EXPLORING LATINO PARENT ATTITUDES TOWARD SCIENCE, INVOLVEMENT IN SCIENCE, AND PERCEPTIONS OF VALUE AND COMFORT OF FAMILY SCIENCE EVENTS

by

Izaak Javier DeLeon, B.M., B.S.

A thesis submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Science
with a Major in Biology
December 2018

Committee Members:

Julie F. Westerlund, Chair

Kristy Daniel

Rubén Garza

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair Use

Duplication Permission

DEDICATION

This work is dedicated to my Mom and Dad, which would not be possible without their support and encouragement.

ACKNOWLEDGEMENTS

First, I would like to acknowledge the biology office staff: Celena Gutierrez, Shane Pierce, and Gloria Rodriguez, as well as the custodial and maintenance staff. Thank you for providing a comfortable and supportive workspace. Next, I would like to acknowledge all of the volunteers who helped with my family science events, which consists of friends, colleagues, and a loving partner. These people are Enrique Aguayo, Rodrigo Aguayo, Carlos Baca, Brandy Gaytan, Lorena Roque Martinez, Veronica Molina, Lindsay Ogan, Geovanny Orduna-Loya, Sydney Robinett, and Robert Shine. A huge thank you goes out to Ashley Schimelman and Pamela Carlile at the San Marcos Public Library, Maria Calcaben at Allen Woods Homes, and Rebecca Manzanares at Centro Cultural Hispano de San Marcos for allowing me to provide these events in your spaces. I would also like to thank the San Marcos Daily Record for featuring my family science events in the newspaper. Twice! I would also like to acknowledge Dr. Lynn F. Ledbetter. Dr. Ledbetter was my violin professor during my undergrad and is responsible for getting me to college. Without her, I do not think I would be where I am today. Words cannot express how thankful I am, but music might. Finally, I would like to acknowledge my thesis committee, Dr. Julie F. Westerlund, Dr. Kristy Daniel, and Dr. Rubén Garza. Dr. Daniel, thank you for accepting me into your lab as an undergrad and for the continued support throughout my master's degree and my thesis. Also, thank you for introducing me to Dr. Westerlund! Dr. Garza, thank you for inspiring me to pursue research and to follow my passion, and for your unhindered honesty. You have helped me

realize that research is something that I can do and excel at. Lastly, Dr. Westerlund, thank you for accepting me as your lone graduate student! During my two years, you have provided me with your expertise and knowledge to help me design my study, violin duets to break away from the monotony of grad school, and wisdom, which have broadened my horizons. Thank you for all of your support and encouragement you have given me these past two years!

TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ABSTRACT

Diversity within teams and organizations guards against groupthink and overconfidence and improves their ability to problem solve and make predictions. Even though efforts have been made to increase diversity within the Science, Technology, Engineering, and Mathematics (STEM) fields, marginalized groups are still largely underrepresented in the STEM workforce. This study focused on the Latino population gap in representation within the STEM fields. Most programs aimed at increasing Latino representation in science focus on directly encouraging students to pursue STEM careers. This study explored Latino parents' attitudes toward science and what types of informal science activities parents engage in with their children. I organized 15 family science events in San Marcos, Texas, in which parents completed a pre- and post-event attitude toward science survey and an additional parental involvement survey to find out their attitudes towards science and what types of informal science activities they are involved in with their children. The activities and experiments performed during the family science events utilized common household items or items that were inexpensive. Twenty-two Latino parents participated in the study and 15 completed both the pre- and post-attitude toward science survey. The attitude toward science survey had 14 items and was scored using a Likert-type scale with a minimum and maximum score of 14 and 70 respectively. I used the non-parametric one-tail Wilcoxon signed-rank test to test for significant differences between the pre and post attitude toward science scores. Latino parent's pre- and post-event attitude toward science means were 59.9 and 62.3 respectively for

attending at least one family science event and this difference was found to be statistically significant with a p-value of ($p=0.009$). However, the effect size (Cohen's d=0.365) was small and power (0.363) was low. On the parental involvement survey, Latino parents identified 27 science activities that they have performed with their children, with 67% of those being discovery-based indoor activities and 59% being free activities. In terms of parent participation, the majority of Latino parents (73%) preferred free activities. This study can help inform school districts, principals, teachers, and informal science education organizations on strategies for changing Latino parent's' attitudes toward science and increasing their involvement in their children's science education.

I. INTRODUCTION

Science, technology, engineering, and mathematics (STEM) careers are crucial for maintaining the United States' competitiveness with other countries around the world (Christensen, Knezek, & Tyler-Wood, 2015). After World War II, increases in the number of graduates with STEM degrees drove a better economy, better jobs, and new industries (Holdren & Lander, 2012). Those who worked in the STEM fields were directly responsible for our country having one of the best economies globally (Christensen, Knezek, & Tyler-Wood, 2014; 2015). Products created by professionals in the STEM field are important and useful for all persons in the United States and are becoming increasingly intertwined in all of our lives (Holdren & Lander, 2012). Though the United States' competitiveness with other countries has decreased as reported in *A Nation at Risk* by the National Commission on Excellence in Education (Gardner, 1983), the U.S. has renewed its commitment to STEM education (Holdren & Lander, 2012). As the United States continues to push the boundaries of science, more career opportunities are created that need to be filled.

An analysis by the Center on Education and the Workforce at Georgetown University has projected that between 2008 and 2018 STEM jobs will grow by 17%, while total number of jobs in general will grow by 10% in the U.S. (Carnevale, Smith, & Melton, 2011). In addition, 91% of all STEM jobs in 2018 will require at least some college (Carnevale, Smith, & Melton, 2011). While the opportunities for STEM careers are increasing, the number of students graduating with STEM degrees is not keeping pace (Chen & Simpson, 2015; Christensen, Knezek, & Tyler-Wood, 2014; Knezek, Christensen, Tyler-Wood, & Periathiruvadi, 2013). Less than 40% of students complete a

STEM degree who initially enter college planning to major in STEM (Holdren & Lander, 2012). Among these, even less are students that are historically underrepresented in science. While minorities make up about 30% of the US population, only about 13% of STEM professionals are from a minority population. These underrepresented minority populations include Hispanic/Latino, Black/African-American, and Native American/Alaskan Native (National Center for Science and Engineering Statistics, 2013). There is a large group of the U.S. population that is not being utilized that would help our country reach its full potential in science.

Various companies and organizations acknowledge that having diverse teams leads to innovation (Tachibana, 2012). These companies and organizations are increasing their efforts or continuing their efforts to increase ethnic and gender diversity within their teams. Companies like Google acknowledge their lack of diversity and are addressing these issues by making efforts in four areas. These areas include expanding access to careers in technology, strengthening their community outreach, broadening their supplier network and creating inclusive products ("Diversity | Google," 2018). Organizations such as Texas State University are also making efforts to increase diversity within their institution. Of their five goals for the entire university, one of them is dedicated to enriching their learning and working environment by attracting and supporting a more diverse faculty, staff, and student body ("Diversity Plan," 2012).

Reported benefits of gender diversity include increased net profit margins (Tachibana, 2012), decreased project costs, and increased employee performance ratings (Brodock & Massam, 2016). Brodock and Massam (2016) also comment on the affect diversity has against groupthink and overconfidence, which are characteristics found in

less diverse groups. In 2014, Glassdoor conducted a survey and found that 67% of job seekers consider a company's diversity when deciding where to apply and then accepting employment ("What job seekers really think of your diversity stats," 2014). Diversity within groups improved the ability to solve problems (Tachibana, 2012) and to make predictions (Page, 2007).

Handelsman and Smith (2016) reported that there has been a large effort to increase diversity within the STEM fields since the beginning of the Obama administration in 2008. Among these efforts include $1 billion in private investments going towards the *Educate to Innovate* campaign, goals to prepare 100,000 math and science teachers by 2021 and investing $3 billion to 14 Federal agencies dedicated to STEM education programs in 2016. The Department of Education has also shown its priority to STEM education over the years by supporting the *Race to the Top* competition, hosting the annual *White House Science Fair*, and encouraging college and university leaders to provide pathways to gain STEM degrees for students that are underrepresented. President Obama's 2017 budget prioritized STEM education by providing $125 million towards Teacher and Principal Pathway programs, $4 billion to support states to expand computer science programs over the next three years, $80 million for communities to develop Next-Generation High Schools, $500 million for Student Support and Academic Enrichment grants, and $16 million specifically to increase diversity in STEM (Handelsman & Smith, 2016).

Despite efforts from the Obama administration to diversify the STEM fields, there has not been much change in increasing the representation of Latinos in the STEM fields. According to the 2010 Census, the US population consisted of 63.6% white and 16.4%

Hispanic/Latino while the population of the STEM workforce consisted of 51% white and 6% Hispanic/Latino (NCSES, 2013; USCB, 2010). By 2015, the white population had decreased to 61.45% and the Hispanic/Latino population had increased to 17.6% (USCB, 2015). In just five years, the representation in the STEM workforce for whites had increased dramatically from 51% to 70.75% while the Hispanic/Latino population has increased only slightly from 6% to 6.6% (USCB, 2015). Even though the Hispanic/Latino population had increased, they are still underrepresented in the STEM workforce. Even with all of the efforts to increase diversity within the STEM field, Latinos face many challenges along the way.

Latinos face numerous obstacles in their education and pursuing a career in the STEM field. Latino students are generally not exposed to culturally relevant science curriculum which could spark an interest in STEM (Flores, 2011). Thus, Latinos who enter post-secondary schooling are not prepared for the curriculum and courses in or related to STEM. While in elementary or secondary school, Latinos are not encouraged to pursue STEM careers and are not exposed to Latino mentors who are STEM teachers or who work in STEM fields (Flores, 2011). Families of Latino students are not made aware of the career opportunities in STEM fields and may not have the knowledge to assist their children in pursuing these fields (Flores, 2011). Latino parents are well aware of these challenges and they recognize their lack of knowledge of college and careers in STEM (Hernandez, Rana, Alemdar, Rao, & Usselman, 2016). Out-of-school programs can influence youth to choose science as a career path, increase achievement in science, and provide conversations with family members about science topics. Interest in Informal Science Education programs are high among Latinos and programming that involves all

the family is preferred among Latino parents (Bruyere, 2010). The purpose of this study is to examine Latino parents' attitudes toward science and parental involvement in their children's science education.

