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Contextual Factors in the Identity Development of Native American and Latinx Undergraduates in STEM Fields

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CONTEXTUAL FACTORS IN THE IDENTITY DEVELOPMENT OF NATIVE AMERICAN AND LATINX UNDERGRADUATES IN STEM FIELDS

by

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ABSTRACT

Contextual Factors in the Identity Development of Native American and Latinx Undergraduates in STEM Fields

by

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Utah State University, 2018

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This longitudinal, multiple paper dissertation study incorporates two papers examining contextual factors in the development of a sample of high-achieving Latinx and Native American undergraduate STEM majors. The aim was to better understand normative professional and personal identity development from a strengths-based perspective. Paper 1 presents the development of a continuous scale designed to measure high-achieving Latinx and Native American undergraduate science majors' perceptions about the importance of various dimensions of mentor-mentee similarity (termed Ideal Similarity) and their perceived actual similarity with mentors (termed Perceived Real Similarity). Support was found for measuring similarity continuously as opposed to dichotomously (i.e., match vs. mismatch). The factor structure derived from exploratory factor analysis is consistent with Kammeyer-Mueller, Livingston and Liao's concepts of deep-level similarity and surface-level similarity. Although participants reported valuing Depth Similarity more than Surface Similarity, the two constructs were correlated. The

relationship between strength of ethnic identity and mentee preferences for similarity with mentors was examined, revealing that students with higher ethnic group identification more highly valued similarity with mentors in both Ideal Surface Similarity and Ideal Depth Similarity. Paper two presents support for the use of two scales adapted from an existing ethnic identity development measure (the Multigroup Ethnic Identity Measure-Revised [MEIM-R], with the aim of measuring Scientist Identity and Ethnic Minority Scientist Identity. A significant positive correlation between identity development as a scientist and ethnic identity was observed, suggesting identity development in one domain facilitates development in other domains. Significant differences were found in the relative strength of identification. Developing a cohesive identity that incorporates both ethnic identity and scientist identity appears more challenging than developing either of these identities in isolation. Both Scientist Identity and Ethnic Minority Scientist Identity were positively correlated with Commitment to a Career in Science, which may indicate intersectional identity development plays an important role in retaining minority students in STEM. The significant relationship between these facets of identity and mentor-mentee deep-level similarity (the Perceived Real Depth Similarity subscale developed in Paper 1) supports assertions in the extant literature that culturally competent mentoring can foster the development of identity as a scientist.

(148 pages)

PUBLIC ABSTRACT

Contextual Factors in the Identity Development of Native American and Latinx Undergraduates in STEM Fields

Angela Marie Enno

This study includes two papers that aimed to provide insights into the experiences of high-achieving Latinx and Native American college students studying science. We wanted to better understand factors that influence these students' ability to develop a sense of identity that weaves together their hoped-for careers as scientists as well as their cultural identities. We looked at how they feel about working with mentors in science fields who were like them in a variety of ways. We found that many students (especially those with a stronger sense of cultural identity) valued working with mentors who were similar to them in demographic characteristics; but overall, the whole group of students agreed that the most important areas of similarity in their opinions were their values and thoughts about how to interact with other people. Students who felt they were similar to their mentors on demographic characteristics were also more likely to believe they were similar in values and ways of interacting. We also examined identity development in three different aspects: ethnic identity, scientist identity, and combining the two into one identity that incorporates being a Native American scientist or a Latinx scientist. We found that the students in this study may find it difficult at times to develop a strong sense of their identity that weaves together both parts of themselves without favoring one over the other, and without seeing the two identities as separate or conflicting. At the

same time, we found that when mentors do behave in ways that are more similar with students' ways of interacting, those students develop a stronger sense of themselves as scientists, and when students have a stronger sense of themselves as scientists, they are more likely to commit to their education. We suggest that people working with Native American and Latinx college students studying science should work on understanding those students' cultural backgrounds and find ways to relate with them, in order to make it more likely that those students will finish school and choose to continue with a career in science.

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Fall semester 2004, I arrived in Logan, Utah, and approached my multicultural psychology professor after class and asked about helping in her lab, to get research experience so I could get into graduate school. She sat me down in her office and pulled out a series of yellow sticky notes that she proceeded to fill with a list of all the things I needed to do to get into graduate school. That series of sticky notes given to me to me by Dr. Melanie Domenech-Rodríguez became the bread crumbs I followed to begin an incredible journey at USU. Melanie, to say thank you is simply not enough. My second

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We did it!

Angela Marie Enno

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CHAPTER 1

INTRODUCTION

Overview

The purpose of this dissertation is a longitudinal exploration of the resources and strengths of a group of high-achieving Native American and Latinx undergraduate students in science, technology, engineering, and mathematics (often referred to as STEM fields). Participants were 113 Latinx and Native American students from universities all over the United States, including Puerto Rico. They were recruited from the Society for the Advancement of Chicanos and Native Americans (SACNAS) 2011 national conference. SACNAS was born from the civil rights movements of the 1970s that focused on the empowerment of Chicano and Native American people. Many of the founding members identified with the Chicano movement, recognizing the indigenous and mestizo heritage of most Mexican people. This tie to the indigenous cultures of the Americas is the link they envisioned between Latinx and Native American people (Kurzweil, J., personal communication, April 27, 2018). The participants are considered high-achieving due to the fact that every one of them is engaged in undergraduate research and attended this national conference. The study aimed to describe normative identity development within the context of STEM higher education, and to better understand the role of mentor-mentee similarity in fostering that development.

A multiple paper format is used to examine two aspects of these students' experiences: similarity with their mentors and intersectional identity development. The

two papers that compose this dissertation aimed to expand on the way these constructs have been examined in the literature to date in several ways: (1) by applying an intersectional lens to aspects of identity development that have frequently been examined in additive or multidimensional models, (2) by incorporating conceptualizations and measures that move toward greater complexity and nuance in examining mentee perceptions of similarity with their mentors, and (3) by collecting additional empirical data to aid in evaluating claims in the extant theoretical literature (e.g. conflicting theories about the relationship between ethnic identity and identity as a scientist). It is hoped that the findings in this study will contribute toward better practices in supporting Latinx and Native American students in STEM, with the goal of increasing their numbers among STEM graduates in the future.

Background

Despite being equally likely to major in a STEM (science, technology, engineering, and mathematics) field, women of all ethnicities and men of certain ethnic minority groups (Black/African American, Native American, and Latina/o) and are less likely than their White male counterparts to graduate with a degree in STEM. This has led to a severe shortage of underrepresented minorities in STEM-related careers (Johnson, 2012; Wladis, Conway, & Hachey, 2015). According to data available through a National Science Foundation report (2017), 21.1% of the U.S. population between ages 18 and 24 in 2014 was Latinx, while only 11.5% of STEM bachelor's degrees, 6.4% of STEM master's degrees, and 4.2% of STEM doctoral degrees were awarded to Latinx

people. Likewise, Native Americans represented 0.9% of the U.S. population ages 18-24 but only 0.5% of STEM bachelor's, 0.3% of STEM master's, and 0.3% of STEM doctoral degree recipients. This situation has lead scholars to declare that "attracting and retaining women and underrepresented minorities in STEM disciplines is a national priority" (Hernandez et al., 2013, p. 90). Many authors have examined the barriers to success that underrepresented minority STEM students face. Others have described and/or evaluated potential methods for addressing these barriers. Understanding the obstacles that may be faced by these students is key; however, knowing their strengths may also better equip STEM faculty to support them.

Aside from creating a STEM workforce that better reflects demographics in the larger population, these fields stand to benefit from the unique perspectives and experiences that Native American and Latinx students may bring. Moll and González (2004) referred to this notion as the "funds of knowledge," developed through learning heavily influenced by sociocultural context. Connecting Native American and Latinx students' own culturally-embedded funds of knowledge to STEM's similarly culturally-embedded knowledge may help Native American (Deloria & Wildcat 2001) and Latinx (González & Moll, 2001; González, Moll, & Amanti, 2005) students weave together multiple ways of knowing and better envision STEM fields as relevant to themselves and their cultural contexts. Research on younger learners (e.g., middle school aged) has already demonstrated that engaging family, friends, tribe, and/or community in discussions of these funds of knowledge within their cultures and STEM fields is one potential way to generate interest in and identification with STEM careers (Stevens,

Andrade, & Page, 2016).

Harper (2010) advised researchers to engage an "anti-deficit achievement-focused" lens to explore what enables minority students to persist to graduation. For example, he called for research that explores "how achievers develop science identities [and] how their confidence in specific science- and math- related tasks is developed" (p 71). A burgeoning discourse in recent research suggests that these underlying processes (such as identity development) are key in understanding what makes some minority STEM students successful. In addition, identity theorists emphasize the importance of context in identity development, specifically "important interpersonal relationships in the context of institutional structures (Syed, Azmitia, & Cooper, 2011, p. 443). In line with these theories, the present study sought to examine normative identity development in context, from a strengths-based approach.

Importance of Mentorship

A common theme in the literature is the importance of applied experiences in research. Many authors have argued that getting practical, hands-on experience that allows students to develop technical skills as a scientist is key to their persistence in STEM (Johnson, 2012; Piper & Krehbliel, 2015; Wilson, Iyengaf, Pang, Warner, & Luces, 2012). Piper and Krehbliel advised STEM faculty to integrate their research into their teaching in order to familiarize students with research and convey "the excitement of research" in order to pique student interest. Regular meetings with a faculty mentor have been found to play an important role (Johnson, 2012; Wilson et al., 2012). Studies

have found that students who present research with a faculty mentor (Wilson et al., 2012), present at undergraduate research symposiums (Piper & Krehbliel, 2015), and participate in summer research experiences (Piper & Krehbliel, 2015) are more likely to persist in STEM education and careers.

Some authors highlight the importance of mentors in helping underrepresented minority students build cultural capital. The term cultural capital refers to nonmaterial resources and assets that facilitate upward social mobility (Wladis, et al., 2015). Cultural capital is generally understood to relate to the position of dominant groups in society. Those who understand the inner workings of the groups in power are thought to possess greater cultural capital by virtue of the fact that those groups establish norms such as the values, assumptions, epistemologies, and procedures that shape a field of study. Due to greater representation of White Americans in STEM fields (Johnson, 2012; Wladis et al., 2015) and to the longstanding power imbalance between Whites and minority groups in the U.S.; the culture of academia in the U.S. is heavily influenced by White American norms. Thus, it is White American students who enjoy higher levels of cultural capital. Cultural capital explains underrepresented minority students' struggle to succeed in academia as, at least in part, a function of differences in academic culture versus their cultures of origin.

Wilson et al. (2012) described the utility of workshops and seminars that focus on helping students build the necessary background knowledge and skills they need in order to engage successfully with STEM training. This beyond-the-classroom learning exposes underrepresented minority students explicitly to the "culture of science" (Johnson, 2012),

rather than assuming they will come equipped with this knowledge or gain it on their own. This is thought to give them a stronger foundation for academic work (Piper & Krehbliel). Examples of some topics covered in these trainings include communication skills (Piper & Krehbliel, 2015; Wilson et al., 2012), social skills for academia and STEM, self-regulation, "non-routine problem-solving", collaboration, "systems thinking" (Piper & Krehbliel, 2015), basic computer skills (Wilson et al., 2012), and learning and study strategies- both general and discipline-specific (Wilson et al., 2012).

On the other hand, while students will likely benefit from better understanding the way things are generally done in STEM, it is important to allow room for students' cultural backgrounds and personal choices about the values and behaviors they adopt as well. Some authors have critiqued the notion of cultural capital as the exclusive domain of those with access to and understanding of White American/academic culture. Moll and González (2004) asserted that connecting Native American and Latinx students' own culturally-embedded funds of knowledge to STEM's similarly culturally embedded knowledge may help Native American (Deloria & Wildcat 2001) and Latinx (González & Moll, 2001; González et al., 2005) students weave together multiple ways of knowing. When they are able to do so, they enrich the STEM fields they belong to, and better envision those fields as relevant to themselves and their cultural contexts. Moll and González (2004) refer to these cultural resources found within students' own cultures as "funds of knowledge," which are developed through learning heavily influenced by sociocultural context. Research on younger learners (e.g., middle school-aged) has already demonstrated that engaging family, friends, tribe, and/or community in

discussions of these funds of knowledge within their cultures and STEM fields is one potential way to generate interest in and identification with STEM careers (Stevens et al., 2016).

An approach that holds the view of mentees' cultural backgrounds as an asset may be more in line with mentee's values and represent more culturally competent mentorship. Alderfer (2014) argued that mentoring, by definition, supports the mentee in developing and actualizing their own vision of who they want to become. This is in contrast to shaping an individual to meet the needs or expectations of an organization. The author cautioned that "mentor programs" sponsored by an organization may serve the needs of that organization without serving the needs of the mentees. STEM programs that fail to value students' perspectives and experiences, even while building their skills in STEM, will likely not see the same positive effects on retention.

