offer solutions for the low socioeconomic status Latin@s are in. *Familismo* ties into low socioeconomic status because Latin@s who suffer from this cultural norm do so because of the economic condition their families are in. Therefore, by providing proof to families exhibiting that a college degree is not a waste of time and instead a secure investment, families can begin to change the stigmas that exist about college. Hence revealing an avenue that can help Hispanic students pursue STEM fields. Many options exist that can help mend this broken educational pipeline and one in particular that pertains to science involves the implementation of science or STEM immersion programs.

**Science/Nature Programs**

Research has shown that early exposure to STEM initiatives and activities positively impacts elementary students’ perceptions and outlooks (Dejarnette, 2012). By capturing student interest in STEM content at an earlier age, it can ensure that students are on track through middle and high school to complete the needed coursework to enter STEM degree programs at institutions of higher learning (Dejarnette, 2012). In addition, a study conducted to find the reasons for low numbers of Hispanic geoscience majors found that more informal outdoor experiences for Hispanic youth could result in more Hispanic undergraduate geoscience majors (Stokes et al., 2014). The cause of the problem for low Hispanic geoscience majors was attributed to the fewer informal outdoor involvements experienced by Hispanics before college, which left them feeling out of place. Meanwhile, Caucasian geoscience majors, who grew up with many outdoor experiences, felt more comfortable. It can be concluded that there exists an alienating factor facing Hispanics, which serves as a barrier to entry into STEM related fields of study. This inadequate exposure of science curriculum to Latin@ youth is an area that needs attention and development if the number of Latin@s within STEM fields are to improve.
Facing institutional, social, and familial barriers, the educational experience of Latin@ male students can be one of struggle and discouragement (Clark et al., 2013). For example, researchers have found that Hispanic high school students who have experienced discrimination while in high school are less likely to apply to college (Storlie et al., 2014). Also, cultural expectations for the Latino man to work to contribute to the family’s well-being rather than pursue a postsecondary degree can play a significant role in Latino men’s educational aspirations and pursuits (Clark et al., 2013). Although a great deal of research of the struggles facing Latin@ students from reaching postsecondary levels of education exists, little research has been conducted on the barriers facing students from reaching specific areas of higher education like STEM fields.

**Hypothesis**

*H1: Latin@ students who come from communities that lack nature and science programs, mentorship, and positive role models are more likely to neglect STEM fields of study when they reach college.*

**METHODS**

**Research Approach**

The objective of this project is to develop a research method that will examine the influencing factors that both Latin@ and non-Latin@ college students experience when choosing a major in respective to STEM fields. In addition, this research will observe two fifth grade dual immersion classrooms consisting of mainly Hispanic, low-income students.

In one classroom, 38 students are being taught science for 30 minutes four times a week. Meanwhile in a second classroom, 20 English language learners are focused on passing the California English Language Development Test (CELDT); thus they are not allotted time for
The purpose of this observation is to determine if early exposure to the sciences has any influence on the opinions of young students’ choices for their future careers.

This research will utilize a qualitative method of analysis. It will include two interview questionnaires, appendix A and B, consisting of thirteen questions that will be administered to college level students and another that will be administered to fifth grade elementary level students consisting of 8 interview questions. Since this proposed research method aims to study humans, federal regulations give the institutional review board the authority to review research involving human subjects (Amdur and Bankert, 2011). Therefore, appendices A and B will be accompanied by cover sheets explaining the interview process, purpose of the study, rights of the respondents as well as clarify that all information supplied will be confidential and anonymous.

The reason for the inclusion of such material is explained by the essential part of qualitative research, which is informed consent (Amdur and Bankert, 2011). Ideally, this process of consent must be continued throughout the progression of a subject’s involvement (Amdur and Bankert, 2011). Furthermore, as the researcher refines the study, subjects should be reminded that participation is voluntary, and their understanding of the risks and benefits of participation should be reminded (Amdur and Bankert, 2011).