Literature Review

When Latinos receive minimal support at home, their achievement in education decreases (Rochin & Mello, 2007). Culturally, Latino parents believe that education is the responsibility of the school and the child's well-being is the responsibility of the parents (Ramirez, McCollough, & Diaz, 2016). Castaneda (2006) found that Latino parents are highly concerned about their children's education but lack the knowledge to support their children. And, when Latino parents are given the opportunity to participate in family science activities, they are interested in bringing these activities back to their home (Hernandez, Rana, Alemdar, Rao, & Usselman, 2016).

Children's attitudes towards science become less positive during middle school and high school (George, 2000). Thus, children who develop an interest in science before they reach middle school and those that do are more likely to pursue science in college (George, 2000). Children spend most of their time at home during their early years with their parents and family members. A child's home experiences affect their motivational beliefs about science (Sha, Schunn, Bathgate, & Ben-Eliyahu, 2016). Families who promote interest in science during these early years are more likely to help develop their children's understanding of science (Dabney, Chakraverty, & Tai, 2013). Parents are not as involved in their children's learning for various reasons, the most common being their level of education (Aktamis, 2017), low knowledge of science and a negative perception of science (Kaya & Lundeen, 2010; Perera, 2014).

A study by Chen (2001) found that children's attitudes toward science education are correlated with their parents' attitudes toward science education. Also, parents who have positive perceptions of science tend to have children with increased interest in science education and science careers (DeWitt et al., 2013). Children's academic achievement in science has also been shown to correlate with their parents' views of science (Aktamis, 2017; Perera, 2014). However, Alrehaly (2011) did not find any relation between parent attitudes and their children's science academic achievement. In addition, studies have shown that parents can influence their children's attitudes toward science in a positive way by encouraging their children to take part in science activities (Papanastasiou & Papanastasiou, 2004). Although there are many studies describing parental attitudes toward science, few to none describe Latino parents' attitudes toward science.

Family Science Nights are becoming more popular in K-12 educational settings and have reported benefits for all students and students' parents as well. Children show greater success (Lozar, 2012; Ramirez, McCollough, & Diaz, 2016), increased confidence, and increased interest in science when their parents are involved in their learning (Kaya & Lundeen, 2010). Research has shown that parents become more supportive of their children's science learning when hands-on activities are provided, but long-term parental involvement is difficult to maintain once a program is over (Kaya & Lundeen, 2010; Perera, 2014).

Family Science Nights have been organized for elementary (Grote, 2000; Kaya & Lundeen, 2010), middle (Mitchell, Drobnes, Colin-Trujillo, & Noel-Storr, 2008; Yanowitz & Hahs-Vaughn, 2016), and high school (Hansen-Thomas & Alderman, 2016)

students throughout the United States. Family Night programs can be found back to the 1980s (McDonald, 1997). Overall, these studies indicate that family involvement is beneficial for students, and the purpose of Family Nights is to engage parents in their children's learning. The majority of Family Night programs focus on the benefits for the students and secondarily attempt to encourage more involvement from parents. While parental involvement increases because of the event, it quickly wanes and becomes difficult to maintain long-term parental involvement. Most Family Night programs are one-night events that contain long periods of time between the next Family Night and almost all of them do not monitor parental involvement once the event is over. Recently, there have been efforts to use Family Science Night programs to benefit English Language Learner students (Hansen-Thomas & Alderman, 2016) and also Pre-Service Teachers (Bottoms, Ciechanowski, Jones, de la Hoz, & Fonseca, 2017; Valadez & Moineau, 2010), but the benefits for parents continues to be secondary. There is a need to find out if Family Science Nights can be mutually beneficial for parents as well. This information can be used to explore how Family Science Nights impact parents' interest in science and involvement in their children's science learning.

Research Questions

1. What types of informal science activities do Latino parents engage in with their children?

2. How are Latino parental attitudes of science changed after participating in a family science event?

3. What are Latino parents' values and comfort regarding family science events?

II. METHODS

Participants

I focused my study on parents or guardians with children in the 9-12 age range, although children outside of this age range were allowed to participate. I required a parent or guardian to accompany their children while participating in the family science event. While children participated in our family science events, they were not the focus of our study. I focused on the parents/guardians as research participants in this study. The children only acted as event attendees and program activity participants. Forty-one parents participated in the study, of which 44% were Hispanic/Latino parents (Fig. 1; Table 1). One of the biracial participants indicated that they were Hispanic/Latino and Black/African American. This participant was not included in the data analysis for this study. I wanted the focus of my study to be on Hispanic/Latino parents.

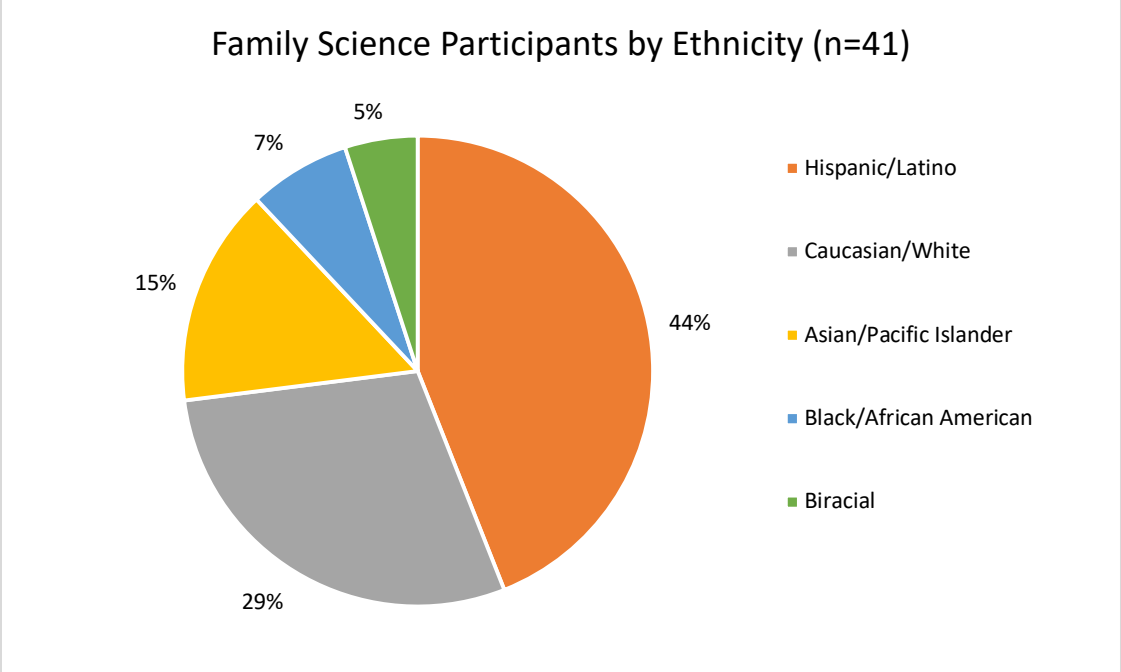


Figure 1. Family science participants by ethnicity (n=41). Forty-one parents participated in the study, of which 44% were Hispanic/Latino.

Table 1. Family Science Participants by Ethnicity (n=41).

Ethnicity	n	%
Hispanic/Latino	18	44%
Caucasian/White	12	29%
Asian/Pacific Islander	6	15%
Black/African American	3	7%
Biracial	2	5%

Pilot Study

I conducted a pilot study in June and July in 2017 to determine if the way the family science events were organized was conducive to my research goals. I organized three family science events at the San Marcos Public Library on Wednesdays from 6pm – 8pm, on June 28, July 5, and July 12.

Family Science Event Structure.

During the three pilot study family science events, I observed that parents/guardians were not involved with the activities their children were performing. Some parents were with their children, but just watching and not really helping their children. Other parents/guardians were not even with their children and were off somewhere else. Therefore, in order to promote parental engagement with their children during the activities, I changed the format of the family science events from a gallery set-up to a workshop set-up (Appendix A). The gallery set-up had six stations, each with a different science activity. The participants were allowed to do perform the activities in any order and did not have to complete all six activities. Each station had a volunteer to assist with the activity and answer any questions. The workshop set-up had tables in rows and all the participants performed each activity together as a group with a volunteer leading the entire family science event. I also created science journals for parents to use with their children (Appendix B). These science journals were called *My Science Journal*

and they included directions for all of the activities that we were going to do at the family science events. The science journals also included dedicated roles that the parent and child would perform. I observed more engaging behavior from the parents/guardians by making this change to the science journal and event format. As a result, the need for volunteers decreased and the cost of each event decreased as well.

Parent/Guardian Continued Participation and *Attitude Toward Science*.

During the pilot study, the families were encouraged to return the next week for more science. I encouraged them to return each week by giving them take-home science experiments in bags (*science in a bag*) and mini-science journals to report their findings at home. We were to discuss their findings at the next family science event. However, even with these take-home science freebies, most parents and guardians did not return each week to participate in family science events. There was only one Latino family that returned each week. By not returning each week, I was not able to survey any change in parental attitudes towards science over an extended period of time. I changed my strategy by surveying their attitudes towards science before and after the family science events.

Parent/Guardian Continued Participation and Mail-In *Involvement* Questionnaire.

During the pilot study, the parent/guardian involvement questionnaire was given as a take-home questionnaire along with a pre-addressed and stamped envelope. I did not receive many questionnaires back from parents/guardians using this strategy. This was a data collection issue for parental involvement in their children's informal science education. I changed my strategy by collecting all data at the family science events. I chose to survey parents before the event with an involvement survey and after with an exit survey. By changing my strategy, I received more data concerning informal science

activities conducted with their children and their comfort level with science and family science events.