The relationship of students with a primary research mentor, such as a faculty member or primary investigator, has also been the subject of many studies on underrepresented minority retention in STEM fields. Several authors highlight the importance of one-to-one mentoring (Johnson, 2012; Wilson et al., 2012). Good mentoring has been linked with feeling connected to school, developing greater self-efficacy, and having positive social relationships (Zand et al., 2009). Alderfer (2014) contended that a central component of mentoring is the ability for the mentee to identify with the mentor. Possible-selves theorists have suggested that identification with a mentor as a role model may be more difficult for ethnic minority students in STEM because of the lack of available mentors of their same ethnicity (Zirkel, 2002). Much of

the extant literature on the impact of ethnic similarity between minorities and mentors has assumed that match is desirable to all minority students; however, some authors have contended that this assumption must be examined through assessment of students' actual preferences (Syed, Goza, Chemers, & Zurbriggen, 2012).

Importance of Identity

Experts in Latina/o and Native American undergraduate STEM retention argue that a key component of their success is developing a sense of identity as scientists (Robnett, Chemers, & Zurbriggen, 2015). As explained by Brickhouse, Lowery, and Schultz (2000), students must grapple with the space they perceive between who they are and who they aspire to become as scientists. Harper (2010) contended that becoming an underrepresented minority scientist often involves identity conflicts that must be resolved for students to persist in higher education and science careers. This likely involves elements of two processes: developing core competencies as a scientist and developing a coherent sense of self which integrates identity as a scientist and ethnic identity.

The Current Study

The data used in this study were collected as part of a larger longitudinal study examining factors in the retention of underrepresented minority students in STEM; and incorporated survey measures completed by both undergraduate students and their primary research mentors. The research was funded by a Minority Supplement to National Institute of General Medical Science Grant #2R01GM071935-05 awarded to

Martin Chemers, Principal Investigator. The Minority Supplement to the larger grant was written by the author of this dissertation, Dr. Chemers (then on faculty at University of California Santa Cruz), project manager Dr. Barbara Goza, and Dr. Renee Galliher (Utah State University). The new scales presented in the current study were written or adapted by the author of this dissertation for the purposes of this doctoral dissertation, with the exception of the Commitment to a Science Career scale, which was authored by Dr. Chemers and has been used in previous research (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011). The research team selected time points for the administration of scales used in the present study in order to balance the time demand on participants across assessments, and to distribute opportunities to contribute research questions among the various members of the research team. The scales presented here were incorporated as the contribution of the author of this dissertation

Participants in the larger study were recruited from a database of students who registered for the Society for the Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS) research conference in 2010 (Cohort 1) and 2011 (Cohort 2). They were recruited via email invitation to participate in a study to "help us learn about the 'active ingredients' that support science students most effectively." Participants were compensated with a $50 gift certificate after each year of study participation. Initially, 40% (n = 806) students agreed to participate but ultimately only 309 continued to participate at every time point. The data used in the current study were drawn from the second cohort (n = 189) of participants and were collected during Summer and Fall 2011 (Time 1), Spring 2012 (Time 2), and Spring 2013 (Time 3). Their

mentors were also recruited for a separate study conducted by the Primary Investigator.

The current study focused on 113 of the participants in Cohort 2: only those identifying as Latinx and/or Native American. These participants were relatively high-achieving undergraduates in STEM. The aim was to increase our understanding about optimal conditions for facilitating the success of Native American and Latinx students in STEM by examining some of the strengths they possess and resources available to facilitate their success.

Participant Academic Progress During the Study

Analyses for the present study focus only on the 113 participants who identified as Native American/Native or Alaskan/First Nations/Indigenous (*n* = 28, 24.8%) and/or Latinx/Chicano/Hispanic students (*n* = 105, 92.9%). These totals add up to more than 100% because some participants indicated belonging to two or more of these groups (*n* = 14, 12.4%). Participants' class standings at Time 1 were: Freshman *n* = 1, 0.9%; Sophomore *n* = 13, 9.8%; Junior *n* = 37, 32.7%, Senior *n* = 60, 53.1%, and Other *n* = 2, 1.8%. Of the two participants whose class level was "Other," one had graduated and one was in a post-baccalaureate program.

Participants were asked again about their class standing at Time 5, 2 years after the first survey administration. At Time 5, 34.5% (*n* = 39) were in graduate school, 38.1% (*n* = 43) were undergraduate seniors, 8% (*n* = 9) were juniors, 3.5% (*n* = 4) were sophomores, 8.8% (*n* = 10) were not enrolled, 7.1% (*n* = 8) selected "other." Among those who selected "other" at Time 6 indicated that their status at Time 6 was: graduated

(*n* = 3), MSI-professional school student (*n* = 1), post-baccalaureate (*n* = 3), "PREP Program" (*n* = 1), preparing for graduate school (*n* = 1), and "gain" (*n* = 1).

Participants were also asked to report their academic major at Time 1. The most common majors were Biology/General Biology (*n* = 19, 16.67%) and Mathematics/ Applied Mathematics (*n* = 16, 14.04%). Table 1.1 presents more detailed information about participant majors. A significant portion of participants (*n* = 18, 15.59%) reported multiple majors; therefore, the total adds up to more than *N* = 114.

Mentor Demographic Characteristics

Participants were asked to identify their primary research mentor, and the larger longitudinal study incorporated survey measures with those mentors as well. Demographic information provided in this document is drawn from that study and includes mentors for the entire sample rather than the specific subset used for this dissertation study. In the larger study, 117 primary mentors were identified by participants and consented to participate in the mentor study. They were 44.4% male (*n* = 52); 55.6% female (*n* = 65). Their average age was *M* = 45.45 (*SD* = 11.305; range 27 to 71 years old). Their reported ethnicities (which add up to more than one hundred percent because participants could select multiple ethnicities) were: White (58.1%, *n* = 68), Mexican-American or Chicano (13.7%, *n* = 16), Puerto Rican (4.3%, *n* = 4.3) Other Latinx (7.7%, *n* = 9); American Indian or Alaska Native (5.1%, *n* = 6), African American or Black (3.4%, *n* = 4), Asian or Asian American (6%, *n* = 7), Other (5.1%, *n* = 6).

Mentors reported they were mostly professors in the students' departments (*n* = 63 or 53.8.4%); specifically, adjunct (*n* =1), assistant professor (*n* = 21); associate

Table 1.1

Academic Majors of Participants

Major	*n*	Percent
Aerospace Operations	1	0.88
Astronomy	1	0.88
Biochemistry	9	7.89
Biology - General Biology	19	16.67
Biology - Animal Biology	1	0.88
Biology - Biology Education	1	0.88
Biology - Evolutionary Biology	1	0.88
Biology - Human Biology	2	1.75
Biology - Marine Biology	1	0.88
Biology - Microbiology	4	3.50
Biology - Molecular, Cellular, and/or Developmental Biology	10	8.77
Biomathematics	1	0.88
Chemistry/Environmental Chemistry	10	8.77
Clinical Laboratory Sciences	1	0.88
Computer Science	8	7.02
Ecology	1	0.88
Environmental Geoscience / Geoscience	2	1.75
Environmental Sciences - concentration in policy	1	0.88
Environmental Systems - Ecology, Behavior, and Evolution	1	0.88
Engineering - Aerospace Engineering	1	0.88
Engineering - Biomedical Engineering / Biomedical Science	2	1.75
Engineering - Chemical Engineering	2	1.75
Engineering - Computer Science Engineering	1	0.88
Engineering - Electrical Engineering	1	0.88
Engineering - Environmental Engineering	1	0.88
Engineering - Mechanical Engineering	3	2.63
Engineering - Materials Science Engineering	2	1.75
Ethnic Studies and Spanish Literature/Native American Studies/Women and Ethnic Studies	3	2.63
Fisheries	1	0.88
General Science	1	0.88
Industrial Biotechnology	1	0.88
Mathematics, Applied Mathematics	16	14.04
Meteorology	1	0.88
Natural Resources	1	0.88
Natural Science	1	0.88
Neuroscience / Psychobiology	2	1.75
Nursing	1	0.88
Pharmacology	1	0.88
Physics	3	2.63
Physiology and Metabolism	1	0.88
Plant and Soil Science (Agronomy)	1	0.88
Psychology	5	4.39
Sociology	1	0.88
Wildlife Management	1	0.88
Zoology	1	0.88

Note. $N = 114$ participants, 18 (15.79%) participants reported multiple majors; therefore, total $N > 114$.

(*n* = 22); regent's (*n* = 3); visiting (*n* = 1), unspecified (*n* = 15). Other titles included: associate dean (*n* = 1); chief of division; director, associate director, or executive director (*n* = 12); academic advisor/instructor (*n* = 1); coordinator, program coordinator, or program manager (*n* = 7); department coordinator or chair (*n* = 2); graduate student (*n* = 8, one master's, three doctoral); postdoctoral fellow (*n* = 4); predoctoral research associate (*n* = 1); one a McNair project assistant (*n* = 1); civil engineer and medical student (*n* = 1); faculty or instructor not otherwise specified (*n* = 6); research specialist, research technician, or science laboratory technician (*n* = 3). The totals do not add up to 117 because some mentors did not indicate their title, and others reported multiple titles.

Study Objectives

The two papers included in this dissertation explore two underlying mechanisms thought to be instrumental in underrepresented minority students' commitment to STEM fields: similarity with faculty mentor and development of identity as a scientist.

In Paper 1, an investigation was conducted into the deep- and surface-level similarities that Native American and Latinx undergraduate STEM majors believe are important in their relationships with mentors. Similarity was measured in a continuous fashion, in contrast to the dichotomous (match or no match) manner used in most of the extant literature. Two scales were developed: Ideal Similarity (capturing the importance students placed on having mentors who were like them) and Perceived Real Similarity (measuring students' perceptions about how similar they actually are with their mentors). Exploratory factor analysis was conducted to identify the dimensions of similarity that

matter most to students in this sample. The extent to which students perceived they were like mentors on the variables that matter most to them was assessed. The research questions were:

1. In the context of a formal research mentoring relationship with a primary investigator or faculty advisor, what are the dimensions of similarity with mentor that matter most to underrepresented minority students in STEM?
2. To what extent are these students like their mentors on the dimensions of similarity that matter most to them?
3. Will a continuous method of measuring mentor-mentee similarity capture mentee perceptions of similarity?
4. Do participants' preferences for similarity with their mentors appear to vary as a function of the strength of their ethnic identity?
5. What is the relationship between similarity with mentors and Commitment to a Science Career?

Paper 2 presents an examination of the patterns of identity development in Native American and Latino undergraduate STEM majors' identity as a scientist, ethnic identity, and intersectional identity as an ethnic minority scientist. The connection between their identity development processes in each of these domains, their confidence as a scientist, and their commitment to careers in STEM was assessed. The approach in this study was an attempt to bridge multidimensional (Latinx + scientist, Native American + scientist), and arguments for an intersectional approach (Native American scientist, Latinx scientist). in the quantitative measurement of identity development, proposing an extension of an existing orthogonal measure, the Multigroup Ethnic Identity Measure-Revised (MEIM-R; Roberts et al., 1999). The proposed study aims to answer the following questions.

1. Can the MEIM-R be adapted to develop a scale measuring Scientist Identity?

2. Can the MEIM-R be adapted to develop a scale measuring Intersectional Identity?

3. How do the orthogonal and intersectional scales compare, when completed by our sample of high-achieving Native American and Latinx undergraduate STEM majors?

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CHAPTER 2

PAPER 1: NATIVE AMERICAN AND LATINX UNDERGRADUATE SCIENCE MAJORS' SIMILARITY WITH MENTORS[1]

Abstract

This paper presents the development of a continuous scale designed to measure high-achieving Latinx and Native American undergraduate science majors' perceptions about the importance of various dimensions of mentor-mentee similarity (termed Ideal Similarity) and their perceived actual similarity with mentors (termed Perceived Real Similarity). The aim was to better understand normative identity development from a strengths-based perspective. Support was found for measuring similarity in a continuous fashion as opposed to dichotomous measurement (i.e., match vs. mismatch). The factor structure derived from exploratory factor analysis in the current study is consistent with Kammeyer-Mueller, Livingston, and Liao's concepts of deep-level similarity and surface-level similarity. Reliability for the subscales in the current study was excellent. Although participants reported valuing Depth Similarity more than Surface Similarity, the two constructs were found to be correlated. The relationship between strength of ethnic identity and mentee preferences for similarity with mentors was examined, revealing that students with higher levels of ethnic group identification more highly valued similarity with their mentors in both Ideal Surface Similarity and Ideal Depth Similarity. Participants in the current study reported levels of both Depth and Surface

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Real Similarity with their mentors that exceeded the level of mentor-mentee similarity they perceived to be ideal, suggesting that in general they were satisfied with the extent to which their mentors were like them.

