THE INFLUENCE OF STEM MENTOR RACE AND CULTURAL COMPETENCY ON RACIAL AND ETHNIC MINORITY MENTEES

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THE INFLUENCE OF STEM MENTOR RACE AND CULTURAL COMPETANCY ON RACIAL AND ETHNIC MINORITY MENTEES

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Abstract: Although the number of racial and ethnic minorities (REM) in science technology, engineering, and mathematics (STEM) fields have been gradually increasing, REM continue to be underrepresented in both STEM education and workforces (National Science Foundation, n.d.). One way to increase representation is through mentorship which is correlated with both self-efficacy and sense of belonging (Chemers et al., 2001, Choi, 2005, Feldman et al., 2010, Giblin & Lakey, 2010, Wood et al., 2015). However, discounting of their race and ethnicity by mentors can lead to lower sense of belonging (Byars-Winston, 2019, National Academies of Science, Engineering, and Medicines, 2019, Schwartz, 2016). While it may be helpful to pair students with mentors of the same race it may overwhelm existing REM STEM professionals (Byars-Winston, et al., 2019, Castellanos, et al., 2016). I examined the influence of mentors' perceived race/ethnicity and perceived cultural competency on REM STEM students in a research mentorship program (N= 99) in a south-central state on their science self-efficacy and sense of belonging in STEM. Students completed an online survey which included: a question about their mentor's race/ethnicity, an adapted Psychological Sense of School Membership Scale (Goodenow, 1993, Jackson, 2016), the Science Self-Efficacy Scale (Chemers et al., 2011), Cultural Congruity Scale (Gloria & Robinson-Kurpius) and Diversity Subscale of the Mentoring Competency Scale (Fleming et al.,2013). Students with same race mentors had higher science self-efficacy ($F(1, 97) = 4.75$, $p = .032$), cultural congruity ($F 1, 97) = 4.817$, $p = .031$) and higher ratings of their mentors' competence in handling diversity ($F(1, 97) = 4.751$, $p = .032$). Participants' science self-efficacy was positively correlated with mentors' competency in handling diversity ($r(97) = .0175$, $p = .043$), cultural congruity scale scores ($r(97) = .42$, $p = .027$) and Psychological Sense of School Membership scores for the general program ($r(97) = .4$, $p < .001$) and their specific research lab ($r(64) = .56$, $p < .001$). I conclude that while having a mentor of the same race can positively influence REM students, mentees can have similar positive effects when their mentor is competent in handling diversity.

TABLE OF CONTENTS

Chapter Page

I. INTRODUCTION 1

Summary of the Problem 2
Purpose of the Study 5

II. METHODS 8

Participants 8
Procedure 9
Measures/Instruments 10

III. RESULTS 18

Additional Analysis 19
Exploratory Questions 19

IV. DISCUSSION 22

Limitations of Study 24
Strengths of Study 26

V. CONCLUSION 27

REFERENCES 29

APPENDICES 35

CHAPTER I

INTRODUCTION

According to the National Science Foundation (n.d.), racial minority groups, including Black, Latinx and American Indian or Alaska Natives, are underrepresented in science and engineering fields. Although the numbers of those from underrepresented racial minorities (REM) have increased gradually in science, technology, engineering, and mathematics (STEM) degrees, they continue to be underrepresented in both educational attainment and in the STEM workforces (National Science Foundation, n.d.). Additionally, of those employed full time in science and engineering fields 70% are white (National Science Foundation, n.d.). Because of the low numbers of REM individuals within STEM, there has been a push for increasing the numbers of REM individuals in STEM. The National Academies of Science, Engineering, and Medicine (2019) reported that increased numbers of REM individuals in STEM fields helps fulfill the current need for more STEM trained individuals and helps increase diverse perspectives within the fields.

Mentorship is one potential way to further encourage REM individuals to be involved in STEM fields. Mentorship can provide students with several benefits including psychological and social development, increased self-efficacy, positive perceived job satisfaction, increased self-confidence, career advancement, an improved sense of belonging, and the development of a professional identity (Carroll & Barnes, 2015, Feldman et al., 2010, Giblin & Lakey, 2010, Shin et al., 2017). Within STEM fields mentorship in research can provide students with the opportunity to practice their research skills and better learn what it means to be a scientist (Carpi, et al. 2017). These positive aspects of mentorship suggest that it would be beneficial to involve students from REMs in STEM mentorship, however for these students there are several complicating factors.

Many of the professionals within STEM who could act as mentors for REM STEM students are themselves not REMs. Due to this, they are more able to ignore the influences of race and ethnicity that REM students may face. This can then lead to REM mentees feeling as though their experiences are minimized and considered unimportant to their mentor (Byars-Winston, et al., 2019). One potential solution would be to pair REM mentees with REM mentors, however due to the low number of REM professionals in STEM, pairing every REM student with a REM mentor would be difficult and impractical. Due to the benefits of mentorship and the lack of availability for REM mentors, it is important to determine ways in which white mentors may best work with REM mentees.

Summary of the Problem

There is currently a growing need for individuals trained in science, technology, engineering, and mathematics (STEM) in the workforce. Additionally, researchers from the

National Academies of Science, Engineering and Medicine (2019) reported that increasing diversity within STEM workplaces helps to both broaden the available talent pool and bring diverse perspectives surrounding the challenges STEM professionals face. Additionally, diversity within the STEM workplace also helps improve research quality and health care, work performance and engagement, and helps encourage innovation and growth. Although progress has been made, as of 2017, members of three racial and ethnic groups, "African American, Latinx, and American Indians or Alaska Native continue to be underrepresented within STEM education and the STEM workforces with the underrepresented being even more pronounced in graduate level work" (The National Academies of Science, Engineering, and Medicine, 2019 p. 53).

One potential way to increase the numbers of REM students within STEM fields is through mentorship. Researchers have defined mentorship in a variety of ways; however, the majority define mentors as people who are more experienced in a field providing practical and emotional support and advice to individuals with less experience in the field for an extended period of time (McCoy et al., 2015). Students who are mentored gained a variety of benefits in the realms of both psychological and social development, including self-efficacy (Carroll & Barnes, 2015). However, in spite of the benefits of mentorship for REM students in STEM there are also several complicating factors which make beneficial mentorship more difficult to obtain for these students. These complications include mentors who do not acknowledge the cultural and racial differences between themselves and their mentees and the experience of microaggressions from their mentor and others within their field (Byars-Winston et al. 2019). I am guided in this research by two theories, critical race theory, specifically the concept of

colorblindness (Manning et al., 2015) and social cognitive career theory with the concept of self-efficacy (Brown, et al., 2013,Baier, 2016, Chen et al., 2001).

