Board 295: HSI Planning Project: Integrative Undergraduate STEM Education at Angelo State University (I-USE ASU Grant #2122828)

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Abstract

Historically, women and racial minorities have been underrepresented among the STEM (science, technology, engineering, and mathematics) workforce. Previous research has identified several factors that contribute to the persistence of minority populations within STEM fields, while other work has identified potential barriers that have influenced these disparities [1-9]. The current study sampled undergraduate students (n=222) from a Hispanic Serving Institute (HSI) in West Texas. Participants were given a survey that explored factors including level of perceived support from family members and friends, level of motivation to pursue a STEM career, and student experiences at the university. Variables of interest focused on sex, ethnicity, and STEM major status. Results and implications are discussed in the following manuscript.

Introduction

The significance of underrepresented women entering STEM (science, technology, engineering, and mathematics) fields and careers is critical for extinguishing the long-lasting negative stereotypes around women and minorities in the field [1]. Both women and racial minorities have historically been the lowest group to be involved within the STEM fields and have been so for several years [2]. Prior work suggests that women are less likely to seek and obtain STEM degrees compared to men and that disparity increases at graduate-level programs [3]. Other findings have indicated that minorities have one of the greater risks of dropping out or changing their majors [4]. Moreover, students of color continue to be underrepresented, overlooked, and excluded in their STEM programs and fields.

Several factors have been identified as possible areas of support for women and ethnic minorities to stay in STEM fields while others have identified potential barriers for these students. In 2014, Foltz [5] set out to understand what factors influenced the persistence to baccalaureate of minority students enrolled in graduate STEM programs. What made this research unique was that the participants were already successful in the completion of their STEM undergraduate training and were able to identify key factors that lead to that success [5]. Interestingly, family expectations were found to be a key motivating factor for some students while being a challenge for others. While many students reported that "the expectation of college attendance was communicated consistently throughout their upbringing" (pg. 4) with many of them having an early childhood experience that piqued their interest in the STEM fields; other students reported that family members were often in disagreement about choice of major and didn't provide much support [5]. Another key factor to persisting through undergraduate STEM training was the student's expectations about their own abilities and capabilities [5] and in some ways, the students with more grit were the ones who persisted. This study also conducted interviews with faculty who confirmed that students need determination to be successful in the field [5]. Lastly, a key factor in the persistence and success of these STEM students was the role of and relationship with faculty in field [5]. All participants in this study recognized that they had experiences with faculty who demonstrate a love of the discipline and an eagerness to learn and that those faculty who did this exceptionally well were those who took an interest in both the personal and academic success of the student [5].

In 2015, Gandhi-Lee and colleagues [6] set out to understand the perceptions that STEM

faculty hold of successful STEM students as well as the major barriers to STEM students' success. This study provided insight into the qualities of successful STEM students and identified possible barriers that lead to attrition problems within the STEM field. One of the main findings for student success was that successful STEM students possessed several skills that were not necessarily discipline specific but were more general and applicable across disciplines [6]. In general, these beneficial skills were personality trait related such as curiosity, inquisitiveness and strong work ethic [6]. Other domain-specific skills were also identified as influential to STEM student success, such as strong written and oral communication skills and strong information synthesis skills [6]. In addition to identifying the qualities of successful students, faculty in this study also identified potential barriers to student success which included insufficient math skills and math efficacy. Nearly all faculty who participated in this study reported that students' fear of math or math anxiety was a major obstacle for recruiting STEM students and retaining them [6].

The current study focuses on several factors that prior work has suggested are influential as to why Latinx and other minority populations have chosen, and remained, in STEM fields and careers as well as factors that have influenced why these populations have left STEM fields. In particular, this study focused on the level of support students felt from family members and friends about STEM and college [7], the level of motivation felt to pursue a career in the STEM field [8] and assessing students' experiences with eight subscales related to college student experiences including: perceptions of faculty, course learnings, experiences with academic counseling, satisfaction with the university, competition and survival culture, psychological adjustment, academic adjustment, and social adjustment [9]. Support for this project comes from

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Methods

Sample

Participants were recruited from a Hispanic Serving Institute (HSI) in West Texas. After receiving approval from the university's Institutional Review Board (IRB), participants were recruited directly through email using various list servs. Those who agreed to participate were asked to complete a consent form and an online survey via Qualtrics software. The survey consisted of demographic information and a series of questionnaires identified below. At the end of the survey, participants were asked if they were interested in being contacted for a follow-up interview. Upon completion of the study, participants were provided with a debriefing form.