Review of the Literature

The extant literature on the retention of underrepresented minority students in science majors frequently contains discussion of mentoring. Several studies have demonstrated that Latinx and Native American college students are more likely to persist in education if they have a mentor (Bergstrom, 2009; Bordes & Arredondo, 2005; Bordes-Edgar, Arredondo, Robinson Kurpius, & Rund, 2011; Brandt, 2008; Demert, 2001; Gloria & Robinson Kurpius, 2001; Guillory, 2009; Guillory, & Wolverton, 2008; Jackson, Smith, & Hill, 2003; Torres & Hernandez; 2009-2010). The positive impact of having a mentor is clear, but there is variability in the effectiveness of mentor relationships. One possible contributor to this variability identified in the literature is the degree of similarity between mentors and mentees. It has been argued that students with mentors who are like them have a greater chance of success, but the relationship between similarity and success may depend on how important similarity is to the student. The current study examines Latinx and Native American students' perceived similarity to their mentors, the importance they place on having mentors who are like them, and the domains in which similarity matters most. Current practices in measuring similarity with mentors are discussed, and a new scale is introduced that seeks to capture dimensions of similarity.

Mentoring Theories

Many theories point to the importance of similarity between mentors and mentees. Byrne's (1971) similarity-attraction paradigm asserted that attraction between two people is strengthened by similarity, leading to a greater likelihood of forging a bond. Tajfel (1978) argued that people identify themselves not only according to their individual identities, but also based on group identities, leading to greater attraction toward in-group than toward out-group members. Possible-selves theorists would also predict better outcomes for students who are like their mentors. According to this theory, students benefit from having identity similarity with mentors because their own self-efficacy increases as they experience success vicariously through role models they believe are like them, making their own success seem more likely. Identification with a mentor as a role model may thus be more difficult for Native American and Latinx students in Science, Technology, Engineering, and Mathematics (STEM) because of the lack of available mentors of their same ethnicity (Zirkel, 2002).

According to Blake-Beard, Bayne, Crosby, and Muller (2011), mentees may find greater comfort working with a mentor "who has already solved some of the problems confronting one's own demographic group" (p. 625). The authors also noted that trust may come easier in interactions with people perceived as in-group members versus others. Likewise, Darling, Bogat, Cavell, Murphy, and Sanchez (2006) identified "cultural mistrust" as a potential barrier to developing a strong working alliance, particularly for mentees of color working with white mentors (see also Liang & West, 2007).

Despite the theoretical literature suggesting potential benefits of similarity in mentoring relationships, the empirical literature shows somewhat inconsistent results (Ortiz-Walters & Gilson, 2005; Turban, Dougherty, & Lee, 2002). The importance of similarity is supported in much of the literature on best practices in the retention of Native American college students (Austin, 2005; Bergstrom, 2009; Jackson et al., 2003; Tippeconnic Fox, 2005). On the other hand, some studies have failed to find support for the assertions that having an ethnically similar mentor is associated with more positive outcomes than being mentored by someone of a different ethnicity than one's own (Bordes-Edgar et al., 2011; Rhodes, Reddy, Grossman, & Lee, 2002).

One possible explanation for these inconsistencies could be the diversity within ethnic minority mentees. Darling et al. (2011) cautioned researchers to remember that "within-group differences are often larger than between-group differences," after all. The impact of mentor similarity may vary, for example, based on different expectations and traits of mentees such as the mentee's "salience of ethnicity" (the strength of their ethnic identification; Darling, et al., 2006, p. 768) or the value they place on similarity with their mentors.

Value Mentees Place on Similarity

The extant literature has often contained the embedded assumption that similarity is desirable to all ethnic minority students. Indeed, evidence suggests that young underrepresented minorities often prefer ethnically similar mentors (Blake-Beard et al., 2011; Sanchez & Colón, 2005; Syed, Goza, Chemers, & Zurbriggen, 2012). However, some authors contend that assumptions about mentees' preferences must be examined

through assessment of their actual preferences (Darling et al., 2006; Syed et al., 2012).

There is clear evidence of variability in mentee preferences regarding similarity with their mentors (Phinney, 1990; Syed, Azmitia, & Phinney, 2007). Jackson et al. (2003) reported that participants in their qualitative study of new medical faculty often viewed racial/ethnic differences with their mentors to be a barrier; however, some participants in their study saw differences in race/ethnicity as a potential source of strength because of their ability to broaden the perspectives and experiences of mentor and mentee alike.

Some studies have found that the impact of ethnic similarity varies as a function of mentee preference for same-ethnicity mentors (Rhodes et al., 2002). Indeed, Syed et al. (2012) examined the importance that adolescents at a 4-week residential science education program placed on being paired with ethnically similar mentors. They found that the impact of ethnic similarity varies as a function of the importance that adolescents placed on similarity with mentors on this dimension. Increased contact with ethnically-similar mentors was associated with increased self-efficacy, identity, and commitment; particularly in those adolescents who placed greater importance on similarity. However, the results of at least one other study suggest that the impact of similarity may not depend on mentees' preferences (Blake-Beard et al., 2011). More research is needed to clarify how important similarity with their mentors is to mentees, and what dimensions of similarity are the most highly valued.

Dimensions of Similarity

Harrison, Price, and Bell (1998) considered mentor-protégé similarity along two

dimensions: “surface-level” and “deep-level” similarity. Surface-level similarity refers to similarities such as gender and race, which are often readily apparent. Diversified Mentorship Theory (Ragins, 1997) argued that differences in demographic characteristics may contribute to a greater likelihood of social categorization, leading to more negative relationship outcomes. However, Harrison and colleagues countered that these surface-level characteristics will decrease in importance as relationships develop. In time, the authors posited, deep-level similarities will come to the forefront and be more predictive of outcomes. Kammeyer-Mueller, Livingston, and Liao (2011) argued that “the two levels of diversity are not separate from one another, with similarity in surface characteristics serving as the backdrop to perceptions of deeper similarities.”

Surface-level dimensions of similarity. By far, the most researched “surface-level” dimension of identity similarity in the extant literature is gender. In a study on mentor-protégé similarity in the workplace, Turban et al. (2002) found that gender similarity was associated with more support received early on in mentoring relationships (though the reverse was true later in mentoring relationships). Other studies have similarly demonstrated benefits of gender similarity (Bozeman & Feeney, 2008; Foley, Linnehan, Greenhaus, & Weer, 2006). However, Ensher, Grant-Vallone, and Marelich (2002) found that gender similarity was related to decreased psychosocial support and unrelated to vocational support or role modeling. Several other studies have likewise found no benefit in mentor-mentee gender similarity (Sosik & Godshalk, 2000; Ugrin, Odom, & Pearson, 2008), and sometimes even benefits from dissimilarity (Downing, Crosby, & Blake-Beard, 2005).

The second most researched "surface-level" dimension of similarity is race/ethnicity. Ensher, Grant-Vallone, and Marelich (2002) found that racial similarity or dissimilarity did not seem to impact the psychosocial, vocational, or role-modeling support mentees received. Others have found that dissimilar cultural identities may negatively impact mentees' experience of the mentoring relationship (Jackson et al., 2003; Liang, Tracy, Kauh, Taylor, & Williams, 2006; Santos & Reigadas, 2002). Racial/ethnic differences may be a barrier to developing strong mentor-mentee relationships. In contrast, Dreher and Cox (1996) argued that ethnic minority mentees may benefit from having white mentors because those white mentors may have greater access to networks of power that can further their mentee's careers. In fact, the American Association of State Colleges and Universities (2005) identified lower cultural capital as one potential contributor to underrepresented minorities' lack of enrollment and persistence in STEM fields. It may be that connections with mentors who possess greater cultural capital is a boon to these students.

In addition to the mixed results on the effects of gender and ethnic similarity, another consideration is the impact of other dimensions of similarity. Even with similarity being always preferable, some research suggests that, in cases where ethnic and/or gender similarity is not feasible, similarity on other dimensions of identity can have an impact. In their review of the literature, Liang and West (2007) point to "shared interests" and "geographic proximity" as possible influences (p. 4). The potential impact of dimensions of similarity aside from race/ethnicity and gender have less often been explored in the extant literature.

Deep-level dimensions of similarity. When it comes to what Harrison et al. (1998) would call "deep-level similarity," some authors have reported a stronger association with outcomes than is found with "surface-level," immediately recognizable forms of similarity. Neilson, Pate, and Eisenbach (2003) found that values and attitudes were more strongly associated with the quality of mentoring relationships than were demographic factors (see also Grossman & Rhodes, 2002). The literature on retention of Native American students suggests that certain mentor personality traits and attitudes can contribute to better success of mentoring relationships, namely: respecting individuals from other cultures (Austin, 2005), perspective taking, and openness to learning from others (Anagnopoulos, 2006); flexibility (Bergstrom, 2009); and sense of humor and tolerance for ambiguity (Anagnopoulos, 2006). Kammeyer-Mueller et al. (2011) found that deep-level characteristics such as introversion-extroversion were more predictive than surface-level characteristics such as age in determining the success of mentoring relationships. In a similar vein, Bozeman and Feeney (2008) suggested that an overall "goodness of fit" (the similarity between mentors' and mentees' personalities, abilities, and needs) may be the best way to understand what makes for a strong working alliance.

Several studies have identified relational components of mentoring style that impact outcomes regardless of ethnic similarity, namely: mutual engagement, authenticity, empowerment, and conflict resolution (Diversi & Mecham, 2005; Liang, Tracy, Taylor, & Williams, 2002; Liang & West, 2007; Spencer, Jordan, & Sazama, 2004). Jackson et al. (2003) referred to these deep-level similarities as "chemistry." The authors found that similar interests and ideals were perceived by new medical faculty as

important components of their relationships with their mentors.

In line with Bozeman and Feeney's goodness-of-fit model, mentee traits, behaviors, and needs may also impact the relationship. Liang and West (2007) pointed out that mentees' communication styles, social cues, and the manner in which they display taking initiative may all vary according to cultural values and identification. The authors contended that mentoring can succeed despite such differences if the mentor has adequate cultural sensitivity, and the mentee feels comfortable that their mentor respects their background (Liang & West, 2007). An example of the impact of culturally sensitive mentoring can be seen in a study by Cohen, Steele, and Ross (1999). In the White mentor/African American mentee dyads in this study, the manner in which feedback was delivered impacted mentees' feelings of closeness with their mentors, as well the effectiveness of the mentoring relationship.

Dichotomous Versus Continuous Measurement of Similarity

Several studies in the extant literature examine the impact of similarity between mentors and mentees. In these studies, similarity is coded as a dichotomous variable (match or no match). Conceptualizing similarity in this way may fail to capture nuances of identity, resulting in an oversimplification of the lived of experience of being similar or dissimilar to a mentor. The present study therefore seeks to build on previous work by measuring multiple dimensions of perceived similarity in a continuous rather than dichotomous fashion.

A continuous approach to measuring gender similarity in particular is consistent

with non-dichotomous conceptions of gender, often referred to as nonbinary in the Queer Theory literature. Burdge (2007) argued that social workers "should reject a dichotomous understanding of gender in favor of more accurate and affirming conceptualizations of gender." Likewise, Ansara and Hegarty (2014) advocated for research methodologies that avoid perpetuating cisgenderism: a system of oppression based on the assumptions that there are two genders (male and female) and to be 'normal' means to identify with the same label (male or female) assigned at birth. A study by Ansara and Hagarty (2012) found that researchers in mental health fields are significantly more likely to use cisgenderist language than other researchers. The authors asserted there is a pervasive problem with cisgenderism in the field of psychology that must be addressed. Coding gender similarity continuously allows for more nuance, asking mentees to indicate the degree to which their mentors are like them, as opposed to simply indicating match or no match.

Coding ethnic similarity with mentors in a continuous fashion may likewise be a more culturally sensitive and nuanced way of capturing the experiences of mentees, especially Native American and Latinx students. A great deal of diversity exists within these groups which sometimes is not explicitly acknowledged or examined in literature. For example, in a dichotomous coding scheme, a Puerto Rican student being mentored by a Mexican American professor might be considered ethnically matched on the basis that both are Latinx. However, the degree of similarity is not the same as it would be if the mentor was Puerto Rican. Furthermore, even if both mentor and mentee are Puerto Rican, if one has indigenous roots and the other does not, considering this a "match" may not be

true to the mentee's experience. As Trimble (2005) explained, using overly broad categorizations to describe ethnocultural groups constitutes ethnic gloss.

