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Investigating Hispanic Preservice Teachers' Mathematics Anxiety, Attitudes, and Self-Efficacy

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ABSTRACT

Math anxiety plagues students and teachers and may cause reduced math competency, avoidance of math courses, and physiological symptoms. This study investigated Hispanic pre-service teachers' math anxiety, self-efficacy, and coping strategies. Previous research found that math-anxious teachers may promote the same feelings in their students and choose less effective teaching strategies. Therefore, we wanted to identify the incidence of anxiety in our Hispanic teacher candidate population while identifying potential differences from previous studies. Very few past investigations looked at this population exclusively and findings from other populations may not apply to our candidates and teachers. We collected data using a digital survey instrument and found math anxiety correlated with low self-efficacy and poor attitudes toward mathematics. Quizzes and exams, statistics, and probability caused the most anxiety among our participants. The most common way participants coped with their anxiety was to study more, followed by mindfulness and test-taking strategies. Based on our findings, math anxiety is quite common among Hispanic teacher candidates and should be studied further since many used coping strategies that did not appear to help even though they have shown promise in previous studies.

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1. Introduction

Few, if any, people would boast about being illiterate, but it is common to hear people discuss their lack of mathematics competence. From teachers commiserating with struggling students to parents helping with homework, one often hears about the fears and struggles encountered with mathematics. It has become socially acceptable to struggle with math, and the prevalence of math anxiety may contribute to this phenomenon, as 61% of students across Organization for Economic Co-operation and Development (OECD) nations worry about earning poor mathematics grades (Legg and Locker, 2009; OECD, 2013). In addition, about 93% of adults in the United States claim to have some math anxiety,

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while 17% suffer from high levels of anxiety (Blazer, 2011; Luttenberger et al., 2018). This phenomenon is common from childhood through adulthood and affects college students significantly. 25% of 4-year and 80% of community college students have math anxiety (Chang and Beilock, 2016). For this study, it is important to note that those who pursue a teaching degree have higher rates of math anxiety than any other college major (Novak and Tassell, 2017). Nearly 60% of preservice teachers had moderate or high levels of math anxiety (Bekdemir, 2010).

Although math anxiety affects people across all majors and demographics, Hispanic students score lower in math than white students and are more likely to have high anxiety (Ahmed, 2018; Gautreau, 2016; Reardon and Galindo, 2007). Hispanic students comprise 26% of students in public schools in the United States, but Hispanic teachers only account for 9% of teachers (Pew Research Center, 2018). Moreover, Hispanic students' complete college at rates lower than any other racial/ethnic group (Schneider et al., 2006). Therefore, increasing the number of Hispanic teachers is essential, especially for students who may not have teachers they can identify with (Banerjee, 2018). With the widespread nature of math anxiety, it is crucial to understand and explore the results of math anxiety, especially among those who will soon teach in their classroom.

Teachers can influence students' future success, especially in math. Unfortunately, that highly means math-anxious teachers pass their anxiety to some students and reinforce it for others (Finlayson, 2014). Moreover, many K-6 teachers chose their grade level due to math anxiety and their perception that teaching early math would be easier (Gresham, 2018). However, even though it may seem simple, many novice teachers do not appreciate the importance of having a good math teacher at an early age. Furthermore, a teacher's math anxiety can influence students' performance, as anxiety negatively affects teacher effectiveness (Tassell et al., 2020). For example, "Higher teacher math anxiety was associated with worse math GPA among students regardless of student prior achievement and mindset" (Ramirez, Hooper, et al., 2018, pg. 7). In addition, students who had math-anxious teachers scored lower on standardized tests and showed a reduced ability to problem solve (Chang and Beilock, 2016). Therefore, math anxiety among Hispanic preservice teachers needs further research to identify causes, effects, and coping mechanisms to help prevent the negative results of math anxiety.

As children progress through school after the effects of COVID-19 closures, they will need teachers who can overcome mathematics anxiety, skill gaps, and incomplete conceptual knowledge to help students catch up. Unfortunately, many teachers may have some of these same challenges (Gresham, 2018). Furthermore, mathematics anxiety and skill deficiencies are so deeply ingrained in our society's collective view of mathematics that these matters have become socially acceptable (Beilock and Willingham; Burns, 1998; Hoffer, 2012; Wallace, 2018). Mathematics anxiety is widespread with more than 9 of 10 US adults claiming to experience it to some degree, while one in six suffer from high levels of anxiety (Blazer, 2011; Luttenberger et al., 2018). While it is disconcerting to think of teachers fearing a content area they may soon teach, more concerning is that those from low-income homes and people of color are affected most. Therefore, our research sought to investigate the prevalence of math anxiety among preservice teachers (PSTs) at a university where Hispanic students comprise approximately 89% of the population.