The sample was comprised of undergraduate students (n=222) from a Hispanic Serving Institute (HSI) in West Texas. The average age of the sample was 20.45 (SD= 3.73) and consisted of 108 females, 110 males, and 4 participants who chose not to identify. The sample was split between participants who were White (n=116) and Non-White (n=102). Of these participants, 0.9% identified as American Indian, 3.2% as Asian, 5.5% as Black or African American, 20.6% as Latinx, 53.2% as White or Caucasian, 12.4% Bi-racial, and 4.1% as other. Most of the sample were STEM majors (n=181) as opposed to non-STEM majors (n=40). For the qualitative interviews, 20 participants who were either previous or current STEM majors

students participated in individual interviews (n=7) and focus groups (n=5) related to their experiences in STEM. Demographic descriptive statistics can be found in Table 1.

Support for STEM and College. This is a 6-item scale developed to assess participants social support regarding STEM majors [7]. This scale was administered once to assess the perceived social support from family and again to assess the perceived social support from friends. Participants responded to statements such as "My family [friends] values my success in college" and "My family [friends] encourage me to study STEM" on a six-point Likert scale ranging from 0=never to 5=always. When evaluating the internal reliability for the 6-item support for STEM and College, results indicated that the alpha for the total scale was $\alpha = 0.81$, with the support from family being $\alpha=0.85$ and support from friends being $\alpha=0.88$.

STEM Career Motivation. This 10-item questionnaire was adapted from the Motivation for Science Career Scale [8] and was developed to assess participants' plans in pursuing a STEM or non-STEM career, personal sense of success, enjoyment, and type of career. This questionnaire utilizes four questions to assess STEM and non-STEM career motivation. Items included questions such as "I plan to pursue a STEM [non-STEM] career" and "I could succeed in a job in a STEM [non-STEM] field" where participants responded on a Likert type scale ranging from 0=strongly disagree to 5=strongly agree. When evaluating the internal reliability for the 10-item STEM Career Motivation scale, results indicated that the alpha for the total scale was $\alpha=0.50$, with those choosing a STEM based career being $\alpha=0.89$ and those choosing a non-STEM based career being $\alpha=0.76$.

Laanan-Transfer Students' Questionnaire (LTSQ). This is a 50-item scale developed to assess students' experiences with eight subscales related to student experiences using a 4-point Likert type scale [9]. When evaluating the internal reliability for the 50-item LTSQ, results indicated that the alpha for the total scale was α= 0.88, with alphas for the following subscales: perceptions of faculty (α=0.8), course learnings (α=0.77), experiences with academic counseling (α=0.75), satisfaction with the university (α=0.78), competition and survival culture (α=0.5), psychological adjustment (α=0.62), academic adjustment (α=0.59), and social adjustment (α=0.27).

Semi-Structured Interviews. Participants who expressed interest were contacted for a semi-structured interview in which they shared more information about their experiences as STEM majors. They were asked questions such as "what are some ways that you've felt supported while you've been in school?" and "who are your role models and how important have these relationships been?" Data from these interviews were analyzed through thematic analysis.

Results

Support for STEM and College – When evaluating the level of social support that students felt from family members and friends regarding their STEM Major, participants reported a moderate amount of support from family (M=3.74, SD=1.15, n=188, range=0 – 5) as well as a moderate (although slightly less) amount of support from their friends (M=3.46, SD=1.24, n=188, range=0 – 5). Descriptive statistics are provided in Table 2. There were no significant correlations between variables of interest (Sex, Ethnicity, and STEM Major Status) and support from friends or family members (r's range= –0.11 – 0.12). Correlations between

variables of interest and other measures are shown in Table 3. There was a significant positive correlation of moderate size between friend support for STEM and family support for STEM (r=0.44, p=0.000, n=187) whereby those who reported more family support for STEM also had reported more friend support for STEM. Correlations between measures are shown in Table 4.