The idea of colorblindness within critical race theory is the belief that America is a post-racial society in which one's success or failure is based on their merit and not their racial identity (Manning et al., 2015. This then led to the belief that individual's race should not be considered when making decisions about them (Manning et al., 2015). While this concept may appear race neutral, it instead can work to obscure actual racial inequality through not allowing people to consider the differences that race and ethnicity can make in people's lives (Delgado & Stefancic,2017, Manning et al., 2015). In not acknowledging the influence race can have immediately on people's lives, colorblindness only allows individuals to critique extreme obvious acts of racism, as opposed to the more day to day subversive microaggression (Sue et al., 2008). Microaggressions are defined as brief, commonplace, "verbal, behavioral, and environmental slights and indignities" that are often automatic and unintentional (Sue, et al., 2008, p. 229). REMs are often underrepresented in STEM fields when compared to their white counterparts (National Academies of Science, Engineering, and Medicine, 2019). Critical Race Theory provides a framework for examining the experiences of these students, including microaggressions within a context where they are underrepresented minorities (National Academies of Science, Engineering, and Medicine, 2019). It also provides a language for how the behavior of their mentors may influence these students.

In addition to Critical Race Theory, I also used the framework of Social Cognitive Career Theory. Drawing from Bandura's Social Cognitive Theory (Bandura, 1994) Social Cognitive Career Theory states that individuals, their environments, and their behavior influence and are influenced by each other specifically in terms of their career choices (Brown et al., 2013,

Kessler, 2013). Specifically, this study concerns itself with the Social Cognitive Career Theory principle of self-efficacy and individual's judgement of their ability to complete a specific course of action (Baier,2016, Brown, et al., 2013, Brown, 2019, Chen et al., 2001). One-way self-efficacy is developed is through seeing individuals who appear similar to them modeling success in the behavior (Bandura, 1994, Brown, et al., 2013, Kessler, 2013). Mentoring relationships are one way of providing modeling for students and improving their self-efficacy. Thus, Social Cognitive Career Theory provides a means of understanding how race of mentors may influence students' self-efficacy which is a focus of my study.

Purpose of the Study

My purpose in this study is to determine the relationship between the perceived race and cultural competence of their mentors by REM STEM students and the level of REM STEM students' self-efficacy and sense of belonging.

Research Questions

In this thesis, I examined the following research questions.

RQ1: How does the perceived race/ethnicity of research mentors of underrepresented minorities (REMs) STEM majors influence REM mentees' self-efficacy in STEM and sense of belonging?

RQ2: How do REM STEM students' perception of their mentors' cultural competency in mentoring influence REM mentees' self-efficacy in STEM and sense of belonging?

Definitions

For this study, I operationally defined the constructs of Perceived Racial and Ethnic Minority (REM) mentors, self-efficacy, sense of belonging, and mentor's cultural competence as follows.

- Perceived REM mentors will be measured through asking students what the race of their mentor is. This will determine whether students believe their mentors to be a member of an underrepresented racial minority or not.
- Self-efficacy is defined as an individual's belief in their ability to achieve things in general and specifically in this study in STEM. Self-efficacy was measured through the STEM Self-efficacy Scale (Chemers et al., 2011).
- Sense of belonging is defined as an individual's belief that they belong within a group or organization. This study determined student's belief that they belong within their laboratory and university. It was measured using the Perceived Sense of School Membership Scale (Goodenow, 1993, Jackson, 2016).
- Mentor's cultural competence is defined as mentor's ability to create a cultural congruent experience for their students as measured by the Cultural Congruity Scale (Gloria & Robinson-Kurpius, 1996) and the Diversity subscale of the Mentoring Competency Assessment (Fleming et al., 2013).

Hypotheses

Based upon exploration of previous literature, my hypotheses for this study were:

Hypothesis 1a**:** Students with perceived REM mentors will have higher self-efficacy than students with mentors who are not REMs.

Hypothesis 1b**:** Students with mentors of the same perceived race/ethnicity as them will have a higher sense of belonging than students with mentors of a different perceived race/ethnicity.

Hypothesis 2a**:** There will be a positive correlation between mentor's perceived cultural competency in mentoring and student's self-efficacy in STEM.

Hypothesis 2b**:** There will be a positive correlation between mentor's perceived cultural competency in mentoring and student's sense of belonging

CHAPTER II

METHODS

Participants

Participants were recruited from the Oklahoma Louis Stokes Alliance for Minority Participation (OK-LSAMP). OK-LSAMP is a program designed for Oklahoma undergraduate college students from underrepresented racial and ethnic minority (REM) groups, including African American, Hispanic, Native American, Native Hawaiian, or Pacific Islander students who are involved in STEM disciplines. OK-LSAMP is an alliance consisting of ten colleges or universities within Oklahoma and is a member of the national Louis Stokes Alliance for Minority Participation. OK-LSAMP is funded by the National Science Foundation and began in 1994. Within this program, students complete research activities under the guidance of a faculty mentor and receive other support from the program (Oklahoma Louis Stokes Alliance for Minority Participation, 2019). At the time of data collection, fall semester 2020, there were 319 students involved in OKLSAMP across the state of Oklahoma. An a priori power analysis was completed

showing that for a strong of 0.4, a sample of 84 was needed and for a medium effect size of 0.25, 210 participants were need (Faul et al., 2009).

Procedure

Protection of Human Subjects

Participants were recruited via the annual program survey given to students involved in OK-LSAMP. At the end of the OKLSAMP program survey, students were directed to a separate survey with a separate consent form which was approved by the Oklahoma State University Institutional Review Board for the Protection of Human Subjects through which they were given written information about the study. This information included that it would take about 15 minutes, that their information from the previous survey would only be used to connect their answers to their demographics, and that the knowledge gained through this research may be able to help the experiences of undergraduate students in STEM.

Participants completed the survey online in Qualtrics. The survey consisted of a demographic page, a question about the ethnicity/race of their current research mentor and four questionnaires. The questionnaires included the adapted Psychological Sense of School Membership (Goodenow, 1993, Jackson, 2016), the Science Self-Efficacy scale (Chemers et al. 2011), Cultural Congruity Scale (CCS) (Gloria & Robinson-Kurpius, 1996) and the Addressing Diversity subscale of the Mentoring Competency Assessment (Fleming et al., 2013). Participants were then provided a link to a separate form in which they could put their email to be entered into a drawing to win one of five twenty-five-dollar gift cards.

Participant's names and email addresses were collected via the OK-LSAMP survey and used to match the participant's responses to the demographic information provided by OK-

LSAMP. This information was only used to match the participants to their demographic information.

Measures/Instruments

Psychological Sense of School Membership (PSSM)

The Psychological Sense of School Membership is an 18-item scale, originally created to measure the sense of belongingness in school of 6th, 7th, and 8th grade students. The PSSM scale had an internal consistency reliability, measured using Cronbach's alpha of 0.875 for suburban students in the first study and 0.884 in a study the following year. For urban students responding to the English version of the scale, PSSM had an internal consistency reliability of 0.803 and one of 0.771 for the Spanish version of the scale (Goodenow, 1993). The scale was later adapted for use in college students by Zumbrunn et al. (2014) to measure their sense of belonging within a single class. This adaptation of the scale was found to be reliable (alpha =0.90). In this revision Zumbrunn et al. edited the wording of the original scale and added two addition items: "I can talk to others if I have a problem" and "In this class, I am included in group work". Additionally, this version was also validated with Turkish college students (Alkan, 2016).