Study Sites

After the pilot study, I conducted 15 additional family science events at various locations in San Marcos, TX over two years. I chose sites that were frequented by Hispanic/Latino families. The sites were the San Marcos Public Library, Centro Cultural Hispano de San Marcos, and Allen Woods homes in San Marcos, Texas. The family science events that took place at the San Marcos Public Library were scheduled on Wednesdays from 6pm – 8pm, July 26, August 2, and August 9 of 2017. In the Summer of 2018, I organized six additional family science events on Thursdays from 6pm – 8pm, August 2, 9, and 16, and Saturdays from 10:30am – 12:30pm, August 4, 11, and 18. The family science events that took place at Centro Cultural Hispano de San Marcos were scheduled on Saturdays from 10am – 12pm, September 16, October 21, and November 18 of 2017. The family science events that took place at Allen Woods homes were scheduled on Mondays from 6pm – 8pm, October 9, 16, and 23 of 2017.

Family Science Event Materials

I designed the science activities and experiments performed at the family science events to be accessible to all families by using materials that most families already have in their homes or materials that can be purchased cheaply at the store. For example, families made eclipse viewers to prepare for the solar eclipse that occurred on August 21, 2017. The materials needed for this activity included a cardboard box, aluminum foil, white printer paper, tape, scissors, and a pin. Making balloon rockets was another activity

families performed. The materials needed for this were a balloon, a straw, string, tape, and scissors.

Data Collection

I provided parental consent forms that were filled out before any data collection was taken in accordance with the Texas State University Institutional Review Board (IRB) guidelines (Appendix C). The research participants initialed their surveys and questionnaires in order to track research participants that participated in more than one family science event. I collected data from pre- and post-event parent/guardian science attitude surveys (Appendix D), a pre-event parent/guardian involvement questionnaire (Appendix E & Appendix F), and a post-family science event exit survey (Appendix G; Table 2).

Instruments

I used Germann's (1988) *Attitude Toward Science* survey (Cronbach's $\alpha = 0.851$) to measure changes in parent/guardian's *attitude toward science*. I used the pre-event parent/guardian involvement questionnaire to find out what types of informal science activities parents engage in with their children. The parent/guardian involvement questionnaire is informed by the parent involvement survey developed by Dr. Hunter Gehlbach and his research team of Dr. Karen Mapp and Dr. Richard Weissbourd at the Harvard Graduate School of Education. Dr. Gehlbach and his research team made use of a multi-step process in developing surveys to ensure high validity and reliability. This multi-step process includes an extensive review of the literature, interviews and focus groups, a synthesis of the literature review and interviews and focus groups, items developed, validation by experts, cognitive pretesting, and then piloting (Bahena,

Schueler, McIntyre, and Gehlbach, 2016; Artino, La Rochelle, Dezee, and Gehlbach, 2014; Schueler, Capotosto, Bahena, McIntyre, and Gehlbach, 2014; Gehlbach and Brinkworth, 2011). Lastly, I used the post-family science event exit survey to measure parent/guardian's perceptions of value and parent comfort of the family science events. The post-family science event exit survey was modified from Kaya and Lundeen's (2010) family science night survey.

Table 2. Data Triangulation Matrix

Research Question	Pre-Attitude Towards Science Survey	Post-Attitude Toward Science Survey	Parent/Guardian Involvement Questionnaire	Post-Family Science Event Survey
1. What types of informal science activities do Latino parents engage in with their children?			X	X
2. How are Latino parental attitudes of science changed after participating in a family science event?	X	X		
3. What are Latino parents' values and comfort regarding our family science events?				X

Data Analysis

Attitude Toward Science Survey.

I calculated *attitude toward science* scores per participant using a 5-point Likert-type scale with a range of 5 being *strongly agree* to 1 being *strongly disagree*. The 14-item survey has a minimum score of 14 and a maximum score of 70. Maximum scores indicate the most positive attitudes toward science and minimum score indicate the most negative views toward science. A quality control item was included to ensure consistent completion of the survey. Any survey that did not correctly answer the quality control item was thrown out. Scores were calculated for the 14 Hispanic/Latino parent participants who completed the pre and post survey and their pre and post surveys were averaged. I used the non-parametric one-tail Wilcoxon signed-rank test to test for significant differences between the pre and post attitude toward science scores. I used the Wilcoxon signed-rank test because my small sample size (n=14) cannot be assumed to be normally distributed. The null hypothesis is there will not be a change in Latino parents' attitudes toward science after participating in a family science event. The alternative hypothesis is there will be an increase in Latino parents' attitudes toward science after participating in a family science event. I also report effect size (Cohen's d), power, and ninety-five percent confidence intervals ($\mu \pm 2\sigma$), which were calculated using the standard deviation of the pre- and post-mean *attitudes toward science* scores. Finally, each of the 14 items on the attitude toward science pre and post survey was averaged for all 14 parent participants and tested for significant differences using a one-tail Wilcoxon signed-rank test.

Parent/Guardian *Involvement* Questionnaire.

I used an inductive approach to analyze the parent/guardian *involvement* questionnaire by applying descriptive codes to the data and then identified patterns of Latino parental involvement in informal science activities.

Post-Family Science Event Exit Survey.

I used the post-family science event exit survey to determine parent/guardian perceptions of value and parent comfort of our family science events, and potential future volunteer opportunities. The post-family science event exit survey includes eight items; only seven of these were used for this study. I scored each of the seven items and then averaged them using a 5-point Likert-type scale where 5 =strongly agree and 1=strongly disagree. A highest score of 5 indicates the most favorable perception toward our family science events and the lowest score is 1.

Expected Outcomes

This study may allow us to determine what types of informal science activities are utilized by Hispanic/Latino families and their attitudes toward science. This information may help school districts, administrators, and teachers to determine the best ways to implement family science programming in their schools or classrooms to better support their students' science education and to promote an interest in science. Latino children who have their science learning supported and have an interest in science instilled in them will be more likely to pursue science in college and move forward to careers in STEM, which will help to decrease the gap in representation of Latinos and Hispanics in the STEM workforce.

III. RESULTS

Parental *Involvement*

My first research question focused on the types of informal science activities that Latino parents engaged in with their children. Parent/guardian participants completed the parent/guardian *involvement* questionnaire before our family science events (Appendix E; Appendix F).

Family Science Event Participation.

There were 15 family science events. Of the Hispanic/Latino participants surveyed (n=18), only two participated in more than one family science event. One of these parents attended four events and the other attended two events.

Types of Activities.

Parent participants identified 27 separate science activities they performed with their children outside of our family science events on the involvement questionnaire. Of the 27 activities mentioned by the parents, 63% were activities that were structured and could be done inside the home and 33% were more discovery-oriented and outside (Table 3). And, 59% of activities were free activities while 41% of activities mentioned required a cost (Table 3).

Parent Participation in Activities.

The top two of the 27 listed activities that parents participated in were talking about science (14%) and visiting the library (13%) (Table 3). There was 55% parent participation for activities that were structured and could be done inside (Table 4). And, there was 32% parent participation for activities that were more discovery-oriented and outside (Table 4). Talking about science was not included in these calculations because I

decided that this activity could be done inside or outside and could be structured or discovery activity. Lastly, there was 73% parent participation for free activities (Table 4). It is important to note that Latino parents listed participating in free, structured and indoor activities more than paid, discovery and outdoor activities.

Table 3. Activities performed by Hispanic/Latino parents/guardians with their children (n=18).

Activity	% Participation in Activity	Activity	% Participation in Activity
Talked About Science	14% (16)	Watched Science TV Show	2.6% (3)
Visited Library	13% (15)	Attended Science Event	2.6% (3)
Worked on Home Science Projects	7% (8)	Birdwatched	2.6% (3)
Collected Rocks	5% (6)	Observed Weather	2.6% (3)
Went on A Nature Walk	5% (6)	Visited Aquarium	1.8% (2)
Watched Science Documentary	5% (6)	Worked on Science Activity Kit	1.8% (2)
Read Book on Science	4% (5)	Taught Science in Homeschool	0.9% (1)
Visited Museum	4% (5)	Watched Science Clips on YouTube	0.9% (1)
Explored River	4% (5)	Attended Science Fair	0.9% (1)
Observed Night Sky	3.5% (4)	Observed Nature	0.9% (1)
Went for a Hike	3.5% (4)	School Fieldtrips	0.9% (1)
Gardened	3.5% (4)	Visited Zoo	0.9% (1)
Researched Science Online	3.5% (4)	Worked on Science Activities Online	0.9% (1)
Helped with School Work	2.6% (3)	Total	114

Note. Values in parenthesis represent raw numbers of parental responses

Table 4. Types of activities performed by Hispanic/Latino parents with their children (n=18).

	% Types of Activities	% Participation in Activity
Inside*	(63%) 17	(55%) 63
Outside*	(33%) 9	(32%) 35
Total	27	114
Structured*	(63%) 17	(55%) 63
Discovery*	(33%) 9	(32%) 35
Total	27	114
Free	(59%) 16	(73%) 83
Paid	(41%) 11	(27%) 31
Total	27	114

Note. Items with an asterisk do not include the activity talking about science.

Parent Participation in Future Volunteer Opportunities.

After performing the science activities at our family science events, parent participants completed an exit survey answering questions about their future *involvement* with their children's science education that included opportunities to volunteer (Appendix G). Eight surveys were not included in the data due to inconsistent responses to the survey. Of the Hispanic/Latino parents/guardians surveyed (n=7; Table 5), 86% of parents were interested in assisting their children's school with science and 43% of parents were willing to volunteer with the family science initiative such as helping in the family science events. It should be noted that the majority of parents were neutral concerning volunteering opportunities and family science.

Table 5. Hispanic/Latino parent/guardian responses to family science event exit survey involvement items (n=7).

Survey Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I am interested in assisting my child's class or school with science.	29% (2)	57% (4)	14% (1)		
2. I am willing to volunteer with the family science initiative.	14% (1)	29% (2)	57% (4)		

Parent *Attitude* Toward Science

The purpose of the second research question was to find out how Latino parental *attitudes* of science changed after participating in a family science event. Fourteen Hispanic/Latino parents/guardians who participated in our family science events completed Germann's (1988) *Attitude Toward Science* survey (Cronbach's alpha=0.851; Appendix D) before and after the family science events. Participants were scored using a 5-point Likert-type scale, with a range from 1=strongly disagree and 5=strongly agree. The survey consisted of 14 items with a minimum score of 14 and a maximum score of 70. Higher scores on the survey are indicative of more favorable attitudes towards science. Individual pre and post scores were calculated, and scores from all of the 14 participants were averaged for pre- and post-event mean *attitudes* toward science.