The complex history of colonization also makes identity very complex for many Native American and Latinx peoples. Consider the case of a Tohono O'odham student raised in the U.S. Their traditional lands have been split down the center by the colonial border between the U.S. and Mexico. If their mentor is Lakota Sioux, are they matched? If their mentor is Nahuatl (a different indigenous Mexican tribe) are they matched? If their mentor is a Mexican immigrant whose first language is Spanish are they matched? What if that professor's phenotypical appearance suggests Mestizo heritage, but the professor does not ever discuss with the student whether they consider themselves indigenous? Are they matched? Perhaps they would (if pressed to give a dichotomous response) indicate match with all three, but would subjectively feel more closely matched with the Nahuatl mentor than the other two. And if a researcher was coding them as matched or not matched, would the researcher know, based on demographic data collection, the complex reality of this person's experience of match? It seems unlikely.

In reality, the extent to which this student experiences similarity with their mentor may depend on the strength of their own ethnic identity, their enculturation in Tohono O'odham culture and their acculturation in U.S. culture. The degree to which they experience similarity could be influenced by whether they grew up in the Sonoran Desert or off-reservation in a city. It could be impacted by their knowledge of their own history, their political views about colonization and immigration, and more (see Miller, 2006). Many Southwest tribes have complex histories related to the colonial border with

Mexico. The Navajo/Diné clan system even includes a clan called Naakaii Dine'é (the Mexican Clan; Lyon, 2000). Thus, coding similarity dichotomously would fail to capture these nuances. Furthermore, in the case where a researcher determines match or no match, it may not make room for the subjectivity of the students' own assessment.

Another complication arises in the case of multiethnic mentees and mentors. Coding ethnic similarity as "match" or "no match" may result in erasure of the experience of multiracial individuals, a growing demographic in U.S. society (Qian & Lichter, 2011). This is especially problematic for Native American participants. The complex history of colonization, genocide, and interracial marriage for indigenous peoples has resulted in a large proportion of Native Americans being multiracial, and often Native Americans' own reporting of their ethnicity varies even for the same person over time and across different demographic data collection strategies (Liebler et al., 2016). Coding similarity as matched or not matched may not be reflective of the actual degree of similarity these individuals experience in the mentor-mentee dyad. Would a multiracial (Ojibwe Native American and White) mentee be considered matched with a White mentor? Would they be considered matched with a full-blood Navajo/Diné mentor? Or would they have to be with a multiracial mentor whose identities are specifically Native American and White? What about a multiracial mentor who is Native American, but not White? Measuring similarity in a continuous fashion allows for any of these possibilities and incorporates the subjectivities of the mentee. This method of measurement does not necessarily exclude those who conceptualize similarity more dichotomously. Mentees who perceive similarity with their mentors more dichotomously

could indicate that using the extreme ends of the scale to indicate total similarity or total dissimilarity.

The current study included an investigation into the deep- and surface-level similarities that Native American and Latinx undergraduate STEM majors believe are important in their relationships with mentors, and measures similarity in a continuous fashion for all the reasons described above. The research questions were as follows.

1. In the context of a formal research mentoring relationship with a primary investigator or faculty advisor, what are the dimensions of similarity with mentor that matter most to underrepresented minority students in STEM?
2. To what extent are these students like their mentors on the dimensions of similarity that matter most to them?
3. Will a continuous method of measuring mentor-mentee similarity capture mentee perceptions of similarity?
4. Do participants' preferences for similarity with their mentors appear to vary as a function of the strength of their ethnic identity?

Methods

The current study is an analysis of extant data collected as part of a larger national longitudinal study of underrepresented minority (URM) undergraduate science majors' mentoring experiences and sources of self-efficacy. The research was funded by a Minority Supplement to National Institute of General Medical Science Grant #2R01GM071935-05 awarded to Martin Chemers, Principal Investigator.

Procedures

Participants were a national sample of underrepresented minority students recruited from a database of undergraduate students who had attended the 2011 SACNAS

(Society for the Advancement of Chicanos and Native Americans in Science) national conference. Students in the database were sent an email invitation explaining the purpose of the project to "help us learn about the 'active ingredients' that support science students most effectively." Those who elected to participate were sent a link to the informed consent (see Appendix A for initial informed consent, and Appendix B for the follow-up informed consent) and survey via email. They completed a series of online surveys at six time-points across two years (thrice per year). The survey took approximately 30 minutes to complete, and participants received a $50 gift certificate each year they participated in the study. Analyses for the current study are derived from data drawn at Time 4. The research was approved by the Institutional Review Board at the University of California - Santa Cruz, and the subsequent data analyses conducted for this research project were also approved by the Institutional Review Board at Utah State University.

Participants

The total number of participants recruited was $n = 189$; however, the analyses for the present study focus only on the 113 participants who identified as Native American/ Native Alaskan/First Nations/Indigenous ($n = 28$, 24.8%) and Latinx/Chicano/Hispanic students ($n = 105$, 92.9%). These totals add up to more than 100% because some participants indicated belonging to two or more of these groups ($n = 14$, 12.4%). Among these participants, 67 (59.3%) selected female and 46 selected male (40.7%). Their ages ranged from 18-51 at Time 1 (Mean = 22.81, $SD = 5.43$). Participants' class ranks at Time 1 were: Freshman $n = 1$, 0.9%; Sophomore $n = 13$, 9.8%; Junior $n = 37$, 32.7%, Senior $n = 60$, 53.1%, and Other $n = 2$, 1.8%. Of the two participants whose class level

was “Other,” one had graduated and one was in a post-baccalaureate program. They came from a variety of majors, all in STEM, and a variety of institutions across the U.S. including Puerto Rico. All of the 113 Native American and Latinx participants completed at least some of the survey at Times 4, 5, and 6.

Measures

Ideal and perceived real similarity. A two-part measure was developed for the study incorporating 54 items related to various dimensions of similarity between mentors and mentees, as perceived by mentees. Items were developed based on several sources of information, including a review of the literature on mentoring Native American and Latinx students and information obtained in interviews during earlier waves of the larger longitudinal study. Twenty-seven of these items asked about how important students perceived similarity to be (Ideal Similarity), and 27 items inquired about the students’ actual similarity with their mentor, along the same dimensions (Perceived Real Similarity). The scale was administered to survey participants at Time 4 in the longitudinal study described above. The dimensions assessed included: gender, ethnicity, urban/rural background, cultural values, communication styles, and values about science. Students were asked to indicate the extent to which they believe it is important to have formal research mentors who are like them on each of these dimensions. They responded on an 11-point Likert-type scale where 0 = Not at all important, 10 = Extremely important. In one item, they also reported globally on how important it is, overall, that they are similar with their mentor.

The Revised Multigroup Ethnic Identity Measure. The revised Multigroup

Ethnic Identity Measure (MEIM-R; Roberts et al., 1999) is a designed to measure the level of identification with one's own group. Prior research has established psychometric properties across a variety of ethnic groups (Ponterotto, Gretchen, Utsey, Stracuzzie, & Saya, 2003). Two subscales, exploration and commitment, compose the scale. All questions are measured on a 4-point Likert-type scale where 4 = strongly agree, and 1 = strongly disagree. The scale may be scored by calculating an average for each subscale separately, or averaging responses on all items for a total scale score (Phinney & Ong, 2007; Roberts et al., 1999). Internal consistency for each subscale has been found to be excellent for high school and college-age students. Coefficient alphas range from .81 (Goodstein & Ponterotto, 1997; Phinney, 1992) to .92 (Taub, 1995). Reliabilities in the current study were good to excellent (α = .914 for commitment; α = .809 for affirmation/ belonging; α = .900 for the total MEIM-R score). Participants in the current study completed this scale at Time 5.

Results

The first set of analyses focused on the ideal similarity items, examining the pattern of preferences participants held regarding similarity with mentors. The product of those analyses was a scale (Ideal Similarity) composed of two factors (Ideal Surface Similarity and Ideal Depth Similarity) measuring the importance of mentor-mentee similarity. The structure derived from these analyses (see Table 2.1) was also applied to the perceived real similarity items to enable measurement of Perceived Real Similarity on each factor derived from the Ideal Similarity factor analysis.

Table 2.1

Principle Components Analysis with Direct Oblimin Rotation, Extracting 2 Factors: Ideal Similarity with Mentor Subscales Conducted On Original Data Set Before Imputation

Scale items	Factor 1 loadings	Factor 2 loadings
Depth Similarity (Factor 1)		
▪ Our thoughts about how to show respect	.704	-.156
▪ Our level of flexibility in exploring career options/ fields of study	.803	.003
▪ Our use of eye contact in communication	.867	-.183
▪ Our level of flexibility in exploring different methodologies	.849	-.079
▪ Our ideas about how I should show enthusiasm for the work I do	.866	-.034
▪ How much we talk (e.g. quiet or talk a lot)	.634	.028
▪ The vocabulary we use	.693	-.039
▪ Our thoughts about how close, or personal, the relationships between students and mentors should be	.637	.147
▪ Our values about the importance of family	.534	.236
▪ Our comfort or discomfort with physical closeness or physical contact	.833	-.119
▪ Our expectations or values about how much I should compete or cooperate with my peers	.679	.159
▪ Our reasons for pursuing a career in science	.497	.246
▪ Our thoughts about when or how I (or my family) should be praised for the work I do	.672	.262
Surface Similarity (Factor 2)		
▪ How important it is for me to live out the traditions of my culture	.080	.703
▪ Our ethnicity	-.059	.886
▪ How long we, or our families, have been in the United States	.129	.643
▪ Our family history in higher education	.005	.828
▪ The type of community we grew up in	-.002	.832
▪ The holidays we observe	.105	.725
▪ Our biological sex	-.150	.862
▪ Our masculinity/femininity	-.165	.809
▪ Our sexual orientation	-.047	.736
Eliminated		
▪ Our openness to learning about other cultures	.348	.328
▪ Our knowledge about diversity and culture	.417	.352
▪ The language(s) we speak	.285	.245
▪ Our thoughts about the importance of considering family, tribe, and/or community's needs in schooling and/or career decisions	.288	.549
▪ Our values about the importance of participating in traditional ceremonies and/or spiritual/religious practices from my culture	.327	.471

Missing Data Analysis: Ideal Similarity

A missing data analysis was conducted to measure the extent and patterns of missing data. The overall summary of missing values indicated 0% of variables, 34.21% of cases, and 8.51% of values had incomplete data. Little's Missing Completely at Random (MCAR) test was conducted and indicated that the Importance of Similarity items were indeed missing at random, χ^2 (635) = 670.809, p = .157. Multiple imputation was then conducted, resulting in five imputed data sets to be compared in subsequent analyses.

Item-Level Descriptive Statistics: Ideal Similarity

Frequency charts and histograms were produced from the original, non-imputed data set to determine whether participants utilized the full 0-10 scale on each item. The full scale was utilized for every item, providing support for the assertion that a continuous method of measurement may be better able to capture students' lived experiences than a dichotomous conception of match. Using SPSS, means and standard deviations were calculated to explore patterns in the individual dimensions of similarity valued by participants (see Table 2.2). Pooled means were also calculated based on the five imputed datasets. Those means were nearly identical to means based on the original dataset, and are therefore not reported.

Exploratory Factor Analysis and Reliability Analysis: Ideal Similarity

Prior to conducting exploratory factor analysis, parallel analysis (Monte Carlo

Table 2.2

Assessment of Reliability, Normality, and Descriptive Statistics: Ideal and Perceived Real Similarity with Mentor

	Ideal			Perceived real			Perceived real x ideal correlations	
Scale items	*N*	Mean	*SD*	*N*	Mean	*SD*	Pearson's	Spearman's
Depth similarity (Factor 1), 13 items								
1. Our thoughts about how to show respect	106	8.15	2.62	93	8.59	2.42	.092	.388***
2. Our level of flexibility in exploring career options/fields of study	106	7.53	2.96	87	8.38	1.95	-.007	.065
3. Our use of eye contact in communication	106	7.31	3.13	104	8.61	2.35	.118	.256**
4. Our level of flexibility in exploring different methodologies	106	7.20	3.06	91	8.29	2.14	-.114	.039
5. Our ideas about how I should show enthusiasm for the work I do	100	6.97	3.31	94	8.61	2.09	-.022	.219*
6. How much we talk (e.g., quiet or talk a lot)	108	6.83	3.17	102	7.86	2.37	-.105	.050
7. The vocabulary we use	108	6.60	3.10	105	7.16	2.58	.030	.147
8. Our thoughts about how close, or personal, the relationships between students and mentors should be	103	6.52	3.35	86	8.26	2.22	.166	.213
9. Our values about the importance of family	106	6.42	3.69	78	8.12	2.35	.203	.147
10. Our comfort or discomfort with physical closeness or physical contact	104	6.39	3.45	75	7.83	2.44	.006	.061
11. Our expectations…compete/cooperate	101	6.33	3.48	95	8.18	2.07	.140	.263*
12. Our reasons for pursuing a career in science	106	6.06	3.59	84	7.51	2.61	-.019	.049
13. Our thoughts about when or how I (or my family) should be praised for the work I do	99	5.57	3.67	70	7.83	2.72	.132	.193
Cronbach's alpha		α = .923			α = .960			
Scale Mean (*SD*)		6.72 (2.35)			8.02 (.186)			
Skewness (SE)		-.921 (.240)			-1.89 (.233)			
Kurtosis (SE)		.375 (.476)			4.88 (4.61)			