STEM Career Motivation – When evaluating the amount of motivation students felt while working towards a STEM career, students reported high career motivation (M=1.99, SD=1.42, n=184, range= -3 – 3). Descriptive statistics are shown in Table 2. Significant correlations between variables of interest (Sex, Ethnicity, and STEM Major Status) and STEM Career motivation were observed. A negative correlation between Sex and STEM Career Motivation (r=-0.22, p=0.003) indicated females reported less STEM career motivation. A positive correlation was also observed between STEM major status and STEM Career Motivation (r=0.54, p=0.000) indicating that STEM majors reported more STEM career motivation than non-STEM majors. Correlations for variables of interest and other measures are shown in Table 3. There was a small although significant negative correlation found between STEM career motivation and feelings of competitiveness within classes (r= -0.19, p=0.02, n=146) whereby those who reported feeling classes were competitive reported less STEM career motivation. Correlations between measures are shown in Table 4.

LTSQ Faculty - There were no significant correlations between variables of interest (Sex, Ethnicity, and STEM Major Status) and mean LTSQ score with faculty relationships (r's range= –0.007 – 0.07). Correlations for variables of interest and other measures are shown in Table 3. However, when examining the correlations between the variables of interest and the

individual items that make up the faculty relationship measure, a significant negative correlation was found between sex and students reporting having "*visited with faculty members and sought their advice on class projects such as writing assignments and research papers"* (r=-0.19, p=0.02) whereby females were less likely to visit with faculty and seek advice. Additionally, there was a significant positive correlation between STEM major status and "*talked to faculty members"* whereby STEM majors were more likely to report talking to faculty than non-STEM majors. Similarly, there was a significant positive correlation between STEM major status and "*Asked my instructor for comment and criticisms of my work"* (r=0.19, p=0.02) whereby STEM majors were more likely to report asking for feedback on their work than non-STEM majors. Lastly, there was a significant negative correlation between STEM major status and "*Faculty tend to be more interested in their research than spending time with undergraduates"* (r=-0.16, p=0.05) whereby STEM majors were less likely to feel that faculty were interested in spending time with undergraduates. Additionally, several moderate correlations were observed between the relationship with faculty and course learning (r=0.45, p=0.000, n=152), seeking academic counseling (r=0.40, p=0.000, n=150), university appraisal (r=0.31, p=0.000, n=148), and social adjustment (r=0.39, p=0.000, n=145) whereby those who reported greater relationships with faculty also reported greater classroom leaning, greater utilization of academic counseling, greater university appraisal and better social adjustment. Correlations between measures are shown in Table 4.

LTSQ Courses - There were no significant correlations between variables of interest (Sex, Ethnicity, and STEM Major Status) and mean LTSQ score with courses (r's range=-0.10 – 0.09). Correlations for variables of interest and other measures are shown in Table 3. However,

when examining the correlations between the variables of interest and the individual items the make up the courses measure, significant positive correlations were found between sex and students reporting that they "*Took detailed notes in class"* (r=0.25, p=0.002) and "*made outlines from class notes or readings"* (r=0.28, p=0.00) with females being more likely to report having taken detailed notes and made outlines. However, significant negative correlations were observed between sex and "*Tried to see how different facts and ideas fit together"* (r=-0.22, p=0.01) and "*thought about the practical applications of the material"* (r=-0.18, p=0.03) indicating females were less likely to engage with those practices. Lastly, a positive correlation was observed between Ethnicity and "*Participated in class discussions*" (r=0.16, p=0.05) whereby white students were more likely to report that they participate in class discussions than did ethnic minority students. Additionally, when examining mean level course learning and other measures there were small to moderate positive correlations observed for academic counseling (r=0.34, p=0.000, n=149), university appraisal (r=0.23, p=0.005, n=147), and social adjustment (r=0.21, p=0.012, n=144) whereby those who reported higher course learning scores were more likely to seek academic counseling, have higher university appraisal and better social adjustment. Correlations between measures are shown in Table 4.