1.1 Problem and Significance

In this study, we explored how Hispanic PSTs' math anxiety was linked to self-efficacy ratings and attitudes toward math. We also investigated which mathematics concepts caused the most anxiety and the coping mechanisms PSTs used to manage their anxiety. We embarked on this study because we are concerned about future teachers' high anxiety rates and their effects in the classroom. Bekdemir (2010) found that 59% of preservice teachers (PSTs) had moderate to high anxiety, while Finlayson's (2014) study of 70 PSTs revealed only two respondents who reported no math anxiety (2.9%). Furthermore, even after teaching for five years, teachers' mathematics anxiety did not decrease substantially (Gresham, 2018). With such a high incidence of mathematics anxiety, we wanted to examine our population to determine if their anxiety rates were similar. Hispanic students make up 26% of the public

school population in the United States but only 9% of the K-12 teacher workforce is Hispanic, necessitating research into possible barriers to teacher certification (Pew Research Center, 2018). Unfortunately, extensive research into Hispanic or Latinx PSTs' math anxiety does not exist, but of the studies performed, Hispanic PSTs were often affected negatively by anxiety (Gautreau, 2016). Due to the scarcity of studies and the number of teachers and students affected, more research was warranted. Therefore, we pursued this study to add to the extant literature and improve our ability to address the issue in our classrooms.

Since the population of Hispanic students in the United States is sizeable, it is imperative to understand the connection between teachers' anxiety and the impact it may have on students. For example, students who had negative experiences in elementary school held more negative math attitudes throughout their lives (Bekdemir, 2010). This may explain why many teachers who choose elementary, especially the lower grades, do so because of their anxiety and the perception that math will be less daunting at that level (Gresham, 2018). As Finlayson puts it, "Students often develop math anxiety in schools frequently as a result of learning from teachers who are themselves anxious about their mathematical abilities" (Finlayson, 2014, pg. 101). Furthermore, students who had highly math-anxious teachers scored lower on standardized tests and had worse mathematics GPAs than students whose teachers had no anxiety (Chang and Beilock, 2016; Choe et al., 2019; Luttenberger et al., 2018; Ramirez, Hooper, et al., 2018). Consequently, we wanted to delve into our population's anxiety, especially in light of the gaps present in standardized testing and mathematics pursuits.

Performance issues aside, PSTs' anxiety may also have other negative consequences. Anxiety leads to avoidance of courses and activities related to mathematics (Foley et al., 2017). If PSTs need to improve their math skills but suffer from anxiety, they may be likely to avoid a potential solution. Furthermore, math-anxious teachers may promote or reinforce anxiety in students by perpetuating negative attitudes toward mathematics (Finlayson, 2014; Swars et al., 2006). This may happen when teachers make negative comments about mathematics or communicate their contempt through facial expressions and/or their tone of voice (Foley, Herts, Borgonovi, et al., 2017). Ramirez, Hooper, et al. (2018) found that teachers may also promote anxiety by giving punitive feedback or relying too much on unproductive instructional strategies. Finally, teachers who have anxiety and do not enjoy mathematics may spend up to 50 percent less time teaching mathematics than other teachers (Sloan, 2010).

Due to the concerning data above, our quantitative study aimed to explore factors related to Hispanic PSTs' math anxiety and its incidence. We collected data through an online survey and used the data to explore mathematics anxiety, self-efficacy, mathematics concepts that elicited the most anxiety, and PSTs' coping strategies. We compared our data using independent variables like household income, level in school, and sex/gender. The following research questions guided our study:

1. How are math anxiety scores related to Hispanic pre-service teachers' self-efficacy ratings and attitudes toward math?

2. Which concepts (e.g. fractions, percents, geometry, etc.) have the highest reported anxiety levels?

3. How did the attitudes of parents and teachers influence respondents' math anxiety, self-efficacy, and attitudes toward math?

4. What coping strategies have PSTs used and how did they affect math anxiety, self-efficacy, and attitudes toward mathematics?

For this study, we used Tobias and Weissbrod's (1980) definition of math anxiety: "the panic, helplessness, paralysis and mental disorganization that arises among some people when they are required to solve a mathematics problem" (p. 65). We chose to focus solely on general math anxiety and not anxiety about *teaching* math. Although some studies compared the two, Olson and Stoehr (2019) stated it may not be necessary for math-anxious PSTs. Since we focused on general math anxiety, our findings may also help other populations.