(*table continues*)

	Ideal			Perceived real			Perceived real x ideal correlations	
Scale items	*N*	Mean	*SD*	*N*	Mean	*SD*	Pearson's	Spearman's
Surface similarity (Factor 2), 9 items								
1. How important it is for me to live out the traditions of my culture	101	4.14	3.80	75	5.45	3.77	.087	.097
2. Our ethnicity	107	3.16	3.66	103	3.25	3.98	.151	.153
3. How long we, or our families, have been in the United States	103	3.06	3.60	73	4.23	4.18	.275*	.253*
4. Our family history in higher education	105	3.01	3.56	67	4.13	3.93	.271*	.279*
5. The type of community we grew up in	105	2.93	3.52	78	4.65	3.73	.122	.119
6. The holidays we observe	103	2.60	3.34	80	6.61	3.22	-.036	-.082
7. Our biological sex	103	2.29	3.33	103	5.46	4.85	.167	.081
8. Our masculinity/femininity	103	2.26	3.30	94	5.21	4.14	.200	.188
9. Our sexual orientation	103	1.72	2.90	88	6.76	4.37	.071	-.007
Cronbach's alpha			α = .914			α = .883		
Scale Mean (*SD*)			2.80 (2.69)			5.06 (2.73)		
Skewness (SE)			.850 (.236)			.083 (.247)		
Kurtosis (SE)			-.196 (.467)			-.896 (.490)		

* $p < .05$
** $p < .01$
*** $p < .001$

Simulation) was conducted using the SPSS syntax developed by O'Connor (2000) to determine the number of factors to extract. Because this analysis is not designed to work with imputed data sets, only the original data set was used for this step. The parallel analysis indicated that two factors could reliably be extracted.

Next, principal components analysis (PCA) was performed on all five imputed datasets as well as the original data. The results were generally consistent across imputations. Given this consistency and the result of Little's MCAR test suggesting a random pattern of missing data, only the results drawn from the original data set are presented in Table 2.1. Two factors were extracted and Direct Oblimin rotation with Kaiser Normalization was used to group the dimensions of similarity into meaningful composite scales. The determinants of all five imputations and the original data set indicated the absence of multicollinearity (ranging from 2.58E-012 to 5.68E-010). The Kaiser-Meyer-Olkin measure of sampling adequacy ranged from .773 (original data) to .821 (imputations #1 and #4), all exceeding the recommended value of .6. Bartlett's test of sphericity was significant for the original, $\chi^2 (351) = 1712.191$, $p < .001$, and all imputations. All diagonals of the anti-image correlation matrix were over .5 for all imputations and the original data (ranging from .597 to .881 for the original dataset). Communalities were above .3 across all imputations and the original dataset for all items except "The languages we speak," supporting the inclusion of each item except "The languages we speak" in the factor analysis. Since this item was relatively high on the list of valued dimensions of similarity ($M = 5.85$ for original data set, $M = 5.86$ for pooled imputations), it was retained in the factor analysis and reliability analyses were later

conducted to examine the impact of retaining or removing the item.

The initial eigenvalues showed that: the first factor explained 40.194% of the variance, the second factor 14.049% of the variance, the 3rd through 27th factors explaining between .129% and 7.380%. The two-factor solution (explaining a cumulative 54.243% of the variance) was preferred, according to the parallel analysis indicating two factors. A cutoff of .4 or above was used for primary factor loadings, while a secondary loading of .3 or above was considered cross-loaded. In the oblimin rotation for the original data set most items loaded cleanly onto one factor and demonstrated primary loadings above .5; except four items, discussed below.

One item failed to load on either factor ("The languages we speak"). As mentioned above, the same item had produced a low communality (.198), supporting the elimination of this item, so it was considered for elimination. However, factor loadings observed in the factor analysis of five imputed datasets suggested it may load significantly onto factor 2 (this is discussed in more detail below), so it was not yet eliminated at this step.

Three items demonstrated cross-loading (with secondary loadings at or above .3) and were eliminated: "Our openness to learning about other cultures" (factor 1 = .348 and factor 2 = .328); "Our knowledge about diversity and culture" (factor 1 = .417 and factor 2 = .352); and finally "Our values about the importance of participating in ceremonies and/or spiritual/religious practices from my culture" (factor 1 = .327 and factor 2 = .471). In total, three items were eliminated at this step, leaving 13 items in factor 1 and 11 items in factor 2.

Factor Loading Comparisons with Imputed Datasets: Ideal Similarity

The pattern of factor loadings observed in analyses of the original dataset were then compared with factor loadings obtained using the five imputed datasets. Without exception, factor 1 loadings were consistent with the original data set for imputations 1 and 2.

Imputations 3 and 4 were also largely consistent with loadings in the original dataset, with a few exceptions. These imputations generated cross-loading for the item "Our thoughts about the importance of considering family, community, and/or tribe in career decisions," though this item demonstrated a clean loading on factor 2 in the original dataset. From a theoretical perspective, it would seem this item should load onto factor 1, which was composed of depth similarity items (e.g., value and attitudes) while factor 2 was composed of surface similarity items (e.g., demographic characteristics). Given the cross-loading demonstrated in two of the five imputed datasets, and the predicted relationship from a theoretical perspective, this item was considered for exclusion from factor 2 despite its strong loading based on the original data set (.549). Reliability analyses were performed including the item (α = .913) and excluding the item (α =.914) and the item was ultimately eliminated.

In imputation #5, eight of the thirteen Factor 1 items also loaded significantly onto Factor 2 and all 27 items loaded significantly onto Factor 1. This was a strong contrast to the other four imputations, in which Factor 2 loadings were consistent with the original data set. Given the agreement of the other four imputations with the original dataset, the two-factor structure was preserved.

Cross-loaded items were generally consistent across all imputations with a few exceptions. On imputation #1 and imputation #2, the item "Our values about the importance of participating in ceremonies and/or spiritual/religious practices from my culture" loaded onto factor 2, but not factor 1. In imputation #2 and imputation #3, the item "Openness to learning about other cultures" loaded significantly onto factor 1, but not factor 2. These cross-loaded items were eliminated in the previous step, and were still excluded after review of the factor analysis results obtained using imputed datasets.

The item that failed to load for the original data set ("The languages we speak") loaded significantly onto Factor 1 in one imputation: imputation #5) and onto factor 2 in four of the five imputed data sets (all but imputation #5). This item was evaluated for possible inclusion in factor 2 through reliability analyses with and without the inclusion of the item. The factor performed better when the item was excluded (α= .914) than when it was included (α = .904), so it was eliminated.

Ultimately, factor 1 consisted of 13 items and had a Cronbach's alpha of α= .923 (see Table 2.2). Factor 2 contained nine items and Cronbach's alpha was α= .914 (see Table 2.2). From a theoretical perspective, the items on the factors aligned nicely with Harrison et al.'s (1998) description of "deep-level" and "surface-level" similarity; thus, Factor 1 was named Depth Similarity and Factor 2 was named Surface Similarity.

Comparing the Depth and Surface Similarity: Dimensions of Ideal Similarity with Mentor

Composite scores were generated for each factor by calculating a mean of all the items contained in the factor. For the original data set in which a significant number of

participants failed to respond to at least one item, the mean score of all the items they did respond to was calculated provided they answered ten out of the thirteen items on Factor 1, and five out of the nine items on Factor 2. Higher scores are indicative of greater value placed on these dimensions of mentor similarity. Descriptive statistics including means, standard deviations, skewness, and kurtosis were calculated using both the original and imputed datasets. The results were consistent across all imputations; thus, only the results obtained from the original dataset are presented in Table 2.2. Depth Similarity (factor 1) demonstrated significant negative skewness, while kurtosis fell within the acceptable range. Factor 2 (Surface Similarity) was positively skewed, while its kurtosis value suggested acceptable centrality.

A paired samples *t* test was conducted on the original dataset to examine whether participants reported higher importance of one factor over the other. The results indicated a significant difference, $t(101) = 15.104$, $p < .001$ (see Table 2.2 for means and standard deviations). The Depth Similarity items that comprised factor 1 were significantly more valued by participants than the Surface Similarity items in Factor 2.

Measuring Perceived Real Similarity

The next series of analyses focused on Perceived Real Similarity: the extent to which participants viewed themselves as being like their mentors as opposed to how much they desired to have mentors who were like them. Notably, the number of missing data points for Perceived Real Similarity was much greater than for Ideal Similarity. This is not surprising, as some participants may not have all the information about their mentors' identities or values and thus would be unable to respond to Perceived Real

Similarity items, but could still provide a rating of how important such similarity with their mentors is for them. Participants utilized all or most of the 0- to 10\-point scale on every item.

Composite scores were generated for Perceived Real Similarity following the same procedures used in developing Ideal Similarity subscale composite scores. The Depth Similarity subscale (Factor 1) demonstrated significant negative skewness (-1.89, *SE* = .233). The kurtosis value obtained indicated a lack of centrality (4.88, *SE* = .461). Visual inspection of the data plotted on a histogram showed a peak at 10 (on the scale of 1-10) and a clear negative skew, suggesting participants perceived their mentors to be very much like them on depth similarity items. In contrast, the Surface Similarity subscale demonstrated no significant skewness (.083, *SE* = .247) and the obtained kurtosis value indicated acceptable centrality (-.896, *SE* = .490). Taken together with visual inspection of the histogram, these results suggest that participants' perceptions of similarity with mentors on surface-level dimensions of similarity was more normally distributed.

The relationship between Perceived Real Surface Similarity and Perceived Real Depth Similarity was also tested by calculating the bivariate correlation between the scale scores. A significant relationship was observed between these two types of similarity, r = .334, p = .001.

Comparing Perceived Real and Ideal Similarity

To better understand the relationship between perceived real and ideal similarity some item-level analyses were conducted. Means were compared (see Table 2.2),

revealing that participants consistently rated their perceived real similarity with mentors higher than their ideal similarity. A paired samples *t* test was conducted on the original dataset to examine whether there were significant differences in the dimensions of match participants valued, and the dimensions on which they believed they and their mentors were well matched. The results indicated a significant difference in Depth Similarity, $t(97) = 4.062$, $p < .001$ with participants reporting greater similarity with their mentors than they thought was necessary for them to succeed (see Table 2.2 for means and standard deviations). Likewise, participants reported significantly greater perceived real similarity than ideal similarity when it came to Surface Dimensions of similarity as well, $t(88) = 5.541$, $p < .001$. The items on which they perceived the least similarity were generally the same items they rated lowest in terms of importance; however, a series of bivariate parametric and non-parametric correlations revealed very few significant correlations between ideal and perceived real similarity items (see Table 2.2).

Relationship of Similarity with Ethnic Identity (MEIM-R)

A series of bivariate correlations was conducted to assess whether there was any relationship between the strength of ethnic identification (as measured by the MEIM-R completed at time 5) and the value mentees placed on similarity (as measured by Ideal Similarity at time 4). Higher scores on the MEIM-R were associated with higher scores on Ideal Surface Similarity for each subscale (for Commitment $r = .203$, $p = .04$ and for Exploration $r = .302$, $p = .002$) and the total score ($r = .289$, $p = .003$). Ideal Depth Similarity was likewise related to ethnic identity, with higher MEIM-R Exploration ($r =$

.203, $p = .046$) and total score ($r = .206$, $p = .043$) demonstrating significant positive correlations. MEIM-R Commitment, however, was not linked with Ideal Depth Similarity ($r = .128$, $p = .207$). Bivariate correlations were also calculated for Perceived Real Similarity, but no significant correlations were observed (p values ranged from .412 to .792).

Discussion

Our first research question centered on the dimensions of similarity with mentor that matter most to underrepresented minority students in STEM. The results suggest that students believe the most important dimensions of similarity are those referred to by Harrison et al. (1998) as "deep-level similarity." They prefer mentors to be like them in values and interpersonal style. This mattered more to these students than being similar in ethnicity, gender, and other demographic characteristics. This does not necessarily mean that similarity in demographics is not desirable, just that other compatibility factors that may influence interpersonal interactions were viewed as more crucial. Recall that Kammeyer-Mueller et al. (2011) argued that deep-level and surface-level similarity are not orthogonal constructs, but rather interrelated. We found support for this argument, as the Depth Similarity and Surface Similarity subscales of the Perceived Real Similarity measure were highly correlated. It may well be that when mentors and mentees are similar in demographic characteristics, they are more likely to be similar in what Harrison et al. termed "deep-level similarity."