LTSQ Academic Counseling - There were significant correlations between variables of interest and mean LTSQ scores of academic counseling with a significant positive correlation between sex and academic counseling (r=0.17, p=0.03) whereby female were more likely to report having used academic counseling services. Correlations between variables of interest and other measures are shown in Table 3. When examining the individual items that make up the Academic Counseling subscale, a significant positive correlation was found between sex and "*I*

talked with a counselor/advisor from my major department about what courses to take, requirements, and education plans" (r=0.198, p=0.02) whereby females were more likely to meet with a counselor/academic advisor. Additionally, small to moderate positive correlations were observed between academic counseling and university appraisal (r=0.25, p=0.002, n=148), social adjustment (r=0.33, p=0.000, n=145) and overall adjustment (r=0.30, p=0.000, n=145) whereby those who reported seeking academic counseling had higher university appraisal, and better social and overall adjustment. Correlations between measures are shown in Table 4.

LTSQ University - There were no significant correlations between variables of interest (Sex, Ethnicity, and STEM Major Status) and mean LTSQ score of university appraisal (r's range= -0.07 – -0.04) nor were there any significant correlations with any of the individual items that make up this subscale (r's range= -0.09 – 0.05). Correlations between variables of interest and other measures are shown in Table 3. A small but negative correlation was observed between university appraisal and psychological adjustment (r= -0.20, p=0.016, n=145) whereby those who reported lower university appraisal had higher levels of psychological adjustment. Interestingly, there was a moderate positive correlation between university appraisal and social adjustment (r=0.30, p=0.000, n=145) whereby those who reported higher university appraisal had better social adjustment. Correlations between measures are shown in Table 4.

LTSQ Competition- There were significant correlations observed between sex and mean LSTQ score with feeling of competitiveness (r=0.20, p=0.02, n=148) whereby females were more likely to report feeling their STEM courses were competitive. However, a negative correlation was observed between STEM major status and mean LSTQ score class appraisal (r=-

0.17, p=0.05, n=147) whereby STEM majors were less likely to report feeling their courses were competitive than non-STEM majors. Correlations for variables of interest and other measures are shown in Table 3. When examining the individual items that make up the class appraisal subscale, a significant positive correlation was found between sex and "*There is a competitive nature among students in STEM majors."* (r=0.21, p=0.01) whereby females were more likely to report feelings of competitiveness than were males. Additionally, there was a significant negative correlation between STEM major status and "*Many students feel like they do not 'fit in' on this campus"* (r=-0.23, p=0.006) whereby STEM majors were less likely to feel like they don't "fit in" on campus. Additionally, moderate positive correlations were observed between feelings of competitiveness and psychological adjustment (r=0.31, p=0.000, n=145), academic adjustment (r=0.29, p=0.000, n=145), and overall adjustment (r=0.34, p=0.000, n=145) whereby those who reported feeling that their classes were competitive showed better psychological, academic and overall adjustment. Correlations between measures are shown in Table 4.

LTSQ Adjustment – There were no significant correlations observed between the variables of interest and the mean ratings of psychological adjustment (r's range = -0.11 – 0.10), social adjustment (r's range= -0.02 – 0.07), or overall adjustment (r's range = -0.15 – 0.11). Correlations for variables of interest and other measures are shown in Table 3. However, a significant negative correlation between mean LTSQ score of academic adjustment and Ethnicity (r=-0.21, p=0.01) was observed whereby white individuals reported less problems with academic adjustment than students of ethnic minorities. When evaluating the individual items that make up the psychological adjustment subscale, a significant negative correlation was observed between STEM major status and "*The large class sizes intimidate me.*" (r=-0.22, p=0.007) whereby

STEM students were less likely to be intimidated by large class sizes than non-STEM students. When evaluating the individual items that make up the social adjustment subscale, a significant negative correlation was observed between STEM major status and "*Adjustment to the social environment has been difficult"* (r=-0.19, p=0.02) whereby STEM majors were less likely to have trouble adjusting to the social environment than non-STEM majors. Lastly, when evaluating the individual items that make up the academic adjustment subscale, a significant negative correlation was observed between ethnicity and "*Adjusting to the academic standards or expectations has been difficult"* (r=-0.19, p=0.03) whereby white individuals were less likely to report difficulty adjusting to the academic standards when compared to ethnic minority students. Unsurprisingly, the mean level psychological, academic and social adjustment measures were significantly and highly correlated with overall adjustment (r's range= 0.46-0.75). Interestingly however, there was a moderately sized positive correlation observed between psychological adjustment and academic adjustment (r=0.30, p=0.000, n=145) whereby those who reported higher levels of psychological adjustment also reported higher scores of academic adjustments.