1.2 Framework

We operated on the assumption that math anxiety leads to poor performance, procrastination, and avoidance (Luttenberger et al., 2018). In addition, due to the differences in demographics, we focused specifically on Hispanic PSTs as Black and Hispanic students were more likely to suffer from high math anxiety than white students, which may be attributed to societal expectations and negative stereotypes that they do not want to live up to (Ahmed, 2018). Our study population offered an opportunity to explore a population different from many previous studies. The College of Education was comprised of 886 students, 82.6% of whom are Hispanic. Female students made up 90% of the population and about 415 students were pursuing elementary educator certification. Since PSTs' anxiety negatively affects self-efficacy and the way they view and approach mathematics, high anxiety, low self-efficacy, and negative attitudes potentially lead to myriad negative outcomes.

Furthermore, a large percentage of our students are first-generation students (51.2%) who seemed to struggle more with math-related stress than non-first-generation students (Carpenter and Clayton, 2014). Therefore, it is crucial to know how common anxiety is, how it affects Hispanic PSTs' attitudes and self-efficacy, and how they currently cope. If anxiety leads to poor performance and an achievement gap exists for people of color, then it may be logical to think that math anxiety should be significantly higher for our group of future teachers. Since students who had highly math-anxious teachers learned less than those who had teachers without math anxiety and increased math anxiety was linked to 34-point lower average scores across OECD nations, identifying the rates of anxiety in the study may improve outcomes while also diversifying the body of literature (Foley et al., 2017; OECD, 2013).

1.3 Literature Review

The Hispanic or Latinx community is the largest group of people of color in the United States with projections claiming this group will make up 26% of the nation's population by 2050 (Gollnick and Chinn, 2021). With such a large segment of Hispanic Americans, it is important to explore math anxiety because, "Simply applying principles that have been effective in explaining the performance of samples of predominately White students does not appear to be acceptable" (Stevens et al. 2006, p. 181). Furthermore, students of color experience greater academic stress and more anxiety than their white counterparts (Carpenter and Clayton, 2014; Casanova et al., 2021; Gautreau, 2016). If students of color are affected this way, it stands to reason that PSTs may also have similar differences. Since Hispanic students have higher anxiety rates than others, we also need to know if Hispanic PSTs have higher levels of anxiety, especially in light of the potential, negative consequences.

1.3.1 Math anxiety, self-efficacy, and attitudes

Math anxiety is common among teachers which leads to numerous negative outcomes like less instructional time spent compared to other content areas, having lower expectations for their students, and students developing math anxiety from their teachers (Finlayson, 2014, Hollingsworth and Knight-McKenna, 2018, Ramirez, et al., 2018).). We know many elementary teachers choose their grade level due to anxiety. If these teachers also had negative experiences in school, it stands to reason they may face additional difficulty in the classroom (Gresham, 2018). One factor connected to heightened math anxiety is poor math self-efficacy, which is the belief a person has in her/his capacity to do math (Siegler and McCoach, 2007). Studies have shown that those who had high math anxiety also had low self-efficacy and a stronger view of one's mathematics ability may lessen anxiety (Ahmed et al., 2012; Gonzalez-DeHass et al., 2017). Although we do not fully know if self-efficacy promotes anxiety or vice versa, one potential reason for the connection is that teachers' math anxiety harms their effectiveness (Tassell et. al, 2020). For example, those who exhibited anxiety employed a teaching style and chose instructional approaches that focused on memorization more than understanding and set the learning tempo on curriculum pacing instead of student needs (Finlayson, 2014). This may partially explain the connection between anxiety and self-efficacy as students who are rushed through the material may develop anxiety due to a lack of understanding and a belief they are not good at math.

Since a teacher's math anxiety may influence students' self-efficacy, it is important to understand how one's self-worth in mathematics can be improved. For students to feel confident in their abilities, they must know concepts and not be limited to rules or steps (Stevens et al., 2006). Improved self-efficacy comes from active engagement because mathematics requires higher levels of reasoning, while direct instruction alone activates lower levels of cognition (Finlayson, 2014). Furthermore, anxiety leads to avoidance of activities related to mathematics, which can further hurt one's math skills and negatively affect self-efficacy (Chang and Beilock, 2016; Choe et al., 2019; Luttenberger et al., 2018). Unfortunately, anxious PSTs may avoid optional courses that could improve their math skills and outlook (Szucs and Mammarella, 2020). Furthermore, many future teachers may not grasp the gravity of their anxiety, as Olson and Stoehr, (2019) shared, "A startling finding was the degree to which the math-anxious PSTs in these studies downplayed the importance of mathematics in their future professions" (p. 80). If PSTs' improvement hinges on their willingness to delve into mathematics more deeply, we need to address their lack of self-confidence and high math anxiety, while helping them see the magnitude of the influence they have on students.