Individual Pre- and Post-Event *Attitude Toward Science* Scores.

Figure 2 shows pre and post event attitudes toward science. Twelve out of the fourteen Hispanic/Latino parent participants had increases in their post-event attitude toward science scores, while only one parent (#2) had a decrease (Fig. 2). One of the parents (#11) did not have a change in attitude scores.

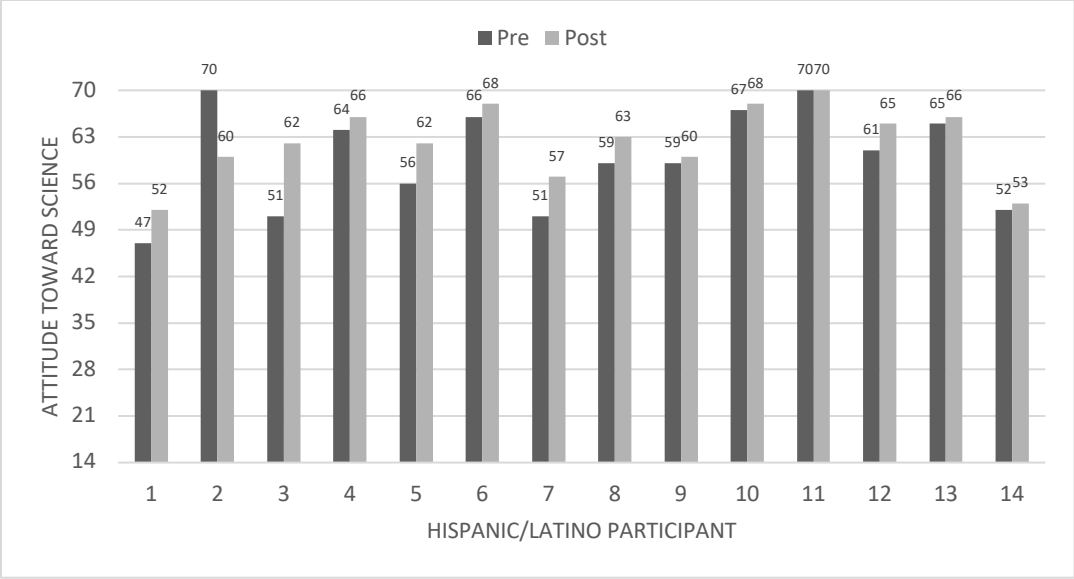


Figure 2. Hispanic/Latino pre- and post-event *Attitude Toward Science* (Germann, 1988) score by participant (n=14).

Pre- and Post-Event *Attitude Toward Science* Means.

Figure 3 shows pre and post event attitudes toward science means. Hispanic/Latino parent's/guardian's (n=14) pre- and post-event *attitude* toward science scores averaged 59.9 and 62.3 respectively, with standard deviations of 7.5 and 5.5 respectively (Fig. 3). I tested for differences between Latino parents' pre and post attitudes toward science using a one-tail Wilcoxon singed-rank test and a p-value of (*p=0.009*) was found. Based on this p-value, a significant difference was found allowing me to reject the null hypothesis in support of the alternative hypothesis stating there was an increase in Latino parents' attitudes toward science after participating in a family science event. I also calculated the effect size (Cohen's d) and power of the difference between Latino parents' pre and post attitudes toward science, which are (Cohen's d=0.365) and (Power=0.363) respectively.

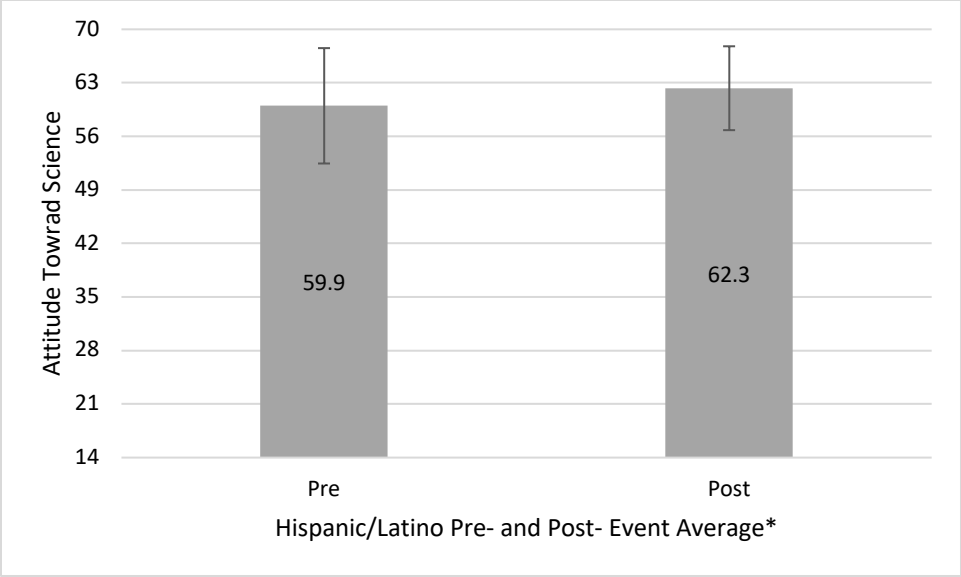


Figure 3. Hispanic/Latino pre- and post-event *Attitude Toward Science* average scores (n=14). Ninety-five percent Confidence Intervals are shown. *The change in Latino parents' attitudes toward science was found to be significant ($p<0.01$) as tested using a one-tail Wilcoxon signed-rank test.

Pre- and Post-Event Mean by Item.

I analyzed each item individually on the *Attitude Toward Science* (Germann, 1988) survey from the 14 parent participants. On an individual item score, the highest possible score indicating favorable attitudes towards science is a 5 and the lowest score is a 1. All of the items except #5 '*feeling sad about not going to science events*' scored at least a 4 (Agree) (Table 6). I tested for differences between Latino parents' pre and post attitudes toward science individual items using a one-tail Wilcoxon singed-rank test. Eleven out of the fourteen items on the survey had increases in the positive direction for the post-event mean score and six were significant at the $p<0.05$ level (Table 6). These items that had significant changes are 3, 4, 6, 7, 12, and 13 (Table 6). These items concerned interest in science events, desire to learn more about science, that science is interesting and enjoyable, science does not make one uncomfortable, restless, irritable, and impatient, feeling at ease with science, and feeling positive towards science.

However, there were three items that had a change in the negative direction (Table 6). These were items 8, 9, and 10, but the changes were not significant (Table 6).

Table 6. Attitude Toward Science Pre-/Post-Event Mean by Item

Item	Pre	Post	Δ	p-value
1. Science is fun.	4.7	4.8	+0.1	0.159
2. I do not like science and it bothers me to have to study it.	4.3	4.4	+0.1	0.159
3. During science events, I usually am interested.	4.4	4.6	+0.2	0.042*
4. I would like to learn more about science.	4	4.6	+0.6	0.013*
5. If I knew I would never go to science events again, I would feel sad.	3.2	3.3	+0.1	0.282
6. Science is interesting to me and I enjoy it.	4.1	4.6	+0.5	0.017*
7. Science makes me feel uncomfortable, restless, irritable, and impatient.	4.1	4.6	+0.5	0.007**
8. Science is fascinating and fun.	4.6	4.5	-0.1	0.317
9. The feeling that I have towards science is a good feeling.	4.5	4.4	-0.1	0.159
10. When I hear the word science, I have a feeling of dislike.	4.6	4.4	-0.2	0.159
11. Science is a topic which I enjoy studying.	4.1	4.3	+0.2	0.079
12. I feel at ease with science and I like it very much.	4	4.4	+0.4	0.013*
13. I feel a definite positive reaction to science.	4.4	4.6	+0.2	0.042*
14. Science is boring.	4.6	4.7	+0.1	0.079

Note. Items that are bolded were reversed scored.
Note. Items with an (*) are significant at the $p<0.05$ level.
Note. Items with an (**) are significant at the $p<0.01$ level.

Parental Perceived Value of Family Science Events and Comfort with Science

My third research question examined parental values and parental comfort of our family science events. Data is taken from the same exit survey as described above where parents answered questions about our family science events (Appendix G). Eight surveys

were not included in the data due to inconsistent responses to the survey. Table 7 shows responses of the family science event exit survey. Seven (100%) Hispanic/Latino parents/guardians agreed that the experience was valuable for their child, was valuable for themselves, and that teaching hands-on science is beneficial to their children. Also, 100% of the parents agreed that the experience made them more comfortable doing science. This was consistent with 71% of parents disagreeing that the experience made them less comfortable while the remaining 29% of parents were neutral.

Table 7. Hispanic/Latino parent/guardian responses to family science event exit survey values and comfort items (n=7).

Survey Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. This experience was valuable for my child.	71% (5)	29% (2)			
2. This experience was valuable for me.	57% (4)	43% (3)			
3. This experience made me less comfortable doing science.			29% (2)	14% (1)	57% (4)
4. This experience made me more comfortable doing science.	43% (3)	57% (4)			
5. I believe that teaching hands-on science is beneficial to my child.	86% (6)	14% (1)			

IV. DISCUSSION

Latino Parent *Involvement*

For my first research question, I wanted to know what types of informal science activities Latino parents are engaging in with their children. Fifty-five percent of Latino parents mentioned participating in structured activities that could be done inside, while 73% of Latino parent participation was for free activities. The data indicate that Latino parents in my study seem to be more engaged with their children in free and structured activities that can be done inside. Since most Latino families have low socioeconomic status, free activities would be highly appealing. The American Psychology Association (2018) defines socioeconomic status (SES) as quality of life attributes as well as the opportunities and privileges afforded to people within society, which include income, education, and social status. According to the Current Population Survey (2017a), 25% of all Hispanic families make less than $30,000 compared to 12% of white families, and on average Hispanic families make $37,000 less than their White counterparts. Free science activities may be all that these families can afford for science education enrichment.