The PSSM was also used by Jackson in their dissertation to measure the sense of belonging of Black students in STEM majors. As with Zumbrunn, Jackson (2016) adapted the language of the scale to fit the setting of higher education, however Jackson specifically used language to measure student's sense of belonging within the entire university instead of the classroom and included statements specifically about the student's experience in their STEM major. The scale consists of statements such as, "I feel like a part of the university" and "Most

professors in my program are interested in my work" which students respond to with a Likert scale ranging with five choices from "Not True at All" to "Extremely True".

Additionally, after completing a principal component analysis, Jackson removed one item from the scale, this item being "As a student, there are a lot of activities that I can participate in at the university" because it did not have at least one correlation with another item above 0.30. After removing this item, Jackson found this scale to have validity and be appropriate for use. The scale was also found to have a reliability comparable to the original scale by Goodenow (1993) ($\alpha = .86$) (Jackson, 2016)

In this study, I used the adapted scale of Jackson in order to measure the sense of belonging of the students. The PSSM is appropriate for this study because it has been previously used to measure the sense of belonging in students who are members of racial and ethnic minorities. Additionally, Jackson used this scale to measure sense of belonging for students in STEM fields. This scale has also been found to have adequate validity and reliability in each of these studies. I adapted this scale in order to determine the students' experiences in their mentored research lab, in addition to their overall experience in STEM. Students who are involved in research labs will complete the first 10 items pertaining to their sense of belonging within the lab in addition to the next ten items pertaining to their sense of belonging in STEM. Students not involved in research labs will only complete the items pertaining to their sense of belonging in STEM. Items restated to include the research lab include items such as "I feel like a part of the research lab" and "In the research lab, I am treated with as much respect as my peers" using the same Likert scale as Jackson. This scale consists of twenty items, ten of which measure belonging in the research lab and ten of which measure belonging in STEM in general. The Likert scale consists of five choices ranging from "not at all true" to "extremely true". This

adaptation was necessary for this study in order to determine the students' sense of belonging within their research lab rather than their sense of belonging within the university as a whole. This scale also includes items about students' sense of belonging in their respective STEM fields with items such as "other students in my program like me the way I am" and "I feel very different from most other students in program." The Cronbach's alpha for the sample in my study was 0.814 for Psychological Sense of School Membership in their research labs and a Cronbach's alpha score of 0.867 for general Psychological Sense of School Membership.

Science Self Efficacy Scale

The Science Self Efficacy Scale is a 10-item scale with statements about students' STEM research experiences, such as "use scientific language and terminology" and "create explanations for the results of a study". Students answer on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (absolutely confident). Within the Chemers et al. study (2011), this scale had a Cronbach's alpha of 0.94 for undergraduate students and 0.95 for graduate students. The Science Self-Efficacy Scale was developed by Chemers et al. (2011) in order to measure students' confidence in their own ability to complete activities related to the STEM field. The scale was used with students from the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) who were currently in college, undergraduate, graduate students, postdoctoral fellows or graduated from university in the last 3 years. That study included participants of diverse racial and ethnic backgrounds, 50% of whom did not speak English as a first language.

This scale is appropriate for this study as it has been used with a racial and ethnic diverse set of STEM students and specifically measures the self-efficacy of students within STEM fields.

As this study was designed to determine the influence of mentors on students' self-efficacy within STEM, this scale is appropriate for use within the current study. The Cronbach's Alpha was 0.931 for the Science Self Efficacy Scale for the sample in my current study.

Cultural Congruity Scale (CCS)

The Cultural Congruity Scale (CCS) is a 13-item scale developed to measure student's perceptions of the cultural congruity or fit between their culture and that of their university. The scale consists of statements such as "I feel that I have to change myself to fit in at school" and "I try not to show the parts of me that are "ethnically" based" which individuals respond to using a Likert scale to answer the extent to which this has occurred to them ranging from "1, Not at all" to "7, A Great Deal".

The CCS was piloted with racial and ethnic minority (REM) undergraduate students at a southwestern university. This scale was validated with Chicano/a undergraduate students at the University of Irvine (UCI) and Arizona State University (ASU). The validation sample consisted of 454 students with a mean age of 21.07 years at UCI and 22.63 at ASU. The CCS Cronbach's alpha was 0.89 (Gloria & Kurpius, 1996). The CCS was also used in a study of Latino/a participants from four predominantly white institutions (PWI) in the Pacific Northwest. For the sample in this study the internal consistency reliability of the CCS was alpha = 0.86. In this study, cultural congruity was found to be one of the variables which influenced student's college GPA with a beta of 20 (Carazo & Chang, 2012).

Bordes and Arredondo (2005) also used the CCS to measure the relationship between mentorship and student's perceived comfort at a university with a sample of 112 first semester Hispanic American or Latino/a students. Cultural congruity was one of the measures used for

perceived study comfort. The alpha coefficient for their sample was 0.77 (Bordes & Arrendondo, 2005). Castellanos et al (2016) also used the CCS in a study exploring the predictive values of cultural fit, measured using the CCS, the University Environment Scale, and the cognitive dimension of mentorship on college and life satisfaction. Students were recruited from two research-focused universities, one in the Midwest and one on the West coast. The sample consisted of 88 males and 141 females with self-reported races and ethnicities of Asian American (n=70), African American (n=66), Chicano/Latino (n=48), Native American (n=12), and Multiracial (n=22). With the remaining students identifying as other or not responding. For my current study the Cronbach's alpha was 0.85. Within this study, cultural congruity acted as a predictor for college and life satisfaction with it being a more prominent predictor for life satisfaction.

This scale was appropriate for my study because it measures the cultural fit students feel within their university and program. Because the CCS has been used with students from a variety of racial and ethnic backgrounds, it fits within the purpose of this research study. This scale was used to determine how much the students feel they culturally fit in with their mentors and research labs. For the current study sample, the Cronbach's Alpha was 0.869 for the Cultural Congruity Scale.

Addressing Diversity Subscale of the Mentoring Competency Scale (MCA)

The Mentoring Competency Assessment is a 26-item skills inventory through which mentees evaluate six different competencies of their mentors. This study will use the subscale items which measure mentors' competency in addressing diversity. The MCA was originally administered to 283 mentor-mentee pairs from 16 different universities. Researchers

administered the MCA to both mentors and mentees, asking mentors to "please rate how skilled you feel you are in the following areas" and each mentee to "please rate how skilled your mentor is in the following areas". These items were responded to using a 7-point Likert scale ranging from 1 = "not at all skilled", 4 = "moderately skilled" and 7 = "extremely skilled". Mentees were also able to choose 0 for "not observed". This study will use items from the addressing diversity subscale which consists of the two following items, "taking into account the biases and prejudices s/he brings to your mentor/mentee relationship" and "working effectively with mentees whose personal background is different from his/her own (age, race, gender, class, region, culture, religion, family composition etc.".