As teachers, we have witnessed numerous students recoil at the thought of fractions, algebra, and an assortment of other concepts. Past research indicates that some areas of math may have higher rates of anxiety. Harper and Daane (1998) discovered word problems, multiplication, division, and geometry were all factors. However, it may not be the content that leads to anxiety but the way these concepts are taught, especially by teachers with anxiety. For example, highly anxious teachers may spend less time on math instruction and respond differently to students' questions and errors (Foley, Herts, Borgonovi, et al., 2017). With less time learning and feeling discouraged to ask questions, it is more challenging for students to learn the material as well as they should. Mathematics mastery requires a willingness to test strategies and ask questions as one works their way to an answer. Unfortunately, it appears that math anxiety may arise from inflexibly controlled classrooms and ineffective pedagogical approaches. In these environments, students feel that the process of doing math requires one *right* way and there is a time limit to their growth and learning (Harper and Daane, 1998). If students cannot learn the lone strategy the teacher has proposed or fail to learn as quickly as others, they may believe they lack the necessary aptitude (low self-efficacy). Furthermore, the shame of not being good with numbers or fast enough to work with them may lead to anxiety. Therefore, certain concepts may appear to have provoked more anxiety, but the influence of parents and teachers may also account for a portion of one's math anxiety.

1.3.2 Attitudes of parents and teachers

Math anxiety and low self-efficacy may be tied to teachers' attitudes, their approaches, and the way they talk and react to math, but numerous other factors can help explain the marriage of anxiety and self-efficacy. Foley et al. (2017) found that the quantity and quality of math interactions with parents could influence a child's math anxiety. In addition, people with high math anxiety often discuss math in negative terms, which may partially explain the influence parents can have on their children (Maloney et al., 2015). Although parents play a role, some teachers can continue a pattern that may lead to anxiety and low self-efficacy for children. Math-anxious teachers seem to have lower expectations for students and some try to protect students from being challenged, which reduces their number of opportunities to learn (Olson and Stoehr, 2019; Ramirez, Shaw, et al., 2018). In addition, anxious teachers also invited student questions less often, gave students harsh negative feedback, and relied on ineffective teaching strategies (Ramirez, Hooper, et al., 2018). Finlayson (2014) found that teachers add more practice and timed tests rather than helping students gain understanding when they suffer from anxiety. If a child does not understand underlying concepts, she/he can become frustrated when the layout of a problem changes, which could account for some of these issues. Furthermore, a lack of knowledge, inadequacy in pedagogy, and perceived hostility toward mathematics led to an increased fear of failure which could account for anxiety and issues with efficacy (Bekdemir, 2010; Finlayson, 2014). Since these factors can have devastating effects, managing and mitigating math anxiety among PSTs may be more important than ever.

1.3.3 Coping with math anxiety

Although the best course of action would be prevention, we must also address the phenomenon in our current cohort of PSTs. Knowing what coping strategies are useful may partly help teachers and students alleviate their anxiety. People handle stress and anxiety differently, but Iossi (2007) identified multiple strategy types that can decrease math anxiety. These include curricular strategies like retesting, instructional approaches such as better feedback, and non-instructional methods like counseling. For example, strategies like Cognitive Behavioral Therapy (CBT), mindfulness, and relaxation can help PSTs address their anxiety and can be used outside of the classroom when instructional methods are not available (e.g. state certification exams). Since math anxiety triggers automatic reactions in the brain and body, CBT may help because it teaches one to challenge negative feelings and actions and cultivate new, constructive outlooks leading to more positive behaviors (Buckley et al., 2016). CBT methods identify and reframe negative thought processes associated with behavior and emotional responses to external stimuli. Using CBT to redirect negative thoughts like, *I can't do any of these problems correctly*, may alleviate anxiety for PSTS and others (Gregor, 2005; Hembree,1988). Furthermore, Gregor (2005) and Zettle (2003) said CBT strategies can reduce anxiety while also improving performance, so they may be especially helpful for PSTs.

Reframing negative thoughts may be helpful but it is challenging to break habits of mind that have been pervasive for years. Therefore, using CBT with mindfulness and relaxation may maximize the benefits. Buckley et al. (2016) believe relaxation techniques may help because math-anxious individuals experience heightened physiological stimulation due to the activation of the autonomic nervous system. Since relaxation practices decrease stimulation, this may help lead to anxiety improvement (Yahav and Cohen, 2008). For those who may need more than relaxation tools, another coping strategy that could help PSTs is mindfulness. The APA (2020) defines mindfulness as "awareness of one's internal states and surroundings" (para. 1). This method helps people avoid damaging responses by considering thoughts, emotions, and events without judging them. Mindfulness activities may diminish the effects of math anxiety by decreasing the cognitive resources needed to process negative stimuli. This reallocation of resources allows the anxious person to address other cognitive tasks instead of focusing on their anxiety and fear (Buckley et al., 2016). Mindfulness may have other promising effects as well. Vacarr (2001) found that PSTs who completed mindfulness training experienced an increased awareness of their students' intellectual needs, which could have a positive influence in a variety of areas. Therefore, a combination of CBT, mindfulness, and relaxation may help but it is also important to know what methods PSTs already use to see if other valid strategies exist. This may also help us find potential avenues to introduce and teach these coping methods to PSTs.