Qualitative Interviews – Upon completing the online survey, participants were asked if they would be interested in providing additional information about their experiences in a qualitative interview. A total of 20 students participated in qualitative feedback (7 individual interviews & 5 focus groups). Demographics for participants in providing qualitative feedback included 8 women and 12 men with an average age of 20.90 (SD=2.85) and were 55% Latinx, 35% white, and 10% other. Using thematic analysis, four major themes emerged in relation to student-faculty relationships. When asked about their experiences, participants reported that they

felt more connected to faculty who were 1) accessible and approachable, 2) supportive of their academic pursuits, 3) could be perceived as role models, and 4) were knowledgeable about their field. The first theme emphasizes that students felt connected to faculty who they felt comfortable approaching with any questions or concerns and who they knew they could access outside of class (e.g., through email and office hours). The second theme focuses on the idea that students felt a connection with faculty members who were supportive of their academic endeavors and wanted to contribute to their success. The third theme emphasized that many students perceived faculty members as role models for their STEM education and future careers. Lastly, the fourth theme focused on the idea that students felt connected to faculty who possessed knowledge about their field and could offer them resources when they were unable to answer their questions.

Discussion

Over the past several decades, research has sought to identify key factors that contribute to the underrepresentation of women and racial minorities among STEM fields. Several areas of support including family expectations, self-perceptions of capabilities, and experiences with faculty have been linked to the persistence of minority groups within STEM fields [5]. On the other hand, factors such as math anxiety and insufficient skills and efficacy have been identified as barriers for STEM recruitment and retention of these groups [6]. The purpose of this study was to contribute to this research by examining the relationships among these components and differences in major, gender, and minority status.

Overall, students, particularly STEM majors, reported high motivation toward STEM careers. This sample was highly stem major concentrated so it would be expected that they would have high levels of STEM motivation. When asked about social support regarding their STEM major, students reported moderate levels of support from their family members and slightly less (although still moderate) levels of support from their friends. The findings regarding family STEM support were consistent with prior literature which has demonstrated that family support can be influential to the likelihood of success in the STEM field [5]. The finding regarding friend support for STEM expands the body of research regarding social support and success in STEM as few studies have examined the role of friend support. While there were minimal findings when comparing variables of interest (Sex, Ethnicity, and STEM Major Status) and mean LTSQ scores, there were significant correlations among individual items within the subscales.

When observing gender differences among LTSQ measures, results indicated that females were less likely to visit with faculty and seek advice but were more likely to report having used academic counseling services. It is important to consider the variety of models that universities employ for academic counseling services when interpreting this finding. The model employed at the university where this data was collected consists of all freshmen being advised by the freshman college, while all sophomore and higher-level students are advised by faculty members within the department of their major. This gives students within the university the opportunity to have one on one discussions with a faculty member about their academic aspirations. It is possible that females feel more comfortable asking questions and seeking advice with a faculty member in the less threating atmosphere of an office setting than in a larger classroom setting. It is also possible that universities that utilize different academic counseling

models may not find similar results. When asked about their coursework, females were more likely to report having taken detailed notes and made outlines, however, they were less likely to report having thought about practical applications of the material, such as the ways in which different facts and ideas fit together. Regarding the perceived competitiveness about their STEM courses, females were more likely to report feeling that their courses were competitive. This has important implications for future success and persistence in STEM fields. In a 2020 policy paper, Sandra McNally describes key factors that impact gender differences observed in STEM fields [11]. McNally details several studies which have demonstrated that women are less likely to apply for jobs in a highly competitive arena even though their confidence levels are similar to that of males [11]. Additionally, this paper details prior work which has demonstrated that feelings of competition are a significant factor for many women to change to a humanities degree [11]. As for differences among ethnicity, results indicated that ethnic minorities were more likely to report problems of academic adjustment, specifically related to academic standards and expectations. Additionally, ethnic minorities were less likely to report that they participated in class discussions as compared to white students.