Fleming (2013) used this instrument with a group of 283 pairs of mentors and mentees with more men participating as mentors and more women participating as mentees. Both mentors and mentees were primarily white with Hispanics consisting of the largest minority groups for both mentors and mentees. The addressing diversity items received a coefficient alpha score of 0.65 for the mentor group and 0.73 for the mentee group. While the scores for the mentor group were below an alpha coefficient of 0.7, this was expected due to the small number of items. The overall instrument received a chi square of 663.20; $df = 284$, with a $p < .001$ for mentors and a chi square score of 840.62 ($df = 284$) with a $p < .001$ for mentees. This subscale in addition to the cultural congruity scale will provide an understanding on the perceived ability of REM students' mentors' competency in addressing cultural differences. The sample in my current study had a Cronbach's Alpha of 0.652 for the Addressing Diversity Subscale of the Mentoring Competency Assessment.

Copies of all the instruments as adapted for this study are in Appendix B.

Demographics

The demographic information is part of the annual survey and OKSLAMP data bases. The demographic data available includes race/ethnicity, gender, first generation status, college year classification, and major. There was a total of 99 participants, with 64 indicating they were female, 33 male, and 2 individuals who did not report their gender. Thirty-one participants reported their primary race as African American. Thirty-three reported their primary race as American Indian. Thirty-three reported their primary race as Hispanic. Thirty-four individuals reported a secondary race. Of these individuals, one reported African American. Two individuals reported their secondary race as Hispanic. Eight reported their secondary race to be American Indian. One reported their secondary race to be Asian. Twenty-two individuals reported their secondary race to be white. Fifty-two of the participants reported being first generation. Forty-two reported not being first generation and five did not respond to this question. Six of the participants were freshmen. Twenty-nine were sophomores, thirty-one were juniors and 27 were seniors. Five participants did not report their classification. The most common major for participants was Biology with twenty-one participants reporting their major as biology. A chart with the frequency of all majors is included in Appendix C.

Perception of Research Mentor Race/Ethnicity Question

Do you perceive yourself as having a mentor of the same race/ethnicity as you?

Exploratory Questions

What kinds of support do you find you receive from your OKLSAMP mentor? (e.g., academic support, technical knowledge, social support, career knowledge)

Are you a member of any STEM-related organizations which provide you with mentorship? Please list:

If so, how is the support you receive from these organizations different from or similar to that of your OKLSAMP mentor?

What influence, if any, do you think your race/ethnicity or culture has on your experience in a STEM field?

CHAPTER III

RESULTS

Ninety-nine participants completed the survey. Sixty-two reported having mentors of a different race and 37 participants reported having mentors of the same race.

Hypothesis 1a**:** Students with perceived REM mentors will have higher self-efficacy than students with mentors who are not REMs. A one-way analysis of variance was used to determine the influence of perceived mentor race on participants' science self-efficacy, sense of belonging, cultural congruity, and mentoring competency scores. Those with mentors of the same race had significantly higher science self-efficacy scores than those with mentors of a differing race ($F(1, 97) = 4.751$, $p = .032$). Hypothesis 1a was supported.

Hypothesis 1b**:** Students with mentors of the same perceived race/ethnicity as them will have a higher sense of belonging than students with mentors of a different perceived race/ethnicity. The score for the Psychological Sense of School Membership for both general STEM and the research lab specifically were not significantly different whether students had mentors of the same or different races. Thus, Hypothesis 1 b was not supported.

Hypothesis 2a**:** There will be a positive correlation between mentor's perceived cultural competency in mentoring and student's self-efficacy in STEM. Participants' science self-efficacy scores were positively correlated with their perception of their mentor's competency in handling diversity *(*$r(97) = 0.175$, $p = .043$) and their scores on the cultural congruity scale ($r(97) = .194$, $p = .027$). Thus, Hypothesis 2a was supported.

Hypothesis 2b**:** There will be a positive correlation between mentor's perceived cultural competency in mentoring and student's sense of belonging.

Participants' scores on cultural congruity were significantly positively correlated with their scores on the psychological sense of school membership for both their general programs ($r(97)= 0.42$, $p < .001$) and for their specific research lab ($r(64) = 0.56$, $p < .001$). Participants' ratings of their mentors' competence in handling diversity were not significant. Thus, Hypothesis 2b was partially supported via one of the measures used to measure mentors' cultural competency.

Additional Analysis

Those with mentors of the same race further rated their mentor's competence in handling diversity significantly higher than those with mentors of differing races ($F(1, 97)=4.937$, $p = .029$). Students with mentors of the same race also rated the cultural congruity of their environments as significantly higher than those with mentors of a different race ($F(1, 97) = 4.817$, $p =.031$).

Exploratory Questions

For the exploratory questions, I reviewed answers for any themes.

When asked what kinds of support they received from their OKLSAMP mentor, eighty-seven participants responded. Participants reported receiving academic support, financial support, informational support, technical knowledge, and emotional support from their mentors. When asked what influence participants thought their race/ethnicity or culture has on their experiences in a STEM field, seventy-eight participants responded. Participants' responses fit into four different categories: their race/ethnicity as motivations, seeing specific expectations based on race, positive racial experiences, and a lack of visible racial minority scientists. An

example of race as motivation includes a participant stating “my race/ethnicity has served as the impetus for pursuing a career in research. As a field that lacks Black women, I want to serve as an example to those wanting to pursue a career in the research field”. Examples of participants noticing expectations based on their race include a participant stating, “I believe we have to work harder to prove ourselves as African Americans” and another student stating “Some races do not expect other races to be knowledgeable in the STEM field which results in feeling the obligation to prove one’s belonging in the field”. Examples of participants reporting positive racial experiences include participants stating, “I feel as though I have a competitive advantage as many places are trying to include more diverse individuals” and “I personally feel that it has opened more opportunities than I would have if I was not a minority”. Lastly, examples of students noticing a lack of visible racial minority scientists include students stating, “It’s rough not seeing someone that’s the same ethnicity as me or people switching majors who were” and It’s definitely harder to find minorities in STEM and being a Black male, it is often not thought of for me to be going into the STEM field”.

Forty-nine participants answered the open-ended question “Are you a member of any other organizations in STEM which provide you with mentorship? Please list:” Twenty-four participants reported being members of other STEM-related organizations which provided them with mentorship. These programs include the McNair Scholars program, the American Chemical Society, the MPS Entomology Scholars program, chemistry club and physics club, the American Indian Science and Engineering Society, the Minorities in Agriculture Natural Resources and Related Sciences, the Society for Advancement of Chicanos/Hispanics and Native Americans in Science, HOSA-Future Health Professionals, Construction Management Society, Society of Hispanics Professional Engineers, Pre-Med Clubs, Science Research Institute, K-INBRE,

Minorities in Medicine, National Society for Black Engineers, Native American Student Association, Phi Delta Theta, Lawrence Berkeley National Lab, and the LU Biology Club.