Mathematics anxiety has been studied for decades, but since 93% of people still have some level of anxiety, it does not appear we are much closer to a solution than we were 50 years ago (Luttenberger et al., 2018). In addition, since people of color may have higher rates of anxiety and due to the persistent achievement gap, further exploration was warranted. Although there have been numerous studies of math anxiety, very few included Hispanic or Latinx PSTs as the primary study group. Therefore, we chose to investigate the prevalence of math anxiety among PSTs at a Hispanic-Serving Institution (HIS) in Texas. By understanding the prevalence of math anxiety, its relationship to attitudes and self-efficacy, and the coping mechanisms employed, we hoped to gain a clearer picture of math anxiety among future Hispanic teachers. We hoped to inform future research and make a step toward improving anxiety for this underserved group. Furthermore, since only 1 in 4 Hispanic children have a same-race teacher in 3rd grade, increasing the number of teachers can have far-reaching benefits for numerous children (Banerjee, 2018). As Gautreau (2016) shared, we need to decrease math anxiety while improving the number of Hispanic teachers in the classroom since so many will benefit.

2. Method

2.1 Participants

We sent a questionnaire, which was approved by the Institutional Review Board (IRB), to 202 teacher candidates at a Hispanic-serving university in Texas. The questionnaire was sent via email in the fall of 2020. Fifty-four PSTs opened the questionnaire, with 42 completing the survey in its entirety, giving an effective response rate of 20.79%. Respondents were students enrolled at the university who had been admitted to the college of education and were studying elementary education. All respondents were pursuing certification as a teacher in Texas and had completed all required mathematics courses to that point. Participants could withdraw from the study at any time and we obtained participants' informed consent electronically before collecting our data.

2.2 Instrument

We collected data through the university's secure online survey software. Informed consent was included as the first page of the online questionnaire and allowed participants to opt out at any time. Our instrument contained sections for math anxiety, self-efficacy, attitudes toward math, open-ended questions, and demographics. The questionnaire consisted of 24 closed-ended questions, three open-ended questions, and seven demographic items. Most respondents were able to finish the questionnaire in about 15 minutes. The math anxiety section adapted questions from Hopko's (2016) Revised Math Anxiety Rating Scale (MARS-R). Our administration of this scale had a Cronbach's alpha coefficient of 0.95, indicating high internal consistency. The MARS-R included 12 statements that asked participants to indicate their level of anxiety using a Likert scale (0 = No Anxiety, 6 = High Anxiety). Example scenarios included items such as watching an algebraic equation worked on the board, working on probability, and signing up for a statistics course. The self-efficacy section included the eight items from the PISA scale (OECD, 2013) but we changed some language to match terms used in the United States (e.g. petrol vs. fuel or gas). Cronbach's alpha coefficient for the self-efficacy scale was 0.81. Participants also identified their anxiety level when working with concepts they may eventually teach, which included algebraic thinking, fractions, probability, etc. Our instrument also asked about participants' attitudes toward math as well as their perceptions of their parents' and teachers' attitudes. Attitude items were scored on a five-point, Likert scale that ranged from mostly negative (1) to mostly positive (5). The demographic data collected consisted of participants' age, year in school, race/ethnicity, gender, and household income. Participants indicated their age with an open-ended question, while all other items provided a dropdown menu to choose from. The final part of the instrument included three open-ended questions that allowed our PSTs to write as much as desired. The open-ended questions consisted of 1) what coping strategies do you use when anxious about math; 2) when did your math anxiety start, and 3) what resources were/are available to improve your math anxiety and skills? These open-ended questions were included to help us better understand the factors connected to math anxiety and to provide insight for potential future research.

2.3 Procedures

Once all surveys were collected and the data collection window closed, all responses were downloaded and imported to a password-protected file in IBM SPSS Statistics, version 25. We performed descriptive and inferential analyses of the data. Inferential statistical tests included *t*-tests, Pearson's correlation, and one-way analysis of variance (ANOVA). For some comparisons, we ran the Welch ANOVA and Games-Howell post hoc test because our groups had unequal variances. We analyzed the math anxiety and self-efficacy scales as continuous variables and divided participants into six groups based on their mean MARS-R scale score (None, Low, Some, Moderate, Significant, High). Since previous studies had grouped participants based on various forms of the MARS scale score, we did likewise to have a frame of reference (Bekdemir, 2010; Lyons and Beilock, 2012). Participants' mean scale score was 27.21 which equated to some anxiety and a mean item score of 2.27 (SD = 1.34). These data were within the range of previous studies that had mean item scores of 2.09, (Sloan, 2010), 2.40 (Gonzalez-DeHaas et al., 2017), and 2.77 (Hopko, 2016).