The fact that students so highly valued interpersonal factors lends support for the

suggestion by Liang and West (2007) that culturally different mentors can still develop effective relationships with mentees if they behave in culturally competent ways. Liang and West contended that students have expectations for the way authority figures like professors and mentors will interact with them, and these expectations are based in the students' cultural mores for interaction in hierarchical relationships. That may be what is captured by these students' assessment of the importance of deep-level similarity. A clear implication is that mentors can enhance mentees' perceptions of similarity by paying attention to mentees' attitudes, interaction styles, and values and doing their best to provide interactions that honor mentees' ways of being in relation to others. Some authors assert that cultural competence training for mentors will better enable them to behave in these culturally compatible ways with mentees whose identities are different from their own (Rhodes, Reddy, Grossman, & Lee, 2002; Sanchez & Colón, 2005). Whether cultural competence training is more important for ethnically different mentor-mentee dyads than for similar dyads cannot be empirically evaluated from the results of this study, but it certainly makes sense from a theoretical perspective.

It is also important to note that the factors derived from our study clarified and distinguished the dimensions of similarity that students believed were important; it did not include any measure of whether this similarity impacted actual outcomes. In future work, we plan to examine the relationship between similarity on these dimensions and outcomes for students, using the importance students place on such similarity as a mediating variable.

The current analyses examined only mentee preference, which may not be the

only potential mediator influencing the impact of similarity on outcomes. In addition to mentee preference, some theorists contend that mentor preference for similarity may impact outcomes for mentees. Ensher et al. (2002) argued that leader-member exchange theory (LMX; Graen & Scandura, 1987; Graen & Uhl-Bien, 1995) would predict that mentors favor protégés who are more like them (viewing them as ingroup members) over those who are dissimilar, which may improve outcomes for protégés who are more like their mentors. More research is needed to evaluate the patterns of mentor preferences, and the influence they have over mentee outcomes. Another construct that may come into play in determining what matters to mentees is their own ethnic identification. The current study did not explore the relationship between ethnic identity, enculturation, or acculturation and the dimensions of similarity that students value. Future studies would benefit from including other student characteristics, such as ethnic identification, in models assessing mentoring values.

When it comes to the measurement of similarity on a dichotomous versus continuous scale, we found some support for our assertion that a continuous method of measurement may be appropriate. Participants utilized all or most of the 0-10 scale for every item. A few items (biological sex, sexual orientation, and ethnicity) heavily favored the extreme ends; but even on those items, some respondents selected more central values and most items showed a fair amount of variability. A continuous method of measurement still allows for participants to take a more dichotomous (match or no match) view of the variables simply by utilizing the extreme ends of the scale. The pattern of responses on biological sex, for example, suggests that when students naturally

viewed items as a match vs. no-match scenario, they favor the extreme ends. This was not the pattern of responses provided for most items. It should be noted that participants were not directly queried about the appropriateness of this method of measuring their experience of similarity or dissimilarity, so the conclusion remains tentative. It would be worthwhile to conduct a qualitative study or focus group to get a better sense of the range of mentee reactions to using a continuous measure versus a dichotomous measure. More research should be done to confirm these findings but based on this study it seems like a reasonable approach.

Our next research question focused on the extent to which mentees in this study perceived they were like their mentors on the dimensions of similarity that matter most to them. The mentees in our sample consistently rated their perceived real similarity with mentors higher than their ideal similarity with mentors, suggesting they are more than satisfied with the extent to which they are like and not like their mentors. Based on examination of the means for each item, it seemed that participants rated their perceived similarity higher on items that they also rated as high in importance. This raised a question about whether participants rated dimensions of similarity as important or not based on the extent to which they experienced similarity mentors on those dimensions (or vice versa). A series of bivariate correlations showed very few statistically significant relationships between perceived real and ideal ratings, suggesting the independence of these constructs in the experiences of these mentees.

We also examined the relationships among various dimensions of similarity and strength of ethnic identity. Recall that assertions have been made in the extant literature

that the "salience of ethnicity" (Darling et al., 2006, p. 768) may play a role in mentee preferences regarding similarity with mentors. We found support for this assertion, in that our participants' strength of ethnic identification did appear to be related to their preferences for both surface and depth similarity, but not with their ratings of the actual similarity they perceive that they share with their mentors. Since the ethnic identity measure was completed at Time 5 and the similarity measure completed at Time 4, we cannot conclude that ethnic identity influenced preferences, but it is clear that the two are linked for participants in the current study.

Some limitations in demographic data collection strategies should be noted. As discussed in this paper, the field of psychology has often been at fault for perpetuating cisgenderism in research methods. While the continuous measurement of gender similarity may have been a less cisgenderist approach to measurement, demographic data collection measured gender as a binary. This is problematic, and future studies should take care to be more inclusive of non-binary conceptions of gender. This seems especially important in data collection with Native American and Latinx students, some of whose cultures of origin often contain non-dichotomous conceptions of gender (Epple, 1998; Lang, 2016; Subero, 2009). Similarly, demographic data collection on ethnicity in the larger study was limited in specificity. No data was collected on the specific tribes of Native American participants. Latinx participants were asked whether they were Mexican/Mexican-American/Chicano, Puerto Rican, or Other. Generational immigration status was not assessed, and participants were not asked whether they lived on a reservation or off, and whether they lived in a rural or urban setting. These variables

could impact the experiences and preferences of mentees, so collecting more detailed information would have been ideal.

Another important limitation of the current study that may limit generalizability was the setting from which participants were recruited. All participants were undergraduates who had submitted a research poster for presentation to the Society for the Advancement of Chicanos and Native Americans in the Sciences (SACNAS) annual conference. They may be qualitatively different from peers who have not attended a similar national conference, and the quality of their relationships with mentors may be different as well. In addition, the nature of this specific conference is very different from other STEM conferences due to its strong cultural focus. It could be that students who submitted to this conference specifically have mentors with high investment in working with minority students and demonstrate higher levels of cultural competence. Their ratings of similarity with mentors could reflect this context. Future studies should explore the patterns of perceived real and ideal similarity with mentors among students who are not submitting research posters, especially to conferences like SACNAS, to get a better sense of generalizability.

In summary, this paper presented initial analyses in the development of a scale designed to measure underrepresented minority science students' perceptions about the importance of various dimensions of mentor-mentee similarity (termed Ideal Similarity). Additional research is needed to further establish the reliability and validity of the scale, but the factor structure derived from exploratory factor analysis in the current study is consistent with the extant literature. Two subscales emerged from the exploratory factor

analysis, which appeared to line up with Kammeyer-Mueller et al.'s (2011) Depth Similarity and Surface Similarity. Reliability for the subscales in the current study was excellent. Some support was found for measuring similarity in a continuous fashion as opposed to the dichotomous measurement more often seen in the empirical literature to date. In addition to measuring Ideal Similarity, parallel items were developed measuring Perceived Real Similarity with mentors along the same dimensions. The factor structure obtained in factor analysis of the Ideal Similarity scale was used to assess Perceived Real Similarity as well. Participants in the current study reported levels of both Depth and Surface Perceived Real Similarity with their mentors that exceeded the level of mentor-mentee similarity they perceived to be ideal, suggesting that in general they were satisfied with the extent to which their mentors were like them.

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CHAPTER 3

PAPER 2: INTERSECTIONAL IDENTITY DEVELOPMENT IN NATIVE AMERICAN AND LATINX UNDERGRADUATE SCIENCE MAJORS[2]

Abstract

In the current study, two measures were adapted from an existing ethnic identity development measure (the Multigroup Ethnic Identity Measure-Revised (MEIM-R), with the aim of measuring Scientist Identity and Ethnic Minority Scientist Identity using item-by-item parallels to the MEIM-R items. The measures were assessed with a sample of high-achieving Native American and Latinx undergraduate STEM majors. Support was found for the use of both adapted scales. A significant positive correlation between identity development as a scientist and ethnic identity was observed, suggesting that identity development in one domain may facilitate identity development in other domains. Significant differences were found, however, in the relative strength of identification; with the strongest identification with scientist identity, ethnic identity falling in between, and intersectional (ethnic minority scientist identity) the weakest. Thus, developing a cohesive identity that incorporates both ethnic identity and scientist identity may be more challenging than developing either of these identities in isolation. A significant correlation was also observed between Scientist Identity and Commitment to a Science Career; and between Ethnic Minority Scientist Identity Commitment and Commitment to Science Career, suggesting that intersectional identity development may

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play an important role in the retention of underrepresented minority students in STEM.

Review of the Literature

Efforts to diversify the pool of graduates in science, technology, engineering and mathematics (STEM) disciplines have resulted in modest growth in the number of ethnic minorities graduating; however, change has been slow and, in some fields, even stagnant. Significant disparities remain (Estrada et al., 2016). The problem of underrepresentation of minorities in the sciences is especially troubling in the context of increasing ethnic diversity in the U.S. The U.S. Census Bureau (2012) estimated that by 2060, the Latinx population will more than double and the Native American population will increase by half. Their data suggest that, while White Americans will remain the largest group, their growth rates will not match those of other ethnic groups and there will no longer be one ethnic group in the majority. The current body of STEM graduates already does not reflect the population's demographics (National Science Board, 2018), and as ethnic diversity in the U.S. continues growing at a faster rate, STEM fields will be less and less representative if large gains are not made.

Compared to White Americans, Native American and Latinx students are less likely to be interested in STEM fields at the outset of their education, less likely to switch from another major to a STEM major, and more likely to switch from STEM to humanities and social sciences (Syed, Azmitia, & Cooper, 2011). According to the National Science Board (2018), the proportion of Latinx science and engineering bachelor's degree recipients (relative to other ethnic groups) increased from 7.3% to

12.8% between 2000 and 2015. Native Americans represented 0.5% in 2015, with no statistically significant difference from their rate (0.7%) in 2000. These numbers represent no improvement for Native American representation. Although there has been modest improvement for Latinx representation, the NSF reports they are still underrepresented among STEM graduates at the bachelor's level. In addition, they note that some of the change observed may be attributed to a change in the way multiracial individuals are counted (from 2000 to 2010, they were not included in numbers of Native American or Latinx graduates but were treated as a separate group entirely. They are now counted in every ethnic group they reported). This may mean the gains are smaller than they appear.

As the body of research on diversifying the pool of STEM graduates has grown, one thing has become clear: new approaches are needed. Traditionally, mentorship has centered on a students' development as a scientist only, without attention to cultural or personal factors. Programs that are making gains in the retention of minorities in STEM are moving away from traditional approaches, and toward "supporting not only the academic needs of students, but also their emotional, cultural, and resource needs" (Gross, Iverson, Willett, & Manduca, 2015). Paramount among those needs is the development of what Erikson (1968) termed a "coherent" sense of identity; a fundamental task of young adult development.

Identity theorists have argued that identity development "is carried out through important interpersonal relationships in the context of institutional structures" (Syed et al., 2011, p. 443). Researchers have demonstrated that identity conflicts may arise for

students of color as they navigate the culture of higher education. In this view, undergraduate education in STEM represents a culture that students encounter and must respond to. As Castillo et al. (2006) noted, "typically the university environment is influenced by the university culture, which is composed of the values, beliefs, and behaviors of White American culture" (see also Castillo, Conoley, & Brossart, 2004, p. 268). Multiple studies suggest that university culture is heavily steeped in individualistic, competitive value systems harboring the expectation that students from collectivist cultures must adapt to succeed (Knight et al., 2010; Navarro, Ojeda, Schwartz, Piña-Watson, & Luna, 2014). Thus, pursuing an education in STEM can be thought of as a process of acculturation for minority students.

For women and underrepresented minorities, stereotypes about the identities held by the typical STEM (White male) could contribute to a perception that they do not belong (Cheryan, Plaut, Davies, & Steele, 2009; Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012). A lack of belonging has been associated with decreased motivation for women in STEM (Good, Rattan, & Dweck, 2012). For some students, viewing themselves (and being viewed by others) as nonprototypical members of the science community may contribute to a sense of "chronic threat" to their identities as scientists and "contingent belonging" (Cook, Purdie-Vaughns, Garcia, & Cohen, 2012; see also Purdie-Vaughns & Eibach, 2008).

Stereotypes about the culture of STEM as competitive rather than collaborative, with individualistic rather than communal goals may also contribute to lack of identification (Diekman, Brown, Johnston, & Clark, 2010). Creating an experience in

which science feels more like "a relational endeavor" may help counter those stereotypes and encourage women and minority engagement (Kobulnicky & Dale, 2016, p. 19).

Indeed, Latinx college students who score lower on Latinx ethnic identity measures, or who show more individualistic tendencies, appear to enjoy higher levels of well-being than their more collectivist peers (Schwartz et al, 2013; Torres, 2003). Conversely, Latinx students more strongly identified with their culture of origin have been shown to experience the climate of universities as more negative, and even report lower levels of commitment to persisting with their education as a result (Castillo et al., 2004, 2006). Taken together, one might infer from this that stronger ethnic identity may contribute to weaker identity as a scientist for undergraduate stem majors.