Thirty-four students answered the open-ended question "if so, how is the mentorship from these organizations different from that of your OK-LSAMP mentor?" Students reported that both their involvement with OKLSAMP and other STEM organization were similar and helpful, however other participants reported some differences. One theme that occurred in responses to these questions was that OKLSAMP was more focused on research and provided funding for that research and student experiences as opposed to other programs participants were involved in. Participants also reported that OKLSAMP provided more structured mentorship in which their mentor was easier to talk to as opposed to some other programs which were more "hands off". Participants also stated that their mentorship from other organizations were also often more personalized to their specific race or ethnicities and STEM major, as opposed to OKLSAMP which is more generally targeted toward REMS in STEM. Students further reported being involved in STEM organization which were open to all students, not just REMS and ones in which they had more one on one time with their mentors.

smaller group, different faculty. Participants stated that they were able to take part in different types of research in different organizations and that they were given different opportunities to expand professionally. Participants described organizations they were involved in as provided more meetings with alumni and more campus events for them to take part in.

CHAPTER IV

DISCUSSION

Mentorship is one of the primary ways of providing STEM knowledge and belonging to incoming undergraduate STEM students, however students from racial and ethnic minority groups often face additional challenges through mentors who are not able to appropriately handle racial and cultural differences these mentees bring (Byars-Winston, et al., 2019). Previous researchers found that having mentors of the same race is correlated with positive outcomes for students from racial and ethnic minorities and may be a possible way to improve outcomes for these students (Byars-Winston, et al., 2019, Castellonos et al., 2019**).** I hypothesized that students with mentors of the same perceived race would have a higher self-efficacy and sense of belonging. Results partially supported this hypothesis with students with mentors of the same perceived race reporting higher self-efficacy scores. However, the perceived race of mentors had no significant effect on students' sense of belonging.

I also hypothesized that students' rating of their mentors' competency in handling diversity would be positively correlated with their science self-efficacy and sense of belonging. This hypothesis was partially supported. Student's science self-efficacy was positively correlated with both their scores on the Cultural Congruity Scale and their ratings of their mentors on the

Mentoring Competency Assessment Diversity subscale which were both used to measure mentor's perceived competency is addressing diversity. Participants scores on the Psychological Sense of School Membership were also correlated positively with their scores on the cultural congruity scale. However, their scores on the Psychological Sense of School Membership were not correlated with the Mentoring Competency Assessment Diversity subscale. This suggests that students who felt as though STEM fit with their cultural backgrounds were more likely to feel as though they belong in their major and lab, however their mentor's specific handling of diversity was not related to their sense of belonging. After completing a reliability analysis, the Diversity subscale of the Mentoring Competency Assessment had a Cronbach's alpha of .0.652 lower than the generally accepted minimum of 0.70 (Tavakol & Dennick, 2011). However, this subscale consisted of only two questions meaning that the reliability of the instrument may have been underestimated (Tayakol & Dennick, 2011).

Although not a part of the initial hypotheses, analysis of the survey data showed that participants with mentors of the same race had significantly higher scores on the Cultural Congruity Scale and the Mentoring Competency Assessment Diversity Subscale. These results suggests that mentors who are from the same race are perceived by students as being more able to handle diversity. The higher scores on the Cultural Congruity Scale may occur because seeing mentors who are from the same perceived racial background may lead to students feeling as though their cultural and racial background is congruent with their STEM majors.

These results build on previous research which suggested that students feel a higher sense of belonging and science self-efficacy when their mentors are able to handle diverse cultural and racial issues in a competent manner. Additionally, this study suggests that mentors who students

perceive as having the same racial identity as they are more likely to rate those mentors as having higher competence in handling diversity.

In completing this study, I was unable to determine which university individual students were from. Because one of the universities included in this study were from Langston University, a historically Black university, it is possible that many of the Black students with mentors of the same race were from Langston. Within this environment the majority of people surrounding the students would be of the same race as them which could have increased their sense of belonging to both their university and STEM in general. It would be valuable for future research to take note of the university type of students to be able to take note of the cultural influences of the university environment they are in.

Future research is needed to determine the influence of mentor race and cultural competence on students experiencing STEM mentorship in organizations other than OKLSAMP which provides specifically research mentoring. Additionally, further research on the role race and ethnicity of mentors plays when students are able to be on campus with their mentors, as opposed to having to work remotely. This study focused on the perceived race of the mentors of STEM students and so it may be helpful for future research to determine the racial identities the mentor's themselves identify as, as opposed to the identities their mentees believe they are.

Limitations of study

One of the main limitations of this study was the fact that it was completed while the on-campus aspects of most universities in Oklahoma were not occurring due to the COVID-19 pandemic. Due to this, students were less likely to spend time with their faculty mentor in person or to spend time in the physical research. As students may have been unable to spend time in

their physical laboratory, this may have impacted their self-efficacy in completing scientific activities as they may have been unable to have practice them.

Another limitation of this study is the fact that the research surveys were attached to the evaluation survey for the OKLSAMP program. Because of this, the students may have felt they needed to respond positively so that the program would be seen positively. Students may have felt this way because they receive funding from the program and want to make sure the program continues to be viewed positively and grant them their funding. The generalizability of these results is limited by the fact that the participants for this study were taken from one STEM mentorship program within several universities in Oklahoma. It is possible that other states with different racial populations would have different results.

While all the students who completed this survey were students participating in OKLSAMP in Oklahoma, I was unable to link participants' responses to the school they were in. Due to this, I am unable to know what impact school type may have had on participants. This is a limitation particularly for students who may have been from the historically Black college of Langston University. It is possible that the Black students from Langston University may have experienced a higher sense of belonging or self-efficacy due to being in an environment wherein the majority of people are of similar culture as opposed to attending a predominantly white institution wherein most of their professors and classmates are of a differing culture.

This study is also limited by the fact that it is self-report. Participants may have more highly rated their experiences with their mentor due to not wanting their mentors to be perceived negatively by OKLSAMP. Additionally, the participants may have interpreted the questions or the rating scales differently than intended. Additionally, because the participants reported their

own perspectives of their mentors' race and ethnicity, it is possible that the mentors may have been of a different race and ethnicity which could have influenced the students' experiences.

Strengths of study

Strengths of this study include the fact that it was able to explore students throughout different universities with different demographics within Oklahoma, including a private university, public research universities, regional universities, and a historically Black university. The different universities' participants provided information about the experiences of students from a variety of university types within Oklahoma. Additionally, because all of the students were a part of the OKLSAMP program, they each have experienced similar mentorship as prescribed by the OKLSAMP program. These similar experiences mean that each of the students should have similar mentorship meaning that different types of research mentorships would not account for the differences in the sample.