2.4 Limitations

Although our study adds to the discussion of math anxiety among PSTs, there are limitations. First, our data were self-reported, and although the data add to our knowledge since math-anxious PSTs fear failure and avoid appearing incapable, their answers may not always reflect their true feelings (Gonzalez-DeHass et al., 2017). Secondly, although our sample was homogenous by design, the findings may not apply to all pre-service teacher candidates. Furthermore, our response rate and sample size were small. Although they were similar to other online surveys, this should be considered when looking at the findings. Finally, since the study was conducted during the height of the COVID-19 pandemic, peoples' sensitivity to and awareness of anxiety may have been heightened or altered by the circumstances.

3. Results

The results of this study were evaluated based on each of the four research questions. The following section explicates our findings.

3.1 Anxiety, Efficacy, and Attitudes

Our first question explored the relationships between math anxiety, student attitudes, and self-efficacy. Therefore, we investigated the relationships between those variables and made comparisons based on demographic data such as gender, year in school, and household income. Most of our participants identified as female (n = 35, 83.3%) and the participants' average age was 23 years old (SD = 4.12). Most of those surveyed were in their fourth year of college (n = 22) and 39 were Hispanic (92.9%), while three identified as Native American/Alaska Native (7.14%).

Math anxiety was common among our participants. Only nine (22%) reported low levels of anxiety, twenty experienced moderate anxiety or above (47.7%), and eight reported significant anxiety or above (19.1%). See Table 1 for more math anxiety data. Participants' mean anxiety scale score was 27.21 (Mdn = 28.5, SD = 15.87) and the mean self-efficacy score was 2.85 (SD = 0.60). Pearson's correlation showed a large negative correlation between math anxiety and self-efficacy, $r(40) = -.672$, $p < .001$. Generally speaking, the higher a respondent's math anxiety, the lower their self-efficacy score.

Table 1. Math Anxiety Levels Based on MARS-R Scale

Anxiety Level	n =	Percent
None, 0-5 Points	4	9.5
Low, 6-17 Points	9	21.4
Some, 18-29 Points	9	21.4
Moderate, 30-41 Points	12	28.6
Significant, 42-53 Points	6	14.3
High, 54-60 Points	2	4.8

Furthermore, there was a correlation between math anxiety and respondents' attitudes toward math as those with higher anxiety had more negative attitudes, $r(40) = -.594$, $p < .001$ (See Table 2 for Correlation Data). Our data did not have homogeneity of variance, so we ran a Welch ANOVA with the Games-Howell post hoc test for differences in both self-efficacy and attitude based on anxiety level. Both variables were found to be statistically significant. The Welch test showed those with higher levels of anxiety also had lower levels of self-efficacy, $F(5, 7.029) = 5.561$, $p = .022$. Furthermore, participants with higher anxiety had more negative attitudes toward mathematics, $F(4, 12.322) = 6.323$, $p = .005$ (See Table 3 for ANOVA and Welch Statistic Data).

Table 2. Descriptive Statistics and Correlations for Math Anxiety, Self-Efficacy, and Attitudes

Variable	n	M	SD	1	2	3
1. Math Anxiety (MARS-R Scale)	41	2.27	1.34	--		
2. Self-Efficacy	39	2.85	0.60	.672**	--	
3. Math Attitude	42	3.62	1.41	-.594	.348*	--

*p < .05. *p < .01

Table 3. One-Way Analysis of Variance of Math Anxiety with Attitudes and Self-Efficacy

Variable	Source	*SS*	*df*	*MS*	*F*	*Sig.*
Self-Efficacy Scale	Between Groups	7.160	5	1.432	7.036	.000
	Within Groups	6.920	34	.204		
	Total	14.080	39			
Your attitudes toward math	Between Groups	37.349	5	7.470	6.035	.000
	Within Groups	44.556	36	1.238		
	Total	81.905	41			

Robust Tests of Equality of Means

		Statistic[a]	*df1*	*df2*	*Sig.*
Self-Efficacy Scale	Welch	5.561	5	7.029	.022

a. Asymptotically F distributed.