The preference of Latino parents for structured activities that can be done inside may be connected to their level of education as Castaneda (2006) and Kaya and Lundeen (2010) found that Latino parents do not have the necessary knowledge and skills to assist their children with science activities. According to the Current Population Survey (2017b), 28% of Hispanics have less than a high school diploma and 18% have a bachelor's degree or more. Whereas, 6% of Whites have less than a high school diploma and 39% have a bachelor's degree or more. This may explain why 55% of the Latino parents that participated in my study preferred structured activities that included a guided

component over discovery-based activities. Examples of structured types of activities include family science events at local public establishments, watching science documentaries or YouTube videos, or reading books on science. Doing more structured and guided science activities with their children may be their solution for their lack of knowledge in science.

A large percentage, 44%, of Latino parents that participated in my study have a bachelor's degree or higher, which is more than double the national value. If it can be assumed that Latino parents in my study know more about science due to their high education levels, then one would expect they could assist their children in both structured and discovery activities inside and outside. An alternative explanation for the preference for inside activities of Latino parents in my study may be a seasonality factor. Ten out of the 15 family science events that I organized took place during the summer months of July, August, and September. In Texas, it gets very hot during these months and may cause parents to engage in activities with their children inside. Still, it is not clear why Latino parents in my study preferred structured activities that could be done inside.

While none of the Latino parents in my study listed that they volunteered at their children's school with science, 86% of them were interested in assisting their children's school with science. This suggests that Latino parents care about their children's science education and are willing to be involved. This is supported by Castaneda (2006) who found that Latino parents do care about their children's education and Hernandez, Rana, Alemdar, Rao, and Usselman (2016) who found that Latino parents who participated in family science activities wanted to keep doing these activities at home.

Latino Parent *Attitude* Toward Science

Next, I wanted to know how Latino parent *attitudes* toward science changed after participating in a family science event. There were changes in the positive direction in 12 out of the 14 Latino parents and in the group mean of 59.9 pre-event and 62.3 post-event score, and this change was significant ($p<0.01$). Although there was a significant change in Latino parents' attitudes toward science, there was a small effect size (Cohen's d=0.365) and low Power (0.363). The small effect size indicates the change, although statistically significant, may not be meaningful. One reason for this may be that all of the Latino parents that attended my family science events already have positive attitudes toward science. A pre-event group mean of 59.9 indicates favorable attitudes towards science. Alrehaly (2011) found a similar finding of parental positive attitudes when they selected parents from diverse background for the study. However, Alrehaly (2011) did not address changes in parents' attitudes toward science. Larger changes may be seen with Latino parents who hold less positive attitudes toward science.

The six items of the *Attitude Toward Science* (Germann, 1988) survey that had significant changes in the positive direction for Latino parents were "During science events, I usually am interested," "I would like to learn more about science," "Science is interesting to me and I enjoy it," "Science makes me feel uncomfortable, restless, irritable, and impatient," "I feel at ease with science and I like it very much," and "I fell a definite positive reaction to science" (Table 6). This finding suggests that family science events may be a medium through which parents can be motivated to learn more about science and participate in more science activities with their children. Although, my finding contradicts Dippel, Mechels, Griese, Laufmann, and Weimer's (2016) study that

found no relationship between Latino parent exposure or participation in science and their attitudes towards science at the 'It's All About Science Festival' in South Dakota. However, their study was different in that the majority of adult participants worked in education, medicine, or science, and the participants were able to complete the science attitude survey at any time during the event.

My study concerned parental attitudes towards science. It is based upon the idea that parental views of education can influence their children's views of science and academic achievement (Aktamis, 2017; Chen, 2001; DeWitt, Osborne, Archer, Dillon, Willis, & Wong, 2013; Perera, 2014). A young child spends most of their time with the family and thus the opportunity for parental or grandparent influence is greater. For example, Aktamis (2017) and Perera (2014) found that children's academic achievement was shown to correlate with their parents' views of science. However, Alrehaly (2011) found that parental attitudes toward science alone is not enough to positively influence their children's academic achievement.

Latino Parent' Perceived Value of Family Science Events and Comfort with Science

Latino Parent' Perceived Value of Family Science Events.

My third research question includes two parts. First, I wanted to know what Latino parents perceived value of family science events are. I found family science events to be highly valued by all of Latino parents and all believe these types of events are valuable for their children as well. This finding confirms prior research that Latino parents prefer informal science events that involve the family as found in Bruyere (2010). I also found 100% of Latino parents believe teaching hands-on science is beneficial to

their children. This finding is supported by Kaya and Lundeen (2010) who found that parents are supportive of hands-on science activities being provided for their children.

Latino Parent Comfort with Science.

Second, I wanted to know whether Latino parents were comfortable with science is after participating in a family science event. All Latino parents responded that their family science experience made them more comfortable doing science, which is consistent with 71% of parents disagreeing that the experience made them less comfortable. This finding is supported by Melber (2006) who wanted to know how museum educators could better connect with members of the surrounding Latino community through an outreach program. One of their goals was to increase the Latino parents comfort level with the museum. The study found that participants showed increases in comfort with the process of learning, desire to learn more, and in feeling more knowledgeable and empowered. Although the Melber's (2006) study was not focused explicitly on science education, it does suggest that family programming including science programming can be beneficial in making parents more comfortable with content.

Limitations

This study lays the foundation for research regarding Latino parents' interests in science. However, there were specific limitations in the study. The first limitation of my study is the small sample size, with only 18 Latino parents participating in the study and 14 completing the pre and post *Attitude Toward Science* (Germann, 1988) surveys. Even though there was a significant difference in Latino parents' pre and post attitudes toward science, the effect size was small (Cohen's d=0.365) and the power was low (0.363). To

have the accepted effect size (Cohen's D) of 0.5 and statistical power of 0.8, I would have needed 34 participants in my study (Helgadottir & Menzies, 2018). Recruiting a larger sample size may be one solution to exploring Latino attitudes towards science. The second limitation to my study is the recruitment process of my participants. Participants were recruited through self-selection, which may explain why all of our Latino parents already had positive attitudes toward science. Family science nights were advertised, and parents chose to come to the events. This suggests Latino parents who hold less positive attitudes toward science may not have chosen to attend family science events. A third limitation to my study is my results are not generalizable to all Latino parents. The Latino parents that participated in my study had higher education levels than the national average. Forty-four percent of the Latino parents that participated in my study had at least a bachelor's degree whereas in the United States, only 18% of Latinos have a bachelor's degree or more advanced degree (Current Population Survey, 2017).

Even with these limitations in the study, the research findings are valuable. Few studies have addressed the attitudes towards science of parents and in particular, Latino parents. Also, it is not clearly established that there are any studies regarding changes in attitudes toward science of Latino parents, as well as studies regarding the types of activities Latino parents engage in with their children. Since parents are the most influential in the early development of children, it is necessary to better understand what Latino parents are doing with their children in science and their attitudes toward science. Through understanding Latino parents, we are better able to indirectly support Latino children's academic achievement in science and interest in STEM careers.

Future Directions

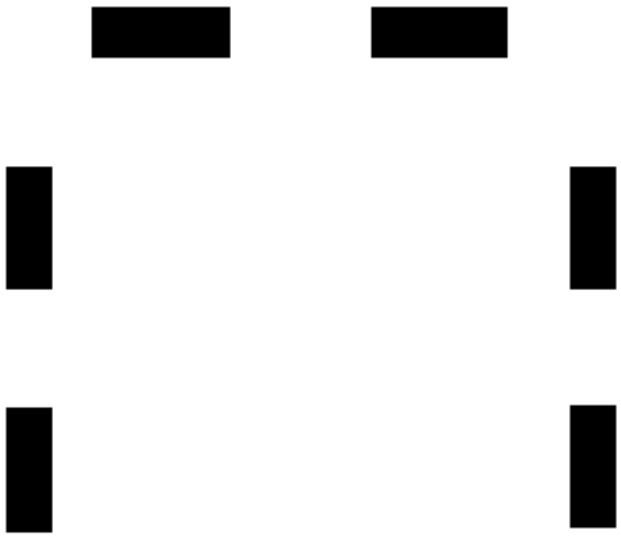
Future studies that explore Latino parents' attitudes towards science should have a larger participant size. One strategy to increase participant size would be looking into sites that are more frequented by a larger number of Latino individuals. Although I chose sites based on this demographic, including a Hispanic cultural center called *Centro Cultural Hispano de San Marcos* in San Marcos, more exploration is needed. Churches, restaurants, children's soccer venues are all possible other sites that may yield a larger participant sample size. A strategy to reduce the effects of self-selection may be to partner with the local school district to organize family science events for their students and parents. An effort in a future study to increase the Latino parent sample size and to reduce the effects of self-selection, would be beneficial in the continued examination of their attitudes toward science and their involvement with their children's science education. This research would help in better understanding what factors, if any, are influencing Latino parents' *attitudes* toward science and *involvement* in their children's education.

APPENDIX SECTION

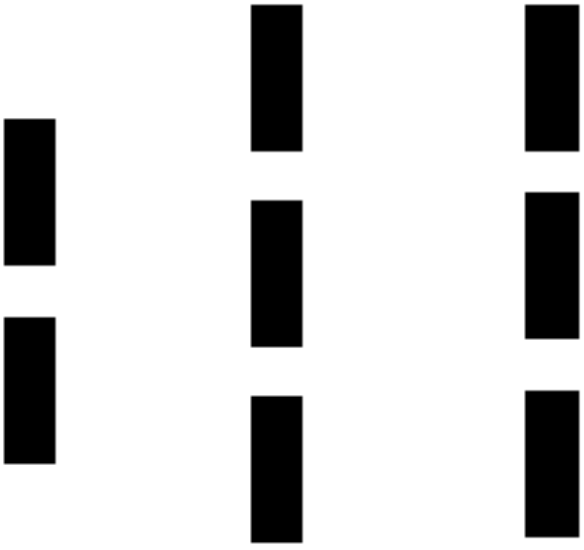
Appendix A: Family Science Event Set-Up

*Black rectangles represent tables

Pilot Study Family Science Event Set-Up



Revised Family Science Event Set-Up



My Science Journal!