CHAPTER V

CONCLUSION

Through this study, I examined the influence of perceived mentor race and cultural competency on STEM mentees' sense of belonging and science self-efficacy. The results fit with previous research that students with mentors of the same perceived race have higher self-efficacy and felt as though science was more congruent with their culture. Additionally, those with mentors' who were rated highly in their competency in handling diversity also had higher self-efficacy and sense of belonging scores. These results suggests that while having a mentor of the same race has a positive influence on REM students, mentees can also have similar positive effects when their mentor is competent in handling cultural differences. This research contributes to the body of knowledge surrounding the experiences of STEM mentees from racial and ethnic minorities. Future research may provide further exploration of the influence of the mentor's own identified race, as opposed to the race mentees perceive them to be. Additionally, because this study was conducted during the COVID-19 pandemic, it may be helpful for further research to be able to examine the influence of mentor race and cultural competency when mentors and mentees are less limited due to the restrictions placed due to COVID-19. The fact that this study was conducted during COVID-19 may have influenced mentees' self-efficacy and sense of belonging due to them not being able to necessarily be physically in the lab for their research

mentorship. Ultimately, this research further emphasizes the important role both mentor race and ethnicity and cultural competency can play in the experience of STEM mentees.

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APPENDIX A

Literature Review

Theoretical Orientation

Critical Race Theory

The first theoretical framework of this study is that of critical race theory (CRT), particularly in its conception of colorblindness. CRT as a theory critiques the idea that we live in a post racial society and instead identifies race as a factor which greatly influences the lives of both REMs and white individuals (Basile & Lopez, 2014, Delgado & Stefancic, 2017). One of the concepts of CRT that is most relevant to the present study is that of colorblindness. Colorblindness comes out of the idea that those in America currently live in a post-racial society in which individuals are able to succeed or fail based on their own merit, not based on their racial identity (Manning et al., 2015). From this idea comes the concept of colorblindness which can be defined as a belief that race should not be a consideration in making decisions concerning individual and that race does not matter in our current society (Manning et al., 2015). Although this concept may appear to be race neutral, it instead works to obscure racial inequality and injustice (Manning et al., 2015). Colorblindness does not allow individuals to consider

differences among other even when being aware of these differences may be used to help others (Delgado & Stefancic, 2017).

Additionally, within CRT colorblindness allows individuals to only critique extreme acts of racism which everyone would notice, instead of the more subversive microaggression which occur day to day. Microaggressions are defined as brief, commonplace, "verbal, behavioral ,and environmental slights and indignities" and are often automatic and unintentional (Sue, et al., 2008, p. 229).One type of microaggression that is particularly relevant to this study is that of microinvalidation which consists of invalidating the racial experience of REMs and acting as though this experience does not matter (Sue et al., 2008).

Within STEM fields, REMs are underrepresented in comparison to white individuals. CRT allows a framework for examining the experience of these students in a context in which they are underrepresented (National Academies of Science, E., and Medicine 2019). Additionally, CRT also provides language for understanding how the behavior of students' mentor's may be influencing them. Lastly as will be discussed later in this paper, STEM fields tend to be suspectable to colorblindness and the belief that culture and race do not matter within the field making CRT a good theory for understanding how culture and race do influence these fields (Byars-Winston et al, 2019)

Social Cognitive Career Theory

In addition to Critical Race Theory, this study will use also use the framework of Social Cognitive Career Theory (SCCT). SCCT draws from Bandura general social cognitive theory and the idea that individuals, their environment, and their behavior influence and are influenced by each other (Kessler, 2013, Brown, et al., 2013). Through social cognitive theory individuals

are influenced to complete behaviors through social learning. Through social modeling, one's behavior can changed based on how they see another person similar to them behaving and being rewarded or punished (Kessler, 2013).

The principle of social cognitive theory which this study is most concerned with is that of self-efficacy. Self-efficacy is defined as how people judge their ability to organize and complete a specific course of action to gain a specific performance (Brown, et al., 2013, Baier, 2016, Chen et al., 2001). Self-efficacy is linked to different domains and activities, for example, and individual may have high self-efficacy about their academic ability, but low self-efficacy surrounding their athletic ability (Brown, et al., 2013). Self-efficacy is influenced by the following four primary types of learning experiences and information sources: personal performance accomplishments, vicarious learning, social persuasion, and physiological and affective states (Brown, et al., 2013). One of the ways individuals can develop further self-efficacy is through individuals who are perceived as similar to the individual modeling success in that behavior (Bandura, 1994, Kessler, 2013, Brown, et al., 2013).

Mentoring relationships are one way of providing modeling for students and improving individual's self-efficacy. As this study is concerned with how to improve the performance and self-efficacy of STEM students, SCCT provides an understanding of how different variables may influence these constructs for REM students.

Mentorship

Carroll and Barnes (2015) found that students who reported positive mentoring experiences had an increase in self-efficacy, positive social interactions, professional competency, perceived job satisfaction self-confidence, career advancements, and development

of a professional identity. Additionally, positive mentoring experience correlated with decreasing work-related conflict (Carroll & Barnes, 2015).

There are two primary ways mentorship appears to lead to these positive outcomes. First, mentoring relationships provide support to individuals, often through the use of role modeling. Role modeling occurs when individuals see others they view as similar to them in some way completing or achieving a task, which leads them to the belief that they can also complete or achieve that task (National Academies of Science, E., and Medicine, 2019). Mentors also provide instrumental support, such as the opportunity for challenging work that allows individuals to further develop their professional skills (The National Academies of Science, Engineering, and Medicine, 2019).

Through providing this support, mentorship is able to help improve the self-efficacy of students (Feldman, et al., 2010, Giblin & Lakey, 2010). Self-efficacy is correlated with several desired academic outcomes and achievements for students. Students with higher self-efficacy had reduced stress and anxiety and an increased level of college satisfaction (Chemers et al., 2001, Wood et al., 2015). Students with higher academic self-efficacy, or self-efficacy specifically about a person's ability to achieve academically had better performances and academic expectations (Chemers, et al, 2001; Wood et al, 2015). Similarly, student's self-efficacy about a specific course they were taking positively correlated with their grades within that course (Choi, 2005). Wood et al. (2015) found that students with higher self-efficacy in math were more likely to be academically integrated as measured by their likelihood of talking to faculty about academic matter, meet with their advisors and use the internet to access library materials. Through improving students' self-efficacy, mentorship allows for the many positive aspects of mentorship to occur.

Mentorship in STEM

Within STEM fields, mentorship provides benefits in addition to those mentorships provide to students in general. One of the ways student gain mentorship in STEM is through participation in research. Through this participation, students are able to apply their knowledge in more practical ways (Carpi, et al., 2017). These experiences have a variety of positive effects on students within STEM fields. Students from underrepresented backgrounds who were involved in mentored research experiences had increased self-efficacy, career ambition, increased GPA, increased graduation rate, and increased odds of continuing in basic math and science courses (Carpi, 2017). These students were also more likely to graduate in biology.