When examining the correlation between measures used in this study, several interesting correlations were observed. Participants who reported having more friend support for STEM also reported higher university appraisal and overall better social adjustment into college. It is possible that the social support being offered from friends is beneficial to students' social adjustment when entering college and can have impacts to the overall appraisal of the university in which they are enrolled. This finding is supportive of previous research which suggests that successful STEM students often report having additional social support from friends and family

[5]. Also, a small negative correlation was observed between STEM career motivation and feelings of courses being competitive. This indicates that students who are highly motivated to stay in the STEM field may be less impacted by the competitive nature of STEM courses. This finding supports the results of previous research investigating the factors that seem impactful to STEM student success in that those students who are successful must be motivated to persevere through difficult learning experiences [5].

Findings particularly relevant to this study were the positive correlations found between faculty relationships and course lessons, seeking academic counseling, university appraisal and social adjustment. Those who reported greater relationships with faculty members were more likely to have better class experiences such as taking and applying detailed notes, doing additional readings and research and actively engaging with the class. Similarly, those with better faculty relationships were more likely to utilize academic counseling services to plan for future courses and degree requirements. Those with greater faculty relationships also had greater appraisal scores of the university overall and were better socially adjusted to college life than those who did not have good relationships with faculty members. Specifically, students reported better relationships with faculty who were accessible, supportive, and knowledgeable about their field. These findings support previous literature detailing the impact faculty members have on college students' success [5, 6].

Findings from the qualitative interviews expand upon many of the quantitative findings described thus far, particularly the role that faculty play in the motivation and success of STEM students. Through thematic analysis, four themes highlighted that students felt most connected to

faculty who were: 1) accessible and approachable, 2) supportive of academic pursuits, 3) perceived as role models, and 4) knowledgeable about their field. Two students provided feedback to support their connection to faculty who were accessible and approachable saying: “Well, right now, what I really like now that I've gotten to know more of my professors is the fact that *they're so approachable and not only that, but you can actually contribute to the conversations you're having with them*. You meet them outside of class and you ask them questions and you understand." (Sibley (21M), Biology) and “I think because it is really close knit, *[the professors] get to know us and we get to know them*. And so that really helps as far as it doesn't feel like asking a complete stranger for help if I need something or if I'm having trouble. I know that I can reach out to people." (Hinata (21F), Physics).

Other students provided feedback that supported the theme that students feel connected to faculty who are supportive of their academic pursuits saying: “her support is incredible. And the fact that *she wants to know what I'm talking about, she has more questions*. She'll do her own research and get back to me too sometimes. So I think that is a really convenient relationship that we found with each other." (Ulric (23F), Biology) and “Like they are your professor, but at the end of the day, but they really do want to get to know you and *they want you to succeed, and they want to be a part of your success*." (Misa (18F), Biology).

Students participating in the qualitative interviews also provided feedback to support the theme that students felt connected to faculty who were perceived as role models saying: "I'd say [professor] is a really good role model. *Just her whole story of you know, coming from abroad and being a woman in the industry*, like at a time when that really wasn't prevalent .... you know

she took that leap and kept on climbing and she is where she is now.... that's really impressive that it's just her doing that" (Valaree (22M), Computer Science) and “It's stories like that. you hear these stories and you're like, wow, *you are teaching me. You did this. And you did all of this and you're still doing more. that's what I'm gonna do.*" (Sibley (21M), Biology).

Students also provided feedback supporting the theme that students felt connected to faculty who were knowledgeable about their field saying: "If you just reach out to one professor, *they will be more than willing to either help you themselves or point you in the right direction to someone who can.*“ (Misa (18F), Biology) and "I was able to kind of expand my professors and through them they would share their knowledge of like kind of how they perceived their route. So it's kind of give you an idea of how to pursue my route." (Anitra (21M), Computer Science).