_____

Name

Measuring Shadows

Purpose: *To explore the relationship between the size and position of shadows and the position of the sun.*

Safety: Do not look directly at the sun!

Performing the activity:
Child: Stand with your back facing the sun. You should be able to see your shadow in front of you.

Parent: Using chalk, outline your child's shadow and then measure the length of the shadow using the tape measure provided. In centimeters, measure from the base of the shadow to the head of the shadow.

Parent and Child: Record your measurements on the table on the next page.

Date	Time	Length

Date	Time	Length	

Ultraviolet Light Detectors

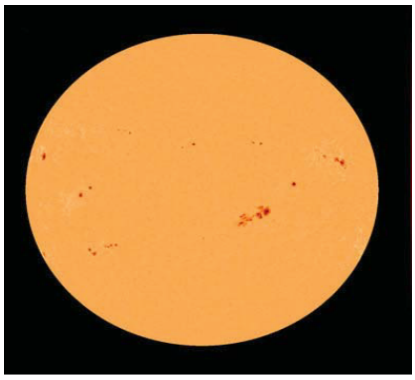
Purpose: *To explore UV Light and how to detect it.*

Performing the activity:
Make a bracelet with the beads and pipe cleaners that you were provided.

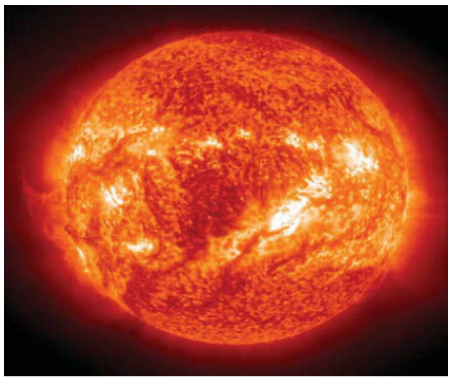
Child: Slide one bead onto the pipe cleaner and place it towards the middle. Continue this for each of the other beads you were provided.

Parent: Assist your child by fastening the pipe cleaner on your child's wrist.

Parent and Child: At home, find different materials to test if they block UV light.



The sun photographed in visible light



The sun photographed in UV light

Item	Does it block UV light?	
Sunglasses		
Sunscreen		
Window		
Clothing		
Paper Towels		

Light Source	Does it produce UV light?	
Flashlight		
Fluorescent light		
Incandescent light		
Computer screen		
Cell phone screen		

Life Cycle of the Fruit Fly

Purpose: To observe the various stages of fruit fly development over time.

Parents assist your child if setting up at home!

Performing the activity:

1. Peel overripe banana and place it in uncapped jar outside.

2. In a couple of hours, fruit flies should be crawling around the banana. You need to capture a number of flies. If no flies have arrived, try waiting for a couple more hours.

3. Cover jar with cheesecloth or paper towel and secure with rubber band.

4. Observe the fruit flies, with a magnifying glass or hand lens if you have one, every day for at least 14 days and draw what you see each day.

Bring back your science journal with home activities completed and you will receive a prize!

My Science Journal!

_____

Name

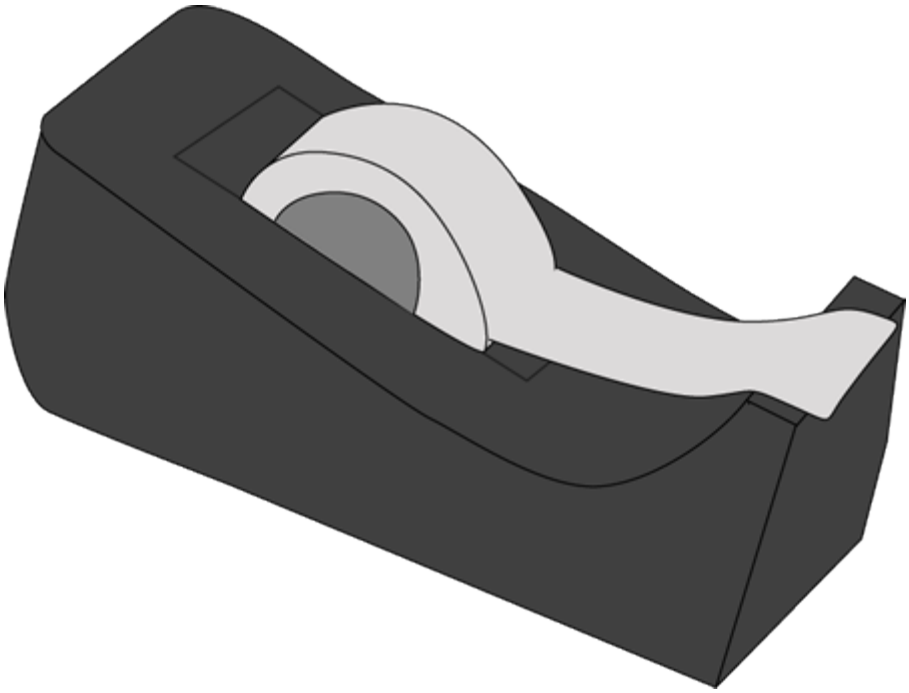
Magic Tape

1. Parent: Pull off two strips of tape about 4 inches long and fold the ends back on themselves to make a handle. Stick the two strips of tape down on top of the table.

   Parent and Child: Quickly rip off the strips of tape and hold them so that they hang down vertically. Slowly bringing the two strips near each other and observe what happens.

2. Parent: Pull off one strip of tape about 4 inches long and fold the end back on itself to make a handle. Stick the strip of tape down on top of the table. Pull another strip of tape of the same length and fold the end back to make a handle and stick this strip on top fo the strip on the table.

   Parent and Child: Pull the two strips of tape off the table and hold them so that they hand down vertically. Quickly pull apart the two strips of tape and slowly bring the two strips near each other and observe what happens.



Magic Balloons

Parent: Find a sink and turn on the water so that a fine stream is flowing. Blow up a balloon and tie it off.

Child: Rub the balloon vigorously on your hair and bring the balloon slowly towards the stream. Observe what happens.

From your observations of Magic Tape and Magic Balloons, what do you think is happening?

Explanation

The two activities above are an example of electrostatic charging. There are two types of electrical charge, Positive+ and Negative-. In normal material there is an equal number of positive to negative charges, which makes the material uncharged. Normal material becomes charged when you rub one material against a different material. Contact between two different materials transfers electrical charge from one to the other. This happened when you pulled the tape off of the table and when you rubbed the balloon against your hair. When two materials are treated the same way they will repel because they have like charges. When treated differently they will pull towards each other.

Magnet Fun!

Child: Take your magnet set and try to match the arrangement of magnets on the provided challenge cards.

Parent: Assist your child in matching the arrangement of magnets on the challenge cards.

Were you able to complete all of the challenge cards? How is it possible to make these arrangements?

Explanation

If an object sticks to a magnet, we say it is magnetic. Most magnetic objects contain iron. Some metals (like copper (pennies) and aluminum (foil)) don't stick to magnets, so we say they are non-magnetic. There is a magnetic field around magnets that makes them affect each other and other objects without touching them. When magnets push away from each other, they are "repelling". You are able to feel the force, or magnetic field, between the magnets. When magnets pull towards each other, they are "attracting." Engineers use magnets in electrical motors, TVs, computers, cellphones, and medical equipment.

Magnetic Materials

Parent and Child: Take your donut magnets and test the rocks and sand provided to determine if they are magnetic.

Bring back your science journal with home activities completed and you will receive a prize!

My Science Journal!

_____

Name

Microscope Fun

1. Parent: Help your child cut out a letter from the newspaper. Make sure it is one of the small letters, not a large or bolded letter. Then place this letter on a slide and place onto the microscope. Use the large knob of the microscope to focus the cut out newspaper and make sure you are using the lowest magnification, which is 4X.

   Parent and Child: Once the slide is in focus, help your child draw what they see in the microscope. You should draw what you see at 4x, 10X, and 40X magnification. If drawing is too much for your child ask them to describe what they see.

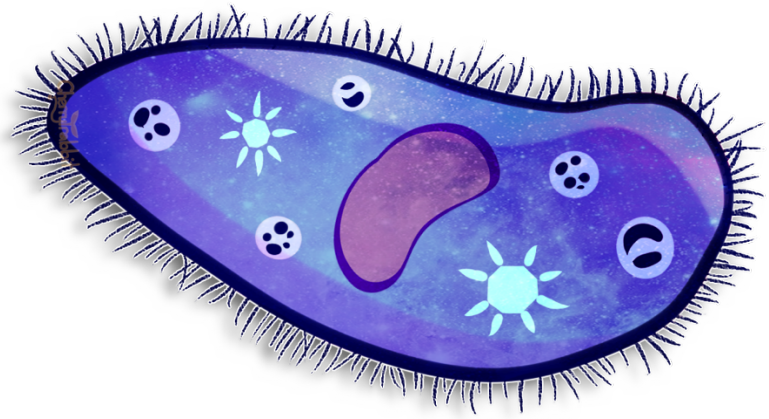
2. Parent: Same as above, but now instead of using newspaper you will cut out a small piece from a magazine. Make sure your piece is about the same size as the newspaper letter you cut out and make sure you cut out a really colorful piece.

   Parent and Child: Once the slide is in focus, help your child draw what they see in the microscope. You should draw what you see at 4x, 10X, and 40X magnification. If drawing is too much for your child ask them to describe what they see.