Harper (2010) argued that successful resolution of the conflict between culture of origin and the culture of higher education is vital to the success of underrepresented minority students in STEM. Some identity theorists contend that resolution can be achieved without the need to reject one culture in favor of another, and discord is not necessarily always present in processes of negotiating multiple cultural contexts (Cross & Cross, 2007; Frable, 1997; Howard, 2000). Orthogonal models of identity development suggest that identity is multidimensional: composed of separate strands of identity. Proponents of these models suggest that an individual's strength of identification with one culture can vary independent of the strength of their identification with another (Oetting & Beauvais, 1990-1991). They contend that as these students begin to develop a sense of identity as a scientist, they may weave that identity in with the other facets of identity, as separate strands that compose the whole of who they are and who they want

to be (Brickhouse, Lowery, & Schultz, 2000). In fact, Fuller-Rowell, Ong, and Phinney (2013) noted that "an already developed identity in a frequently encountered social identity domain… may also free psychological resources for development within other domains" (p. 421). From this perspective, the ideal outcome would be akin to the concept of bicultural identity, in which students would develop an integrated sense of self, able to move flexibly between their culture of origin and their identities as scientists.

Multidimensional theories of identity development thus suggest that a person can maintain their ethnic identity while also acculturating to a fit a new context. These models provide rich insights into the marginalization that many Latinx and Native American students in higher education experience. They account for the processes of conflict, acculturation, and integration. However, the view of identity as separate and distinct parts pieced together does not ring true for some theorists. Feminist intersectional theorist Kimberlé Crenshaw, who coined the term intersectionality in 1989, posited that a person does not experience the facets of their identity as separate and distinct dimensions, but instead experiences the self as a whole, with all dimensions of identity operating simultaneously and in interaction with each other (for more discussion of intersectionality and identity research in psychology, see Bowleg, 2008; Cole, 2009; Galliher, McLean, & Syed, 2017; Purdie-Vaughns & Eibach 2008; Rosenthal, 2016).

The notion of intersectionality is born from experiences of Black women such as Crenshaw, who critiqued feminist movements for their lack of attention to the concerns of women of color. Crenshaw's contention was that being a woman did not function the same way in the lives of Black women that it did in the lives of White women; and being

Black did not function the same way for Black women as for Black men. The experience of being a Black woman represented something phenomenologically different from either identity in isolation, or even the sum of the parts. Similarly, referencing the intersection between LGBTQ and ethnic minority identities, Meyer (2010) explained that "This intersection creates a new, unified identity that cannot be split" (p. 451).

An intersectional interpretation of their position would suggest that there is something different about the identity development of Latinx and Native American undergraduate students in STEM that cannot be captured by examining identity as a scientist and ethnic identity as separate strands standing alone, nor even in a multidimensional model wherein the separate strands are examined in an additive manner (Latinx + scientist). As Bowleg (2008) explained in the context of Black lesbians, "Black + Lesbian + Woman ≠ Black Lesbian Woman" (p. 312). Likewise, Native American + scientist is not the same as Native American scientist. In an intersectional model, identities interact, informing and altering one another over time. Thus, identity must be viewed as a gestalt operating in context. A natural extension of this conceptualization might be that identity development as a Native American or Latinx scientist is more than a process of acculturation, in which students acquire the ability to function in a new cultural context with the result being an achieved 'bicultural' (Latinx + scientist) identity. Instead, perhaps being a scientist is not the same for a Native American student as it is for a White American student. Being Latinx may not be the same for a scientist as it is for someone in another field altogether. A new identity is forged at the intersection where cultures combine and interact with context in an iterative and recursive process.

In their intersectional identity theory for LGBTQ people of color, Purdie-Vaughns and Eibach (2008) discussed the notion that U.S. ethnic minorities are viewed as "non-prototypical" due to the impact of ethnocentrism centering a White American cultural and racial identity and establishing this identity as the "standard person" (p. 378). Extending this concept, underrepresented minority STEM majors represent non-prototypical scientists. Developing a cohesive identity that incorporates both ethnic identity and scientist identity may be more challenging than developing either of these identities alone, because the prototypical scientist is a White American, and the prototypical Latinx person is not in STEM.

A compelling argument for applying an intersectional approach to the education of underrepresented minority students in STEM was presented by Syed et al. (2011). They described a trend observed in the college majors chosen by students of color: that those who begin college with an interest in STEM are very likely to switch to a major within the humanities and social sciences. Syed and colleagues posited that this switch occurs in part due to a drive to explore and develop both their ethnic and career identities. They admonished STEM faculty to make STEM curricula more culturally relevant, for example highlighting prominent scientists who belong to students' respective ethnic groups. An intersectional lens can further elucidate the underlying process at work in the identity development of these students. If students are seeking majors that better incorporate and reflect their cultural identities, perhaps this is about something different than the development of two distinct identities (ethnic and career) in a parallel process. They could turn to other sources to aid in their ethnic identity development and seek only

career development through their college experiences, but it appears these students are seeking a forum for intersectional identity development—a space in which being a Native American scientist means something different from being a scientist of another ethnicity.

This review has outlined arguments for examining identity development orthogonally (Latinx + scientist, Native American + scientist), and arguments for an intersectional approach (Native American scientist, Latinx scientist). It could be that one of these theories is superior to another, better capturing the real lived experience of minorities in STEM. It could also be that useful information about the identities of Native American and Latinx students in STEM can be obtained through either lens, with orthogonal and intersectional theories presenting different views of the same phenomena. The present study attempts to bridge the two approaches in the quantitative measurement of identity development, proposing an extension of an existing orthogonal measure, the Multigroup Ethnic Identity Measure-Revised (MEIM-R; Phinney, 1992). This study sought to answer the following questions.

1. Can the MEIM-R be adapted to develop a scale measuring Scientist Identity?
2. Can the MEIM-R be adapted to develop a scale measuring Intersectional Identity?
3. How do the orthogonal and intersectional scales compare, when completed by our sample of high-achieving Native American and Latinx undergraduate STEM majors?

Methods

Procedures

The sample for the current study was underrepresented minority (URM) undergraduate students from colleges and universities all over the U.S., including Puerto

Rico. All participants attended the 2010 SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) national conference and were subsequently emailed to invite them to participate in this study. The recruitment email advised them that this study would "help us learn about the 'active ingredients' that support science students most effectively." Online surveys were administered at six time-points across three years. The survey took approximately 30 minutes to complete, and participants received a $50 gift certificate each year they participated in the study. The Institutional Review Board at the participating university approved the research protocol.

Participants

Participants were undergraduate STEM majors at institutions across the U.S., including Puerto Rico. They represent a subset of 114 Native American/Native Alaskan/ First Nations/Indigenous (n = 28, 24.6%) and Latinx/Chicanx/Hispanic students (n = 105, 92.9%) who participated in this study at Time 1. Fourteen (n = 12.4%) of these participants reported multiple ethnicities, thus the totals add up to more than 100%. Other ethnic groups have been eliminated for the current analyses (the total number of participants in the larger sample was n = 189 and includes White/Caucasian students and minority students who are not underrepresented in the sciences). The sample was 59.6% (n = 68) female. The average age at Time 1 was 22.81 (SD = 5.43; Range 18-51). Participants reported being undergraduate STEM majors at Time 1, and their class ranks were: Freshman n = 1, 0.9%; Sophomore n = 13, 11.4%; Junior n = 37, 32.5%, Senior n = 61, 53.5%, and Other n = 2, 1.8%. Of the two participants whose class level was "Other," one had graduated and one was in a post-baccalaureate program.

The analyses for this study are drawn from survey measures completed at Time 5. Of the 114 Native American and Latinx participants, all 114 completed at least some of the survey measures at Time 5. They reported their year in school at Time 5 as: Graduate Student *n* = 41, 36.0%; Senior *n* = 43, 37.7%; Junior *n* = 9, 7.9%; Sophomore *n* = 4, 3.5%; Post-Baccalaureate, Internship, or Prep Program Student *n* = 5, 4.4%; Graduated and applying to graduate school *n* = 4, 3.5%. Four individuals reported that they had graduated with a bachelor's degree and were now working. Three of the four indicated they were working in a science related field and one of them was also applying to graduate school (this person is listed in both categories—graduated and working and applying to graduate school). The fourth person did not indicate what type of work they were doing. Four individuals reported that they were not enrolled and did not indicate if they were currently employed. Of these four, one reported they were graduated and now taking a year off with plans to work in their field and apply for graduate school, two reported they were graduated but provided no additional information, and one provided no information about their status.

Measures

The Revised Multigroup Ethnic Identity Measure. The revised version of the Multigroup Ethnic Identity Measure used in this study (Revised MEIM; Roberts et al., 1999) is a measure designed for use with individuals of any ethnicity, to assess the strength of individuals' identification with their own ethnic group, and to be applicable across ethnic groups (Ponterotto, Gretchen, Utsey, Stracuzzie, & Saya, 2003). It is composed of two subscales: exploration and commitment. All questions are measured on

a 4-point Likert-type scale where 4 = strongly agree, and 1 = strongly disagree. An average score may be calculated for each subscale (*affirmation/belonging* and *exploration*), or the scales can be combined to obtain an overall measure of the strength of ethnic identification (Phinney & Ong, 2007; Roberts, et al., 1999). The subscales demonstrate excellent internal consistency for high school and college-age students, with coefficient alphas ranging from .81 (Goodstein & Ponterotto, 1997; Phinney, 1992) to .92 (Taub, 1995). For the present study, reliabilities were good to excellent (α = .914 for commitment*;* α = .809 for affirmation/belonging; α = .900 for the total MEIM-R score).

Factor structure for the MEIM has varied across studies. Some studies have reported the inventory fit a two-factor structure consistent with the theoretically orthogonal processes of exploration and commitment (Pegg & Plybon, 2005; Roberts et al., 1999; Spencer, Icard, Harachi, Catalano, & Oxford, 2000; Yancey, Aneshensel, & Driscoll 2001; Yap et al., 2014). Others suggest the two-factor solution had high inter-factor correlations suggesting the factors were distinct but interrelated (Roberts et al., 1999). Finally, some studies have supported a one-factor structure (Ponterotto et al., 2003; Reese, Vera, & Paikoff, 1998; Worrell, 2000; Worrell, Conyers, Mpofu, & Vandiver, 2006). Phinney, Torres Campos, Kallemeyn, and Kim (2011) argued that ethnic identity is one construct composed of two related dimensions, and thus both the one-factor or two-factor approach to interpretation are appropriate.

Scientist Identity. The Scientist Identity scale (see Appendix E) was adapted from the MEIM-R (Roberts et al., 1999) for use in the present study, in addition to the original scale's measure of ethnic identity. Parallel items were developed for every

MEIM-R item, adapting the wording to capture strength of identification with being a scientist where the original MEIM-R captured strength of ethnic identification. Participants completed this adapted scale at Time 5, along with the MEIM-R.

Ethnic Minority Scientist Identity. The Ethnic Minority Scientist Identity (EMSI) scale (see Appendix F) was also adapted from the MEIM-R (Roberts et al., 1999) for use in the present study. Parallel items were developed for every MEIM-R item, adapting the wording to capture strength of intersectional identification with being an ethnic minority scientist where the original MEIM-R captured strength of ethnic identification only. Participants completed this adapted scale at Time 5, along with the MEIM-R and the Scientist Identity scale described above.

Perceived real depth and surface similarity. A two-part measure developed for another part of the larger longitudinal study was incorporated into the analyses for the current paper (see Enno, Galliher, & Chemers, 2018, unpublished manuscript for scale development information). The 13-item Perceived Real Depth Similarity subscale measured the degree to which participants perceived their mentors to be like them when it came to values, communication style, and other interpersonal behaviors. Cronbach's alpha for this sample was .923. The 9-item Perceived Real Surface Similarity subscale measured the degree to which participants perceived that their mentors were like them on surface dimensions, such as demographic characteristics or family history with higher education. Cronbach's alpha for this sample was .914.

Commitment to a Science Career. Another scale assessed degree of commitment participants felt toward a career in science. The 7-item Commitment to a

Science Career scale was developed for a previous study (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011). The scale assessed participants' intentions to persist in science-related careers and their perceived likelihood that they would work hard in order to make that intention a reality. Chemers et al. (2011) reported an alpha of 0.96 for their sample of 242 undergraduate STEM majors and 0.94 for 278 graduate STEM majors, suggesting adequate internal reliability. Participants completed the Commitment to a Science scale at every administration. For the purposes of this study, their scores at Time 6 are used. Cronbach's alpha for these participants at Time 6 was .971.