Carpi (2017) also found that these research experiences improved student's socialization into STEM fields. Students involved in these experiences have better socialization to STEM careers and a better understanding of what it means to be a scientist and conduct research, (Carpi, 2017). Through these programs, students are exposed to role models in STEM, which has a positive effect on both their academic sense of belonging and their academic self-efficacy (Shin et al., 2016). Students who completed these programs were better prepared to discuss research results, give a poster presentation, and apply ethical principles in research (Carpi, et al, 2017). Effective mentorship in STEM for underrepresented students also enhanced both recruitment into and retention in research-related career pathways (The National Academies of Science, Engineering, and Medicine, 2019)

One of the benefits of mentorship for students in STEM is that it helps to improve their sense of belonging within the field (Shin et al., 2017). One's sense of belonging consists of one's sense of being accepted valued, included, and encouraged by others within a group and is

connected with feelings of comfort and security within a place (Rainey et al., 2018, Ahn & Davis, 2020). Within higher education, students' sense of belonging is related to the respect, perception of potential and evidence that students matter which students perceive as existing within their university (Cureton & Gravestock, 2019).

Rainey et al. (2018) found that having a high sense of belonging correlated with academic achievement, retention, and persistence in college, with this effect being more evident in students from racial and ethnic minority groups. However, despite these positive influences of having a high sense of belonging both students of color and women have reported having less of a sense of belonging than male and white students (Rainey, et al., 2018). Students of color reported less sense of belonging than their white peers, with women of color being the least likely to report a sense of belonging (Rainey, et al., 2018). This low sense of belonging among students of color helps provide a sense of why mentorship which helps improve sense of belonging can be so important for students of color (Shin et al., 2017).

In addition to improving students' sense of belonging, experiences in mentorship have also been found to improve students' self-efficacy in STEM. Carpi et al. (2017) found that students who were involved in an undergraduate research program described increases in their self-efficacy as they talked about their experiences in an undergraduate research experience. Students reported feeling as though they now knew what they were doing in STEM and that they now felt that they would be able to go on to graduate school if they wanted to (Carpi et al., 2017). Due to this study having been completed at a Minority-Serving Institution, it also provides an example of the impact mentorship can have on REM STEM students (Carpi, et al., 2017).

Racial and Ethnic Minorities (REM) and Mentorship

Castellanos and colleagues (2016) report that for REM students, mentorship several positive aspects in addition to those generally found in mentorship. They found that student perception of being mentored was positively correlated with increased positive perception of cultural fit, retention, academic goal definition, and college adjustment (Castellanos et al, 2016). Despite these positive effects of mentorship, students from underrepresented backgrounds have received less mentorship than those not from this background and are less likely to develop mentorship relations that lead to gains in social capital (National Academies of Science, E., and Medicine, 2019; Schwartz, 2016). Because of this, these students who may most benefit from the experience of being involved in mentorship, receive less mentorship than others. One potential solution would be to involve more students from underrepresented background in mentorship programs, however, for REM students, there are several complicating factors that make creating mentorship that is effective and positive for these students more difficult.

Traditionally, STEM fields have not considered themselves as being influenced by culture (Byars-Winston, 2019). Within these fields there is a cultural myth that science is objective and not influenced by race and culture. Both mentors and mentees have been found to view race and ethnicity as being separate from science and stated that race and ethnicity were relatively unimportant to research mentoring relationship (Byars-Winston, 2019). In addition to belief in STEM fields that science is not influenced by race and culture, the majority of individuals in these fields are white males, who through being members of a dominant group, are less likely to think of themselves in terms of race and ethnicity (Byars-Winston et al., 2019). This lack of acknowledged experienced with race and ethnicity can lead to this group further discounting the influence of these aspects (Byars-Winston, et al., 2019).

Due to this discounting of race and ethnicity, white mentors within STEM often behave toward REM students in a colorblind manner (Byars-Winston et al. 2019). In terms of race, behaving in a colorblind matter occurs when individuals ignore the influence of race and ethnicity and act as though it does not matter (Byars-Winston, et al., 2019). This handling of race can make REM students feel as though their cultural and racial backgrounds are being ignored and considered unimportant(Byars-Winston et al, 2019). Moreover, white professors engaging in colorblind perception of their REM mentees and minimizing their students' experiences, they continue to make subtle references to racial issues such as being surprised a Black student is "so articulate" (McCoy et al., 2015). Mentors are placed in a unique position to allow or confirm assumptions, both negative or affirming that REM students may have about being a REM in their field and lessen the negative experiences of their students. However, because of their colorblindness and a lack of knowledge surrounding REMs, white mentors may not address racial and ethnic issues appropriately, leading to the diminishment of REM students' success (Byars-Winston, et al., 2019)

One potential solution for the difficulties of REM students in mentoring relationships with white mentors is to pair REM students with mentors from similar REM backgrounds. Students in STEM from historically underrepresented background felt more supported and understood when their mentors were matched by race (Byars-Winston, et al., 2019). This may be due to the perceived similarity of mentors of the same race as Hernandez et al. (2017) found that perceived similarity of values was more highly associated with perception of quality mentorship than demographic similarities. Similarly, within two different universities, students with mentors who had higher cultural fit and more mentoring had a general perception of being mentored and higher college and life satisfaction than those who did not have such mentors

(Castellanos, et al., 2016). Mentees themselves within STEM also perceived benefits of having mentors from similar background who they could identify with and who could serve as role models (Byars-Winston, 2019). Additionally, mentorship partnerships in which the mentor and the mentee were similar in perceived attitude, values, interest, and personality reported better perceived mentoring and learning (Allen & Eby, 2003) and greater mutual liking (Lankau, et al., 2005).

Although there are many positive effects to pairing mentees with mentors from similar backgrounds there are also several practical difficulties in enacting this. One of the primary reasons for attempting to recruit and retain more REM students in STEM is due to the current lack of REM individuals in STEM (National Academies of Science, E., and Medicine). This lack of REM individuals in STEM fields leads to a lack of potential STEM mentors who are from REM backgrounds, meaning that pairing all REM STEM students seeking mentorship with REM mentors would be incredibly difficult, especially without overwhelming REM professionals (Carroll & Barnes, 2015).

Because of the variety of potential benefits to mentorship for REM students in STEM, the unique difficulties REM students face and the lack of REM STEM professionals, it is valuable to find ways to make interracial mentorships more effective and beneficial. Because of the importance of acknowledging cultural and racial differences in mentorship relationship and not ignoring them, it would follow that REM students with mentors who can better handle racial and ethnic difference will have a higher sense of belongings and self-efficacy. Additionally, due to the findings that mentorship relationships with those who are from similar background, mentees with mentors who are from REMs will have higher self-efficacy and sense of belonging.

APPENDIX B

Measures/Instruments

Psychological Sense of School Membership (PSSM) (Goodenow, 1993, Jackson, 2016)

Sense of Belonging Survey

Instructions: Please rate the following statements on how true they are to you based on your experiences in your research lab.