Microscopes and Microorganisms

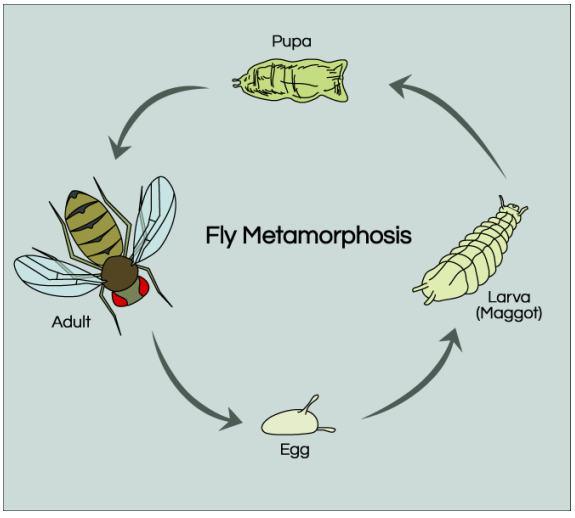
Parent: Help your child pipette out some of the pond water onto a microscope slide. It just needs to be one drop. It is best to pipette from the bottom of the container. Then place a slide cover over your drop of pond water on the slide. Then place this slide on the microscope and focus as before.

Parent and Child: Once the slide is in focus, help your child draw what they see in the microscope. You should draw what you see at 4x, 10X, and 40X magnification. If drawing is too much for your child ask them to describe what they see.



Fruit Fly Life Cycle

Parent and Child: Use the diagram below to help your child determine which of the tubes provided represent each stage of the fruit fly life cycle.



Mutations in Fruit Flies

Parent and Child: Help your child observe adult fruit flies with the hand lenses or under the field microscopes. Then once you have done that observe the tubes with fruit flies that have mutations. Using the picture on the next page, help your child determine what mutations are present.

HINT: There are four of them!

My Halloween Science Journal!

_____

Name

Skeleton Hand

Questions to consider:
1. How many bones do you have in your hand? Can you count them?

2. How many bones do you have in your wrist? Can you count them?

Procedure for activity:
Parent: Trace your child's hand on the black construction paper. Use the pencil to sketch in the bones of your child's wrist using the photo as a guide. Help your child cut the straws into pieces that will be used for their finger bones.

Child: Take the cut pieces of straws and glue them into place on their outlined hand. Use the photo as a guide.

Frankenstein's Hand

Procedure

Parent: Help your child pour vinegar in a jar halfway below the baseline. Then help your child add a spoonful of baking soda to the inside of the glove.

Child: Gently place the glove over the opening of the jar making sure no baking soda from the glove goes into the jar. Lift the glove up to release the baking soda from the glove into the cup.

Watch what happens! What happened to the glove?

Candy Corn Science

You will be placing candy corn in water, vegetable oil, and vinegar to find out which liquid dissolves the candy.

Questions to consider:
1. What do you think will happen when you out the candy corn in each liquid?
2. Which liquid will dissolve the candy corn?

Procedure
Parent: Pour about 1 inch of each liquid (water, vegetable oil, and vinegar) into separate bowls.

Child: Place one candy corn into each bowl.

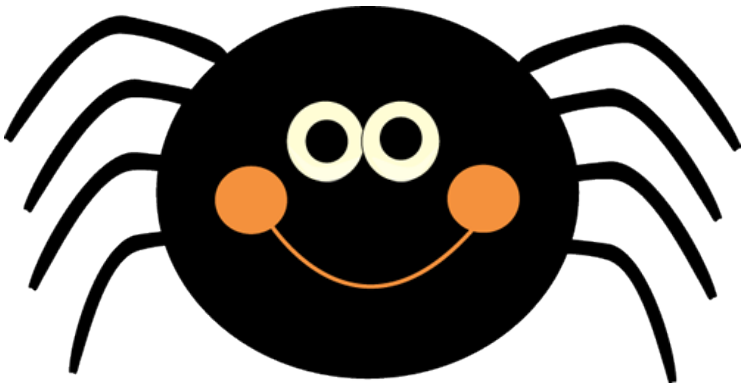
We will check on this in a few minutes to observe what happens!

Scary Spider Science

Questions to consider
1. How do spider's web trap insects that spiders eat, but spiders themselves don't get stuck?

Procedure:
Parent: Help your child build a spider's web around the opening of a sandwich container, with the sticky side up. Create any type of web you like.

Child: Press your fingers onto the web. How does it feel? Now dip your fingers into vegetable oil and press your fingers onto the web. Do your fingers still stick to the web?



Appendix C: **INFORMED CONSENT**

Study Title: Increasing Parent Interest in Science and Parental Involvement for Latino Parents with Family Science Nights

Principal Investigator: Izzy De Leon

Co-Investigator/Faculty Advisor: Julie Westerlund, PhD

This consent form will tell you why this study is being done. It will tell you why you are invited to participate. It will also tell you what you need to do to participate. You will be told about risks and difficulties that you may have while participating. We encourage you to ask questions at any time. If you decide to participate, you will be asked to sign this form. You will be given a copy of this form to keep.

PURPOSE AND BACKGROUND

This study will explore parent interest in science. Also, parent involvement in their children's science learning. You are asked to participate because you are the parent or guarding of a child in the 9-12-year age group.

PROCEDURES

If you agree to be in this study, you will participate in the following:

- A Family Science Night event
- A science attitude survey & event exit survey (10 min.)
- A take-home parent/guardian involvement questionnaire (10 min.)

Family Science Nights will be at the San Marcos Public Library. They will be on Wednesdays from 6pm-8pm, June 28, July 5, July 12, July 26, August 2, and August 9. You will first complete the science attitude survey. After the Family Science Night, you will complete the exit survey. At the end of the event, you will be given a take-home questionnaire. This will be mailed back to us or returned during the Family Science Night event.

RISKS/DISCOMFORTS

The survey will have questions about your background. If you are not comfortable answering these questions you may leave them blank. If the survey or questionnaire makes you uncomfortable, you may leave them blank.

BENEFITS/ALTERNATIVES

The benefits to you are more awareness of science. Also, how to be more involved in your children's science learning.

EXTENT OF CONFIDENTIALITY

Your name will not be used in any written reports or publications. Information from paper documents will be converted to an electronic file. Then all paper documents will

be shredded. The electronic file will be password protected and kept for three years. Then the electronic file will be deleted.

PAYMENT/COMPENSATION
You will not be paid for your participation in this study.

PARTICIPATION IS VOLUNTARY
You do not have to be in this study if you do not want to. You may refuse to answer any questions you do not want to answer. You may withdraw from this study at any time.

QUESTIONS
If you have questions about this study, you may contact Izzy De Leon: izzydeleon@txstate.edu.

This project [insert IRB Reference Number or Exemption Number] was approved by the Texas State IRB on [insert IRB approval date or date of Exemption]. Questions about the study should be directed to the IRB Chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

DOCUMENTATION OF CONSENT
I have read this form and will participate in the project described above. Its purposes, involvement and risks have been explained to my satisfaction. I understand I can withdraw at any time.

Printed Name of Study Participant	**Signature** of Study Participant	Date

Signature of Person Obtaining Consent	Date

Appendix D

Initials:_____

Family Science Survey

Instructions: Please complete this survey. You may choose not to answer any questions you feel uncomfortable with.

1. What is your relation to your child?

- ○ Mother
- ○ Father
- ○ Female Guardian
- ○ Male Guardian

2. What is the highest level of education you have completed?

- ○ Some High School
- ○ High School
- ○ Trade/Technical/ Vocational Training
- ○ Some college
- ○ Associate Degree
- ○ Bachelor's Degree
- ○ Graduate/Professional Degree

3. Ethnicity

- ○ African American/Black
- ○ Caucasian/White
- ○ Asian/Pacific Islander
- ○ Hispanic/Latino
- ○ Native American/ American Indian
- ○ Biracial

4. Have you attended any other Family Science Nights?

- ○ No
- ○ Yes

5. If you answered 'yes' to Question 4, which Family Science Night did you attend?

- ○ San Marcos Public Library
- ○ Other

6. Does your child attend Public School or Home School?

- ○ Public School
- ○ Home School

Instructions: Read each statement and then fill in the circle that best shows how you feel about each statement.

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1. Science is fun.	○	○	○	○	○
2. I do not like science and it bothers me to have to study it.	○	○	○	○	○
3. During science events, I usually am interested.	○	○	○	○	○
4. I would like to learn more about science.	○	○	○	○	○
5. If I knew I would never go to science events again, I would feel sad.	○	○	○	○	○
6. Science is interesting to me and I enjoy it.	○	○	○	○	○

7. Science makes me feel uncomfortable, restless, irritable, and impatient.	○	○	○	○	○
8. For this question, fill in 'Undecided'.	○	○	○	○	○
9. Science is fascinating and fun.	○	○	○	○	○
10. The feeling that I have towards science is a good feeling.	○	○	○	○	○
11. When I hear the word science, I have a feeling of dislike.	○	○	○	○	○
12. Science is a topic which I enjoy studying.	○	○	○	○	○
13. I feel at ease with science and I like it very much.	○	○	○	○	○
14. I feel a definite positive reaction to science.	○	○	○	○	○
15. Science is boring.	○	○	○	○	○

Appendix E

Family Science – Parent/Guardian Involvement Questionnaire

Instructions: We would appreciate your completion of this questionnaire. You may choose not to answer questions that you are not comfortable with.

1. What ways are you involved with your child in science activities? Please explain.

2. What ways do you have conversations with your child about science? And how often? Please explain.

3. How comfortable are you doing science with your child? Please explain.

4. What sorts of things might help you feel more comfortable doing science as a parent/guardian? Please explain.

5. In what ways, if any, are you involved in the science being taught at your child's school? Please explain.

6. What is the biggest obstacle, if any, that prevents you from getting more involved in your child's science education? What might be able to help you overcome this obstacle? Please explain.

Appendix F
Modified for Summer 2018
Family Science – Parent/Guardian Questionnaire

Instructions: We would appreciate your completion of this questionnaire. You may choose not to answer questions that you are not comfortable with.

1. In the box next to each activity, mark the number of times you have done that activity with your child in the past week. If an activity you and your child have done is not listed please describe in the section called "other".