Significant positive correlations were observed between course learnings and utilization of academic counseling, university appraisal, and social adjustment whereby those students who reported higher course learning (e.g. taking detailed notes, applying materials outside of class, engaging with class discussions) were more likely to report utilization of academic counseling services, greater university appraisal, and better social adjustment into the college learning environment. It is possible that the students who have higher self-efficacy within the academic setting (i.e. faith in ones abilities to perform actions needed to achieve desired outcomes) [10] are more likely to engage with course learnings and transfer those skills to other university services such as academic counseling, or student organizations which in turn can impact overall university appraisal and social adjustment. Similarly, positive correlations were observed between utilization of academic counseling and university appraisal, social adjustment and

overall adjustment. Those who reported utilizing academic counseling services were more likely to report higher university appraisal and better social and overall adjustment into the college learning environment. It is possible that academic advising can be used as a tool to help ease the transition into the college learning environment and provide positive benefits to social and overall adjustment to the student while also enhancing the student's overall appraisal of the university.

Another area of interest which was explored in this study was how feelings of competitiveness within the classroom are associated with adjustment to the college learning environment. Positive correlations were observed between feelings of competitiveness and psychological, academic, and overall adjustment indicating that feelings of competitiveness within the classroom seemed to boost psychological, academic and overall adjustment but did not impact social adjustment. These findings suggest that competition may be a useful tool to explore for STEM student success. It is possible that feelings of "friendly or healthy competition" within the classroom may be a beneficial tool to help increase students psychological and academic adjustment as they learn to use competition to expand their critical thinking skills. However, it is also possible that "aggressive or hostile" competitiveness within the classroom could lead to disengagement and loss of motivation to utilize critical thinking skills.

This study has several limitations that must be considered. Given this sample is limited and only reflects the student experiences from one medium sized university in West Texas, these findings may not be representative of student experiences of a larger sample from other areas of

the country. Further, as many of the participants were early in their academic careers, their experiences may not reflect those who are farther along in their STEM studies. Due to the cross-sectional nature of this study, retention rates of participants within STEM majors were not measured. One of the individuals who participated in the focus groups started college as a STEM major but changed their major to history. This student provided feedback about their experiences after changing majors saying: "I've definitely felt more supported in the history department. Maybe it's because of the fact that I was in like the early stages of stem when I was like there.... it was a lot less personal with the professors. Science in general I feel is kind of intimidating, especially if you're not doing like amazing in a class, it can be very hard to talk to that kind of professor because they may seem a little more harsh when really, they're just like more blunt or like straight to the point. Here's what you need to know, things and history professors in my experience have just been more, um, Kind of like warm and like easier to approach." (Herta (21F), History). Further research is needed to capture a more diverse population of student experiences over time to support the generalizability of these findings. While this study does have limitations, it also provides avenues for future research.

With the time remaining on the current grant, investigators plan to target students who have left the STEM fields for other majors and gather more qualitative data. By interviewing students who have left STEM majors, the investigators hope to have a better understanding of the specific diversion points that cause students to leave the STEM fields. What's more, the investigators will also be surveying rural adults to better understand a community member's perspective of STEM fields. The findings from this study have also been used to develop an NSF Training Grant which intends to develop training materials for faculty in STEM fields to help

enhance classroom engagement and mentorship type models within STEM classrooms. The developed training program will improve the way STEM faculty engage with their students, through addressing how faculty can improve engagement with their students, using a lens of intersectionality. The successful development of a faculty leadership and classroom engagement training program will inform interventions for other institutions, through sharing training content and implementation plans, which will result in improved connection between faculty and students across universities. Ultimately, the results of the proposed project will work to increase students' retention and graduation rates from similar cultural, social, and financial localities. Additionally, the findings from this study provide many areas that need further exploration such as the impact that feelings of competition have on students in the STEM field, how academic counseling may be a useful tool for student success and retention, and how the psychological, academic, and social adjustment to the college learning experience may impact STEM student success.