3.2 Mathematics Concepts and Anxiety

Our second research question attempted to determine if specific mathematics concepts and scale items seemed to cause the most anxiety. When viewing individual items on the MARS-R scale, we looked at questions that had the highest percentage of respondents with significant anxiety or above. The items with the highest numbers of anxious individuals were exams or quizzes (35.7%), statistics (35.7%), interpreting probability statements (38.1%), waiting for a score on a test (40.5%), and pop quizzes (47.6%). In addition to the MARS-R, we also asked participants to score ten math concepts based on their perceived level of anxiety (1 = high anxiety; 10 = no anxiety. We looked at mean scores to determine which concepts caused the most anxiety (a lower score = higher anxiety). The concepts that elicited the most fear were fractions (M = 5.95), probability (M = 5.83), percent (M = 5.66), and statistics (M = 5.38). Although these are similar to some of the challenges identified in the MARS-R, group comparisons showed no statistically significant differences based on age, income, etc.

3.3 Parent and Teacher Attitudes

Our third research question explored teachers' and parents' attitudes influence on participants' attitudes, anxiety, and/or self-efficacy. Although those who had parents and/or teachers with negative attitudes had higher math anxiety and lower self-efficacy, none of the findings were statistically significant. However, there was a moderate, negative correlation between parents' attitudes toward math and respondents' MARS-R scale score, $r(40) = -.359$, $p < .020$ (See Table 4 for ANOVA data) . Furthermore, when looking at parent and teacher attitudes together through a one-way ANOVA, we found an influence on participants' attitudes. Those whose parents and teachers had more negative attitudes also had more negative attitudes toward math now, $F(6, 35) = 3.651$, $p = .006$.

Table 4. One-Way Analysis of Variance of Parent/Teacher Attitudes and Participant Attitudes

Source	*SS*	*df*	*MS*	*F*	*Sig.*
Between Groups	31.530	6	5.255	3.651	.006
Within Groups	50.375	35	1.439		
Total	81.905	41			

3.4 Coping Strategies

Our final research question investigated PSTs' coping strategies, and we looked at both the number of strategies participants used as well as the type of strategy employed. Participants used a mean of 1.33 strategies each, with 38.1% using one strategy and 47.6% using two or more. The most common strategy was extra study time with 40.5% (n = 17) reporting it as a way to cope. Other methods included actions similar to mindfulness/CBT (16.7%) and test-taking tricks (14.3%). Two respondents avoided math (4.8%) due to their anxiety and six said they did nothing (14.3%) (Frequency information can be found in Table 5). Although the number and type of coping strategies differed, there were no statistically significant differences in attitude, MARS-R score, anxiety level, or self-efficacy. However, those who were in the last year of their program used more coping strategies (M = 1.652, SD = 0.57) on average

than sophomores (M = 1.00, SD = 1.41) or juniors (M = 0.94, SD = 0.66) as evidenced by a one-way ANOVA, $F(2, 39) = 6.245$, $p = .004$.

Although it was not one of our research questions, due to our curiosity we also looked at the effect of teacher attitudes on individual MARS-R items using a Welch ANOVA and Games-Howell post hoc test. One item had significant differences, which also happened to be the item that caused the most anxiety, *waiting for a test to be returned*. Respondents who had teachers with negative attitudes had greater anxiety (M = 4.11, SD = 1.27) waiting for a test than participants who had mostly positive teachers (M = 2.00, SD = 1.91), $F(3, 17.407) = 4.542$, $p = .016$.

Table 5. Frequency of Coping Strategies

Coping Strategy	n =	Percent
Avoidance	2	4.8
None	4	9.5
Other	6	14.3
Test-Taking Strategies	6	14.3
Mindfulness/CBT	7	16.7
Study (Reviewing notes, textbook, etc.)	14	40.5

4. Discussion and Implications

The purpose of this study was to investigate Hispanic PSTs' math anxiety, self-efficacy, and attitudes toward mathematics. In addition, we wanted to explore anxiety-inducing concepts, the relationship between math anxiety and self-efficacy, and participants' coping strategies. We found that math anxiety was common and those who had negative attitudes toward math experienced more math anxiety. In addition, self-efficacy decreased as math anxiety increased. The concepts that caused the most anxiety were fractions, statistics, probability, etc., but tests and quizzes were also significant precursors to anxiety. Furthermore, parent and teacher attitudes can influence others' approaches and attitudes as we found connections to the MARS-R. Finally, the number of coping strategies participants used increased as they progressed in their program. However, our sample's anxiety did not differ based on which coping methods they chose. The following discussion highlights connections between our sample and extant research as well as suggestions for future lines of inquiry.