	Collected Rocks		Visited Aquarium		Visited Zoo		Worked on Science Activities Online		Observed Weather
	Observed Night Sky		Went on a Nature Walk		Used Physical Models		Worked on Home Science Projects		Visited library
	Went Camping		Went Fishing		Went for a Hike		Explored River		Birdwatched
	Attended Science Event		Attended Science Fair		Visited Museum		Watched Science Clips on YouTube		Taught Science in Homeschool
	Gardened		Talked About Science		Watched Science Documentary		Watched Science TV Show		Read Book on Science
	Researched Science Online		Worked on Science Activity Kit		Other:				

2. What obstacles, if any, prevent you from being more involved in your child's science education?

3. What might help you overcome any obstacles you listed above? Please explain.

Appendix G

Family Science Night – Exit Survey

Instructions: Please complete this portion of the survey after you have completed your activities for the Family Science Night.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. This experience was valuable for my child.	○	○	○	○	○
2. This experience was valuable for me.	○	○	○	○	○
3. This experience made me less comfortable doing science.	○	○	○	○	○
4. I believe that teaching hands-on science is beneficial to my child.	○	○	○	○	○
5. I am interested in assisting my child's class or school with science.	○	○	○	○	○
6. I am willing to volunteer with the family science initiative.	○	○	○	○	○
7. This experience made me more comfortable doing science.	○	○	○	○	○
8. I liked science when I was in elementary school.	○	○	○	○	○

LITERATURE CITED

Aktamis, H. (2017). Determining the factors that influence parents' views about science and technology. *Research in Science & Technological Education*, *35*(2), 169-182.

Alrehaly, E. D. (2011). *Parental attitudes and the effects of ethnicity: How they influence children's attitudes toward science education* (unpublished doctoral dissertation). The University of Arkansas, Fayetteville, Ar.

American Psychological Association. (2018, October). *Ethnic and racial minorities & socioeconomic status*. Retrieved from https://www.apa.org/pi/ses/resources/publications/minorities.aspx

Artino Jr., A. R., La Rochelle, J. S., Dezee, K. J., & Gehlbach, H. (2014). Developing questionnaires for educational research: AMEE guide no. 87. *Medical Teacher*, *36*, 463-474.

Bahena, S., Schueler, B. E., McIntyre, J, & Gehlbach, H. (2016). Assessing parent perceptions of school fit: The development and measurement qualities of a survey scale. *Applied Developmental Science*, *20*(2), 121-134.

Bottoms, S. I., Ciechanowski, K., Jones, K., de la Hoz, J., & Fonseca, A. L. (2017). Leveraging the community context of family math and science nights to develop culturally responsive teaching practices. *Teaching and Teacher Education*, *61*, 1-15.

Brodock, K., & Massam, G. (2016). How and why to hire a diverse workforce: What you need to know. *Strategic HR Review*, *15*(5), 208-213.

Bruyere, G., & Salazar, G. (2010). Engaging lation audiences in out-of-school programs about science. *Journal of Extension*, *48*(3), 1-6.

Carnevale, A. P., Smith, N., & Melton, M. (2011). STEM: Science technology engineering mathematics. Retrieved from Georgetown University Center on Education and the Workforce website: https://1gyhoq479ufd3yna29x7ubjn-wpengine.netdna-ssl.com/wp-content/uploads/2014/11/stem-complete.pdf

Castaneda, M. E. (2006). The impact of a latino outreach project on science museums: A program evaluation focused on institutional change (Dissertation). Pepperdine University.

Chen, H. (2001). Parents' attitudes and expectations regarding science education: Comparisons among American, Chinese-American, and Chinese families. *Adolescence*, *36*(142), 305-313.

Chen, P. D., & Simpson, P. A. (2015). Does personality matter? applying holland's typology to analyze students' self-selection into science, technology, engineering, and mathematics majors. *The Journal of Higher Education*, *86*(5), 725-750.

Christensen, R., Knezek, G., & Tyler-Wood, T. (2014). Student perceptions of science, technology, engineering, and mathematics (STEM) content and careers. *Computers in Human Behavior*, *34*, 173-186.

Christensen, R., Knezek, G., & Tyler-Wood, T. (2015). Alignment of hands-on STEM engagement activities with positive STEM dispositions in secondary school students. *Journal of Science Education Technology*, *24*, 898-909.

Dabney, K. P., Chakraverty, D., & Tai, R. H. (2013). The association of family influence and initial interest in science. *Science Education*, *97*(3), 395-409.

DeWitt, J., Osborne, J., Archer, L., Dillon, J., Willis, B., & Wong, B. (2013). Yound children's aspirations in science: The unequivocal, the uncertain and the unthinkable. *International Journal of Science Education*, *35*, 1037-1063.

Dippel, E. A., Mechels, K. B., Griese, E. R., Laufmann, R. N., & Weimer, J. M. (2016). Midwest science festival: Exploring students' and parents' participation in and attitudes toward science. *South Dakota Medicine*, 343-349.

Diversity | Google. (2018). Google. Retrieved from https://diversity.google/

Diversity Plan. (2012, August). Texas State University. Retrieved from http://universityplan.avpie.txstate.edu/diversity-plan.html

Flores, G. M. (2011). Increasing latina/o participation in science, technology, engineering, and math (STEM) related fields. *Latino Studies*, *9*, 327-335.

Gardner, D. (1983). A nation at risk: The imperative for educational reform. An open letter to the American people. A report to the nation and the secretary of education. Government Printing Office, Washington, p 20402.

Gehlbach, H., & Brinkworth, M. E. (2011). Measure twice, cut down error: A process for enhancing the validity of survey scales. *Review of General Psychology*, *15*(4), 380-387.

George, R. (2000). Measuring change in students' attitudes toward science over time: An application of latent variable growth modeling. *Journal of Science Education and Technology*, *9*(3), 213-225.

Germann, P. J. (1988). Development of the attitude toward science in school assessment and its use to investigate the relationship between science achievement and attitude toward science in school. *Journal of Research in Science Teaching*, *25*(8), 689-703.

Grote, M. (2000). Service, science, and soup beans. *Science Scope*, *23*(8), 8-10.

Handelsman, J., & Smith, M. (2016). STEM for all. Retrieved from https://obamawhitehouse.archives.gov/blog/2016/02/11/stem-all

Hansen-Thomas, H., & Alderman, H. C. (2016). Family Science Night. *Science Teacher*, *83*(4), 37-40.

Helgadottir, F., & Menzies, R. (2018). Sample size calculator. Retrieved from https://www.ai-therapy.com/psychology-statistics/sample-size-calculator

Hernandez, D., Rana, S., Alemdar, M., Rao, A., & Usselman, M. (2016). Latino parents; educational values and STEM beliefs. *Journal of Multicultural Education*, *10*(3), 354-367.

Holdren, J. P., & Lander, E. S. (2012). Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics (Executive Report). Washington, D.C.: President's Council of Advisors on Science and Technology.

Kaya, S., and Lundeen, C. (2010). Capturing parents' individual and institutional interest toward involvement in science education. *Journal of Science Teacher Education*, *21*, 825-841.

Knezek, G., Christensen, R., Tyler-Wood, T., & Periathiruvadi, S. (2013). Impact of environmental power monitoring activities on middle school student perceptions of STEM. *Science Education International*, *24*(1), 98-123.

Lozar, H. R. (2012). Including parents in classroom science nights (Thesis). Montana state University.

Melber, L. M. (2006). Learning in unexpected places: Empowering Latino Parents. *Multicultural Education*, 36-40.

McDonald, R. B. (1997). Using participation in public school "Family Science Night" programs as a component in the preparation of preservice elementary teachers. *Science Teacher Education*, *81*, 577-595.

Mitchell, S. E., Drobnes, E., Colina-Trujillo, M. S., & Noel-Storr, J. (2008). NASA family science night: Changing perceptions one family at a time. *Advances in Space Research*, *42*, 1844-1847.

National Center for Science and Engineering Statistics. (2013). Women, minorities, and persons with disabilities in science and engineering. Retrieved from http://www.nsf.gov/statistics/wmpd/

Page, S. E. (2007). Making the difference: Applying a logic of diversity. *Academy of management Perspectives*, 6-20.

Papanastasiou, C., & Papanastasiou, E. C. (2004). Major influences on attitudes toward science. *Educational Research and Evaluation*, *10*(3), 239-257.

Perera, L. D. H. (2014). Parents' attitudes towards science and their children's science achievement. *International Journal of Science Educa*tion, *36*(18), 3021-3041.

Ramirez, O., McCollough, C. A., & Diaz, Z. (2016). Creating a model of acceptance: Preservice teachers interact with non-english-speaking latino parents using culturally relevant mathematics and science activities at family learning events. *School Science and Mathematics*, *116*(1), 43-54.

Rochin, R. I., & Mello, S. F. (2007). Latinos in science. *Journal of Hispanic Higher Education*, *6*(4), 305-355.

Schueler, B. E., Capotosto, L., Bahena, S., McIntyre, J., & Gehlbach, H. (2014). Measuring parent perceptions of school climate. *Psychological Assessment*, *26*(1), 314-320.

Sha, L., Schunn, C., Bathgate, M., & Ben-Eliyahu, A. (2016). Families support their children's success in science learning by influencing interest and self-efficacy. *Journal of Research in Science Teaching*, *53*(3), 450-472.

Tachibana, C. (2012). Diversity: Promoting new perspectives. *Science*, *337*(6092), 367-370.

U.S. Census Bureau. (2010). *American community survey* [Data file]. Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#acsST

U.S. Census Bureau. (2015). *American community survey* [Data file]. Retrieved from https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#acsST

U.S. Census Bureau. (2017a). *Current Population Survey* [Data file]. Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-finc/finc-01.html

U.S. Census Bureau. (2017b). *Current Population Survey* [Data file]. Retrieved from https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pinc/pinc-03.html

Valadez, G., & Moineau, S. (2010). The ESL family science night: A model for culturally sensitive science education pedagogy. *International Journal of Whole Schooling*, *6*(2), 4-18.

What Job Seekers Really Think of Your Diversity Stats. (2014, November 17). Retrieved from https://www.glassdoor.com/employers/blog/diversity/

Yanowitz, K. L., & Hahs-Vaughn, D. L. (2016). Adults' perceptions of children's science abilities and interest after participating in a family science night. *School Science and Mathematics*, *116*(1), 55-64.