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Table 1: Demographic Descriptive Statistics

	N	Percent of Sample
Sex by Ethnicity		
Male		
Ethnic Minority	50	45.5
White	60	54.5
Female		
Ethnic Minority	52	48.1
White	56	51.9
Sex by STEM Major		
Male		
Non-STEM	8	7.3
STEM	102	92.7
Female		
Non-STEM	32	28.8
STEM	79	71.2
STEM Major by Ethnicity		
Non-STEM		
Ethnic Minority	16	41
White	23	59
STEM		
Ethnic Minority	86	48.3
White	92	51.7

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	222	18	53	20.45	3.74
Sex	222	1	2	1.51	0.5
Family STEM Support	188	0	5	3.74	1.15
Friend STEM Support	188	0	5	3.46	1.24
STEM Career Motivation	184	-3	3	1.99	1.42
LTSQ Faculty	159	0.14	2.93	1.69	0.46
LTSQ Courses	152	0.56	3	2.27	0.45
LTSQ Academic Counseling	150	0	3	1.19	0.6
LTSQ University	148	0	3	2.3	0.59
LTSQ Competition	148	0.25	3	1.64	0.5
LTSQ Psychological Adjustment	145	0	2.5	0.88	0.56
LTSQ Academic Adjustment	145	0	3	1.59	0.71
LTSQ Social Adjustment	145	0	2.75	1.59	0.51
LTSQ Overall Adjustment	145	0.08	2.36	1.35	0.38

Table Notes: Sex (male=1, female=2), White (no=0, yes=1), LTSQ = Laanan-Transfer Students' Questionnaire

Table 3: Correlations with Variables of Interest

	Sex	White	STEM Major
Sex	1	-	-
White	-0.27	1	-
STEM Major	-0.28**	-0.06	1
Family STEM Support	-0.11	0.03	0.12
Friend STEM Support	0.12	-0.1	0.11
STEM Career Motivation	-0.22**	-0.14	0.54**
LTSQ Faculty	-0.01	-0.05	0.07
LTSQ Courses	0.06	0.09	-0.1
LTSQ Academic Counseling	0.17*	-0.14	-0.09
LTSQ University	-0.07	-0.05	-0.04
LTSQ Competition	0.20*	0.05	-0.17*
LTSQ Psychological Adjustment	0.1	-0.04	-0.11
LTSQ Academic Adjustment	0.05	-0.21*	0.05
LTSQ Social Adjustment	0.07	-0.02	0.02
LTSQ Overall Adjustment	0.11	-0.15	-0.01

Table Notes: Sex (male=1, female=2), White (no=0, yes=1), LTSQ = Laanan-Transfer Students' Questionnaire, **=significant at the 0.01 level, *=significant at the 0.05 level

Table 4: Correlations of Social Support and Laanan-Transfer Students' Questionnaire

	1	2	3	4	5	6	7	8	9	10	11	12
STEM Support												
1. Family	1	-	-	-	-	-	-	-	-	-	-	-
2. Friend	**0.44**	1	-	-	-	-	-	-	-	-	-	-
3. STEM Motivation	0.12	0.12	1	-	-	-	-	-	-	-	-	-
LTSQ												
4. Faculty	-0.88	0.13	0.10	1	-	-	-	-	-	-	-	-
5. Courses	-0.04	0.08	0.02	**0.45**	1	-	-	-	-	-	-	-
6. Academic Counseling	0.08	0.15	-0.16	**0.40**	**0.34**	1	-	-	-	-	-	-
7. University	0.15	**0.25**	0.11	**0.31**	**0.23**	**0.25**	1	-	-	-	-	-
8. Competition	-0.05	0.07	*-0.19*	0.02	0.02	0.05	-0.13	1	-	-	-	-
9. Psych. Adjustment	-0.03	-0.06	-0.07	-0.10	-0.12	0.13	*-0.20*	**0.31**	1	-	-	-
10. Academic Adjustment	-0.09	-0.01	-0.02	-0.38	0.02	0.15	-0.09	**0.29**	**0.30**	1	-	-
11. Social Adjustment	0.07	**0.23**	0.03	**0.39**	*0.21*	**0.33**	**0.30**	0.02	0.54	-0.02	1	-
12. Overall Adjustment	-0.04	0.06	-0.04	0.10	0.05	**0.30**	-0.02	**0.34**	**0.69**	**0.75**	**0.46**	1

Table Notes: LTSQ=Laanan-Transfer Students' Questionnaire, Bold = Significant at the 0.01 level, Italics=Significant at the 0.05 level