**Sampling Frame and Data Collection Method**

With an ethnically diverse population, Sacramento State will be the location where data will be collected for the college level interviews of this study. In 2012, 40% of students identified as Caucasian, 21% identified as Asian-American or Pacific Islander, 19% identified Latino/a, 6% identified as African-American, 1% identified as Native-American, while the rest identified as other (Office of Institutional Research, 2012). The classroom observations as well as the interview of the younger cohort will be conducted at an elementary school located in the
city of Vacaville, California called Edwin Markham Elementary School. This school is the ideal location for a study that looks to identify issues that deter young Latin@ students from considering a major in science, technology, engineering or mathematics. In addition, due to its demographics, this dual immersion school is an adequate location to conduct research. At Edwin Markham Elementary, the student ethnicity is comprised of: 75% Hispanic/Latino, 13% White, 6% African American, 2% Native American, 1% Filipino, and 1% as two or more (Edwin Markham Elementary).

**Strengths and Limitations**

An advantage to utilizing a survey with open-ended questions is the flexibility and freedom the respondent have at their disposal. This flexibility allows the study to capture the true nature of the individuals’ feelings, outlooks, and experiences. This survey suffers a limitation in its small sample size and sampling method, which limits generalizations. Ultimately, this qualitative study will develop hypotheses rather than test or validate one (Amdur and Bankert, 2011). Due to a limited amount of research focused on finding causes for a lack of interest in pursuing STEM careers within the Latin@ communities, this study has the potential to provide qualitative results. The exploratory findings will supply testimonial accounts, which can later serve future studies.
References


Appendix A: College Student Survey

1. In your opinion, do you think your socioeconomic status influenced your decision when choosing your major(s)? If yes, how so?

2. During your K-12 education, can you recall any nature/science programs that you were involved in? If yes, what were they and did they impact your decision in choosing a major?

3. Do you have a mentor within your department?

4. Growing up were you expected to provide for your family right after high school? If yes, in what ways?
5. Growing up, did you ever have an educational role model? If so, who was it and how were they influential in your life?

6. What is your age? _____

7. What is your gender? _________________

8. Which ethnicity do you identify with?

   (1) _____ Hispanic/Latino
   (2) _____ Black or African American
   (3) _____ Asian
   (4) _____ Native Hawaiian or other Pacific Islander
   (5) _____ American Indian or Alaska Native
   (6) _____ White
   (7) Other______________________________

9. State your major(s) ________________________________________________

10. What past experiences influenced you to choose your major(s)?
11. What best describes your mother’s education?

(1) _____ Less than high school
(2) _____ High school
(3) _____ Associate/Junior College
(4) _____ Bachelors
(5) _____ Graduate

12. What best describes your father’s education?

(1) _____ Less than high school
(2) _____ High school
(3) _____ Associate/Junior College
(4) _____ Bachelors
(5) _____ Graduate

13. What best describes your family’s income when you were growing up?

(1) _____ below $20,000
(2) _____ $20,001 -- $30,000
(3) _____ $30,001 -- $40,000
(4) _____ $40,001 -- $60,000
(5) _____ $60,001 -- $90,000
(6) _____ above $90,000
Appendix B: Elementary Student Survey

1. Are you in science or ELD?

2. Do you enjoy school? Why or why not?

3. What do you want to be when you grow up? Why?

4. Who is someone you look up to and why?

5. Which of the following subjects do you enjoy the most?
   a. Science
   b. Math
   c. Technology
   d. Engineering

6. What is your age? _____

7. What is your gender? ________________
8. Which ethnicity do you identify with?

(1) _____ Hispanic/Latino

(2) _____ Black or African American

(3) _____ Asian

(4) _____ Native Hawaiian or other Pacific Islander

(5) _____ American Indian or Alaska Native

(6) _____ White or Caucasian

(7) Other ________________________________