1. I feel like a part of my research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

2. Sometimes I feel as if I don't belong at my research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

3. As a student, there are a lot of activities that I can

participate in at my research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

4. I can really be myself in my research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

5. I wish I were at a different research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

6. I feel proud of belonging to this research lab.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

7. There's at least one professor at this university that

I can talk to if I have a problem.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

8. People at this research lab are friendly to me.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

9. Professors here are not interested in people like

me. R

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

10. In the research lab, I am treated with as much respect

as my peers.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

Instructions: Please rate the following statements on how true they are to you based on your experiences in your STEM

Major.

11. People in my program notice when I'm good at

something.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

12. It is hard for people like me to be socially accepted in my program. R

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

13. Other students in my program take my opinions seriously.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

14. Most professors in my program are interested in my work.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

15. I feel very different from most other students in program.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

16. The faculty and staff in my program respect me.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

17. People in my program know I can do good work.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

18. Other students in my program like me the way I am.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

19. There are other students in my program that I feel comfortable talking to if I have a problem.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

20. I feel included when completing group work.

Not at all true

Slightly true

Somewhat true

Very true

Extremely true

Science Self-Efficacy (Chemers et al. 2011)

This section assesses your confidence in your abilities to function as a scientist. Indicate the extent to which you are confident you can successfully complete the following tasks. (Please circle one response per item.)

Response options:

1 = not at all confident

2 = to a small extent

3 = to some extent

4 = to a large extent

5 = absolutely confident

1. Use technical science skills (use of tools, instruments, and/or techniques).

2. Use scientific language and terminology.

3. Generate a research question to answer.

4. Figure out what data/observations to collect and how to collect them.

5. Figure out/analyze what data/observations mean.

6. Create explanations for the results of the study.

7. Use scientific literature and/or reports to guide research.

8. Relate results and explanations to the work of others.

9. Develop theories (integrate and coordinate results from multiple studies).

10. Report research results in an oral presentation or written report.

Cultural Congruity Scale (Gloria & Robinson-Kurpius, 1996)

For each of the following items, indicate the extent to which you have experienced the feeling or situation at school, particularly concerning your experiences with your research mentor. Use the following ratings:

Not at all A Great Deal

1 2 3 4 5 6 7

1. I feel that I have to change myself to fit in at my research lab.

2. I try not to show the parts of me that are "ethnically" based.

3. I often feel like a chameleon, having to change myself depending on the ethnicity of the person I am with at my research lab.

4. I feel that my ethnicity is incompatible with other students.

5. I can talk to my friends at my research lab about my family and culture.

6. I feel I am leaving my family values behind by going to college.

7. My ethnic values are in conflict with what is expected at my research lab.

8. I can talk to my family about my friends from my research lab.

9. I feel that my language and/or appearance make it hard for me to fit in with other students.

10. My family and school values often conflict.

11. I feel accepted at my research lab as an ethnic minority.

12. As an ethnic minority, I feel as if I belong in my research lab.

13. I can talk to my family about my struggles and concerns at my research lab.

Diversity Subscale of the Mentoring Competency Scale (Fleming et al., 2013)
Please rate how skilled you feel your mentor is in each of the following areas: [We understand that you can only speak from your personal experience. Please try to rate a skill whenever possible, reserving the 'not observed' category for cases where you have no basis for assessment]**.**

Not at all Moderately Extremely Not observed

1 2 3 4 5 6 7 0

1. Taking into account the biases and prejudices s/he brings to your mentor/mentee relationship.

2. Working effectively with mentees whose personal background is different from his/her own (age, race, gender, class, region, culture, religion, family composition etc.)

Question Concerning Mentor Race and Ethnicity

Do you perceive yourself as having a mentor of the same race/ethnicity as you?

Exploratory Questions

What kinds of support do you find you receive from your OKLSAMP mentor?(e.g., academic support, technical knowledge, social support, career knowledge)

Are you a member of any STEM-related organizations which provide you with mentorship?

Please list:

If so, how is the support you receive from these organizations different from or similar to that of your OKLSAMP mentor?

What influence, if any, do you think your race/ethnicity or culture has on your experience in a STEM field?

APPENDIX C

Participants' Majors

Participants' Major	**Frequency**	**Percent**
Aerospace Engineering	1	1
Animal Science	1	1
Biochemistry & Molecular Biology	1	1
Biochemistry	2	2
Biochemistry and Psychology	1	1
Biology	21	21.2
Biology (Clinical Lab Science)	1	1
Biology and Psychology	1	1
Biology/Fish and Wildlife	1	1
Biology/Chemistry	1	1
Biomedical Engineering	1	1
Biomedical Sciences	1	1
Cell and Molecular Biology	3	3

Chemical Engineering	1	1
Chemical Engineering	1	1
Chemistry	11	11.1
Chemistry/Biochemistry	1	1
Computer Science	2	2
Computer Science and Computer Simulation and Gaming	2	2
Construction Engineering Technology	1	1
Electrical Engineering	2	2
Electrical Engineering Technology	1	1
Engineering	1	1
Entomology	4	4
Environmental Engineering	1	1
Environmental Science	2	2
Health Physical Education Recreation	1	1
Health Science and Chemistry	1	1
Industrial Engineering and Management	1	1

Information Technology	1	1
Management Information Systems	1	1
Mathematics	1	1
Mechanical Engineering	3	3
Medical Science	2	2
Microbiology	1	1
Microbiology/Cell & Molecular Biology	8	8.1
Molecular Biology	1	1
Natural Resources Ecology and Management	2	2
Organismal Biology	1	1
Physics	3	3
Pre-Pharmacy Biology	1	1
Software Engineering	1	1

APPENDIX D

Oklahoma State University Institutional Review Board

Date: 11/20/2020

Application Number: IRB-20-510

Proposal Title: OK-LSAMP: Influencing Factors of STEM Mentors on Mentees

Principal Investigator: Stephanie Zackery

Co-Investigator(s): Nicole Colston

Faculty Adviser: Sue Jacobs

Project Coordinator:

Research Assistant(s):

Processed as: Exempt

Exempt Category:

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as

outlined in 45CFR46. This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population

composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.

2. Submit a request for continuation if the study extends beyond the approval period. This

continuation must receive IRB review and approval before the research can continue.

3. Report any unanticipated and/or adverse events to the IRB Office promptly.

4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have

questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,

Oklahoma State University IRB

VITA

Stephanie Lynn Zackery

Candidate for the Degree of

Master of Science

Thesis: THE INFLUENCE OF STEM MENTOR RACE AND CULTURAL COMPETANCY ON RACIAL AND ETHNIC MINORITY MENTEES

Major Field: Mental Health Counseling

Biographical:

Education:

Completed the requirements for the Master of Science in Mental Health Counseling at Oklahoma State University, Stillwater, Oklahoma in July, 2021.

Completed the requirements for the Bachelor of Arts in Psychology at Oklahoma Baptist University, Shawnee, OK/U.S. in 2019

Experience:

Mental Health Counseling Intern Oklahoma State University Counseling and Counseling Psychology Clinic- June 2020-May 2021

Oklahoma State University OKLSAMP Research Group Research Assistant- February 2020-July 2021

Professional Memberships:

American Psychological Association
American Counseling Association
Society of Indian Psychologists