Participants in the study experienced concerning levels of anxiety and low self-efficacy considering they will be teaching in classrooms where a significant share of students come from low-income homes, maybe learning a second language simultaneously, etc. Previous studies showed that some math-anxious teachers use ineffective strategies and spend less time on math, so it is imperative to address math anxiety, so these students receive the best education possible (Finlayson, 2014; Foley et al., 2017). Furthermore, participants had a lower percentage of moderate to high anxiety levels than those found in Bekdemir (2010) (47.7% vs. 59%). However, they had similar significant or high anxiety levels (19.1% vs. 17%) when compared to respondents in Luttenberger et al. (2018). Since our findings indicate a relationship between anxiety, self-efficacy, and attitude, more work is needed to determine how these three variables interact and which may come first, especially among Hispanic PSTs and other people of color. If it is true that math anxiety leads to reduced competency and an achievement gap exists, then we thought it logical that our participants would have significantly higher rates of anxiety (Ramirez, Shaw, et al., 2018). However, our data, although from a small sample, show that this is not the case, necessitating further investigation.

Addressing the three variables above is important but our findings also raise the question of why some concepts promote anxiety more than others. Although common sense dictates tests and quizzes cause anxiety because of the consequential nature of doing poorly, what about other items like statistics and probability? Is this due to the nature of the mathematics itself or is it a result of instructional practices, or something else altogether? Warwick (2017) found that negative early experiences like rigidity with alternative methods and negative discourse led to low scores and high math anxiety. Furthermore, Ramirez, Hooper, et al. (2018) found that math-anxious teachers entertained questions from students

less often than those who did not have math anxiety. Therefore, more investigation is needed to determine why concepts like fractions elicit negative feelings. Since fractions are introduced later in elementary school it may be that some highly anxious teachers use fewer solution strategies, field fewer questions, and spend less instructional time on some of these concepts. This may help explain the different levels of anxiety in these areas. Furthermore, since participants who feared waiting for their test results also had teachers with more negative attitudes, it would be valuable to determine if specific approaches to fractions, statistics, tests, etc. may account for some of our findings.

Although many differences based on parent/teacher attitudes and coping strategies were not statistically significant, those that were significant showed the importance of continuing to work with novice teachers, parents, and the community to help decrease negative attitudes toward mathematics. Furthermore, it may be beneficial for colleges of education to evaluate teacher candidates' math anxiety before admission, so faculty can help them work through it (Sloan, 2010). By identifying students with marked math anxiety, we may be able to teach them to cope more effectively, choose better pedagogical strategies, and prevent or alleviate math anxiety in their future students. Although most of our participants used a variety of strategies and resources, their levels of anxiety indicate PSTs need more guidance to handle their anxiety. The only difference we found for coping methods was the number used. Since the type of strategy participants used did not seem to affect anxiety, this non-finding shows the need for more research to find effective strategies for this group of PSTs, especially because they can also use these methods to help their students who may have anxiety.

Although math anxiety has been researched extensively, our findings further add to the literature by focusing specifically on the phenomenon among Hispanic PSTs. The fact that anxiety levels are not appreciably higher than other groups and their chosen coping strategies do not seem to be overly effective, more investigation is needed to address anxiety and self-efficacy in an underserved, yet important population. Our findings show that math-anxious Hispanic PSTs also have poor self-efficacy, which mirrors Ahmed's (2018) findings. Therefore, we see these results as merely the beginning stage of more research to come.

5. Conclusion

The societal acceptance of math anxiety and poor performance has created an environment where math-anxious teachers are common. Although few admit an inability to read, numerous people are proud to admit their rocky relationship with math. Our participants experienced anxiety and low self-efficacy and they may inadvertently pass some of this to their students if we do not act. As Gautreau (2016) wrote, "Because mathematics anxiety is a learned behavior, it is important to find strategies to break the cycle within the most vulnerable communities" (p. 34). As Gresham (2018) stated, teachers must concede they have anxiety and determine its causes, but how can we expect them to do so when we do not fully understand the issue, especially among underserved populations? If we can help PSTs in this regard, they can improve their confidence and promote positive attitudes toward mathematics in their students. Our data and others show math challenges are prominent for people of color and a need exists for more Hispanic teachers in the classroom to improve diversity (Banerjee, 2018). Since only 26% of first and second-generation Mexican students were proficient in math compared to 53% of non-Hispanic White students, we must address any potential barriers to success (Reardon and Galindo, 2007). This is especially true when one considers the finding from Stevens et al. (2006) that Hispanic students seem to have higher levels of interest in math than other populations. Therefore, neglecting to address math anxiety among PSTs prevents an opportunity to cultivate this interest and increase Hispanic students' participation in STEM disciplines. Although our study focused on one group alone, other researchers believe identifying, preventing, and reducing math anxiety may lead to better outcomes for all students (Blazer, 2011). With performance gaps showing few signs of abating, we must better address math anxiety before it negatively impacts another group of children eager to learn about mathematics only to grow despondent and anxious about fractions, statistics, and testing. Although this is only a small step toward understanding anxiety among Hispanic PSTs, it is a necessary one we hope leads to more discourse and action for teachers and students who may struggle with math anxiety.

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