Results

Exploratory Factor Analysis: 12-Item MEIM

Before conducting analyses on the newly developed scale items, a principal components factor analysis was performed to examine whether the data in the present study fit the two-factor structure for the MEIM-R (Roberts et al., 1999) items. Two factors were extracted and a Direct Oblimin rotation with Kaiser Normalization was used because, in their development of the twelve-item scale, Roberts et al. found that a correlated two-factor model was the best fit. All factor loadings were consistent with the two-factor structure derived by Roberts et al. except that Item 3 was not cross-loaded in the present study.

Exploratory Factor Analysis: Scientist Identity Items Adapted for the Present Study

Exploratory factor analysis was then performed on the Scientist Identity items

adapted for the present study. A parallel analysis (Monte Carlo simulation) was conducted first using O'Connor's (2000) syntax. The results indicated that two factors should be extracted. A principal components factor analysis was then performed extracting two factors and using a Direct Oblimin rotation with Kaiser Normalization. The Kaiser-Meyer-Olkin measure of sampling adequacy was .752, exceeding the recommended value of .6, and Bartlett's test of Sphericity was significant, $\chi^2(66) = 376.140$, $p < .001$. All of the diagonals of the anti-image correlation matrix were over .5 (with a range of 588 to .855) and all communalities were above .3 (see Table 3.1),

Table 3.1

Factor Loadings and Communalities Based On a Principle Components Analysis with Direct Oblimin Rotation for 12 Items, Extracting 2 Factors

	Factor		
Items	1	2	Comm.
Scientist identity: Commitment items			
1. I have a clear sense of what I want to do for a career.	.760	.010	.584
2. I am happy that I am a member of a community of scientists.	.630	-.004	.395
3. I have a strong sense of belonging to the community of scientists.	.632	.098	.452
4. I understand pretty well what it means to be a scientist in my chosen field.	.850	-.254	.636
5. I have a lot of pride in the field I've chosen to go into, and what has been accomplished in my field so far.	.563	.190	.428
6. I feel a strong attachment toward my chosen field of study.	.733	.016	.546
7. I feel good about my chosen field of study.	.675	.153	.551
Scientist identity: Exploration			
1. I have spent time trying to find out about my chosen career.	.022	.661	.448
2. I am active in organizations or social groups for people in my chosen career.	.114	.520	.326
3. I think a lot about how my life will be affected by my career choice.	.008	.550	.306
4. To learn more about my chosen career, I have often talked to other people about it.	-.147	.730	.480
5. I participate in practices of my profession (e.g., reading special books and journals, attending conferences or scientific lectures).	.205	.456	.315

Note. 12 items, Scientist Identity scale, adapted from Revised Multigroup Ethnic Identity Measure (N = 111).

supporting the inclusion of each item in the factor analysis. Thus, factor analysis incorporated all 12 items.

The initial Eigenvalues showed that: the first factor explained 33.708% of the variance, the second factor 11.836% of the variance, the 3rd through 12th factors explaining between 1.893% and 9.506%. The two-factor solution (explaining 45.544% of the variance) was preferred due to previous empirical and theoretical support, parallel analysis indicating two factors, and clean factor loadings in the pattern matrix. In the oblimin rotation, all items had primary loadings above .5 and the highest cross-loading of any item was .205. All factor loadings were consistent with Roberts and colleagues' (1999) two-factor structure. Item 3 was not significantly cross-loaded (see Table 3.1.

Reliability analyses were conducted for each factor, and the Scientist Identity Total score. Descriptive statistics and reliabilities are presented in Table 3.2. Factor 1 (Commitment) consisted of seven items (α = .831), and Factor 2 (Exploration) consisted

Table 3.2

Reliability, Assessment of Normality, and Descriptive Statistics: Revised, Scientist Identity Items, Ethnic Minority Scientist Identity Items

Subscale	No. of items	Mean	*SD*	Skewness	*SE*	Kurtosis	*SE*	Alpha
MEIM-R Commitment	7	3.34	.65	-0.91	.23	0.07	.45	.914
MEIM-R Exploration	5	2.78	.80	-0.41	.23	-0.41	.46	.809
MEIM-R Total	12	3.10	.64	-0.60	.23	-0.23	.46	.900
Scientist Id. Commitment	7	3.46	.49	-1.37	.23	3.65	.45	.831
Scientist Id. Exploration	5	3.41	.44	-0.56	.23	-0.51	.45	.577
Scientist Id. Total	12	3.44	.39	-0.75	.23	0.46	.46	.804
EMSI (One Factor)	12	2.91	.66	-0.50	.23	-0.43	.46	.895

Note. Revised MEIM (12 items, *N* – 112; Roberts et al., 1999); Scientist Identity Items (12 items, *N* = 111, adapted for the current study); EMSI (12 items, *N* = 110, adapted for the current study.

of five items (α = .577), and the Scientist Identity Total score consisted of 12 items (α = .804). Next, composite scores were generated for each factor by calculating a mean of all the items contained in the factor. Higher scores are indicative of stronger scientist identification. To evaluate skewness and kurtosis, each was divided by its standard error and compared to a cutoff of +/- 1.96. The skewness for both factors and the total score indicated strong negative skewness. Kurtosis for Scientist Identity Commitment was high, violating the assumption of normality. Kurtosis for Scientist Identity Exploration and the total score fell well within the acceptable range.

Exploratory Factor Analysis: Ethnic Minority Scientist Identity Items Adapted for the Present Study

A parallel analysis (Monte Carlo simulation) was also performed for the intersectional identity items developed for the present study. The results indicated that a one-factor structure was the best fit for these data. A principal components analysis was conducted extracting one factor. The Kaiser-Meyer-Olkin measure of sampling adequacy was .851, exceeding the recommended value of .6, and Bartlett's test of Sphericity was significant, χ^2 (66) = 642.216, $p < .001$. All of the diagonals of the anti-image correlation matrix were over .5 (ranging from .764 - .911). One item had a communality just below .3 ("I think a lot about how my life is affected by my ethnicity because of my career choice, or how it is affected by my career choice because of my ethnicity," Communality = .298), supporting the inclusion of all but this item in the factor analysis (see Table 3.3). Given that this communality was very close to .3, factor analysis still incorporated all 12 items to obtain factor loadings and make a decision about inclusion or exclusion of the

Table 3.3

Factor Loadings and Communalities Based On a Principle Components Analysis for 12 Items, Extracting 1 Factor

Items	Factor 1	Comm.
I have a clear sense of what it means for someone of my ethnicity to pursue the career I've chosen.	.669	.448
I am happy that I am a scientist and a member of my ethnic group.	.589	.347
I have a strong sense of belonging to the community of scientists of a similar ethnicity to me.	.763	.583
I understand pretty well what it means to be a scientist of my ethnicity.	.700	.489
I have a lot of pride in the accomplishments of scientists of my ethnicity.	.726	.527
I feel a strong attachment toward being a scientist of my ethnicity.	.799	.639
I feel good about being a scientist of my ethnicity.	.637	.405
I have spent time trying to find out about people of a similar ethnicity to me in my chosen career.	.681	.464
I am active in organizations for people of a similar ethnicity to me in my chosen career.	.666	.444
I think a lot about how my life is affected by my ethnicity because of my career choice, or how it is affected by my career choice because of my ethnicity.	.546	.298
To learn more about being a scientist of my ethnicity I have talked to other people about it.	.756	.571
I participate in practices of my profession that are specific to people of a similar ethnicity to me, e.g. reading special books and journals, attending conferences, or scientific lectures.	.665	.442

Note. 12 items, Ethnic Minority Scientist Identity scale, adapted from Revised Multigroup Ethnic Identity Measure (N =111).

item from there.

The initial Eigenvalues showed that the first factor explained 47.140% of the variance, and factors two through 12 explained from 1.523% to 11.788%. All items loaded significantly onto the factor, with loadings ranging from .589 to .799. Reliability analyses were conducted, first eliminating the item with low communalities ("I think a lot about how my life is affected by my ethnicity because of my career choice, or how it is

affected by my career choice because of my ethnicity," Communality = .298, Factor Loading = .546) to create an 11-item, one-factor scale (α = .893, n = 111; see Table 3.2) and then returning the item to create a 12-item, one-factor scale (α = .895, n = 111; Table 3.2). The item slightly increased Cronbach's alpha and was associated with a significant factor loading and the communality is very close to .3; therefore, it was retained in the final scale for the one-factor solution.

Based on the literature on the revised MEIM supporting a two-factor structure, a principal components analysis was also performed extracting two factors and using a Direct Oblimin rotation with Kaiser Normalization to assess the fit of the two-factor model. In this model, all of the diagonals of the anti-image correlation matrix were over .5 and all communalities were above .3, supporting the inclusion of each item in the factor analysis. Thus, factor analysis incorporated all 12 items.

The initial Eigen values showed that: the first factor explained 47.140% of the variance, the second factor 11.788% of the variance, the third through twelfth factors explaining between 1.523% and 7.883%. The two-factor solution explained 58.928% of the variance. In the oblimin rotation, five items failed to load on any factor (both loadings for these five items were less than .32). Two items had primary factor loadings between .32 and .5. The remaining five items had primary loadings above .5. The highest cross-loading of any item was .205. All factor loadings above .32 loaded on to Factor 1, supporting a one-factor structure.

The one factor solution was preferred because the parallel analysis supported a one-factor structure and the pattern of factor loadings supported the one factor structure

in both principal components analyses. The Cronbach's alpha (α = .895) suggested good to excellent internal reliability. A composite score was calculated using the mean of all 12 items on the scale. Descriptive statistics are presented in Table 3.1. To evaluate skewness and kurtosis, each was divided by its standard error and compared to a cutoff of +/- 1.96. The scale scores were negatively skewed, but kurtosis was acceptable indicating central tendency.

Relationships among Ethnic, Scientist, and Ethnic Minority Scientist Identities

Repeated measures ANOVA was conducted comparing MEIM-R, Scientist Identity, and Ethnic Minority Scientist Identity (EMSI) total scores to compare participants' strength of identification in each domain. Mauchly's Test of Sphericity was significant, χ^2 (2, n = 107) = 29.598, $p < .001$; therefore, the Greenhouse-Geisser correction was used. The results were significant and the large effect size suggested the difference was meaningful, $F(1.606, 170.194) = 48.368$, $p < .001$, $\eta^{2} = .313$. Post hoc tests indicated significant differences for every pairwise comparison. Strength of identification was highest for the adapted scale measuring Scientist Identity (M = 3.42, SD = .395), followed by the MEIM-R (ethnic identity) scale score (M = 3.09, SD = .636), and the adapted EMSI scale (M = 2.90, SD = .662).

Next, the exploration and commitment subscales for each identity domain were compared through a series of two Repeated Measures ANOVAs. The EMSI scale was broken down into exploration and commitment subscales to facilitate comparison, but recall that factor analysis indicated a single factor structure was a better fit for the current

sample. When it came to the exploration subscales, Mauchly's Test of Sphericity was significant, χ^2 (2, n = 109) = 27.550, p < .001; therefore, the Greenhouse-Geisser correction was used. The results were significant and the large effect size suggested the difference was meaningful, F(1.63, 176.039) = 48.368, p < .001, $\eta^{2 =}$ .429. Post hoc tests indicated significant differences for every pairwise comparison. Exploration was highest for the adapted scale measuring Scientist Identity (M = 3.40, SD = .437), followed by the MEIM-R (ethnic identity) scale score (M = 2.78, SD = .800), and the adapted EMSI scale (M = 2.56, SD = .817). When it came to commitment, Mauchly's Test of Sphericity was significant, χ^2 (2, n = 110) = 12.891, p = .002, and the Greenhouse-Geisser correction was used again. The results were significant and the large effect size suggested the difference was meaningful, F(1.798, 195.954) = 15.007, p < .001, $\eta^{2 =}$ .121. Post hoc tests indicated no difference between Scientist Identity (M = 3.46, SD = .488), and ethnic identity (M = 3.33, SD = .652) commitment, with EMSI commitment (M = 3.16, SD = .668) being significantly lower than either of the other two.

A series of bivariate correlations was conducted to examine the relationships among the three identity development domains. The MEIM-R (ethnic identity) was positively correlated with Scientist Identity, r = .321, p = .001. The MEIM-R and EMSI scales were correlated, r = .816, p < .001. Finally, the Identity as Scientist scale and the EMSI scale were also significantly correlated, r = .436, p < .001.

Relationship of Identity Development Variables and Commitment to a Science Career

Another series of bivariate correlations was conducted to investigate the

relationship between each identity development domain and the Commitment to a Science Career scale administered at the following time point. The MEIM-R subscales and total score were not significantly correlated with Time 6 Commitment to a Science Career (Commitment subscale r = -.022, p = .829; Exploration subscale r = -.146, p = .144; Total r = -.092, p = .357). Commitment to a Science Career was significantly correlated with Scientist Identity Commitment (r = .542, p < .001), Scientist Identity Exploration (r = .259, p = .006) and Scientist Identity total (r = .509 p < .001). The Ethnic Minority Scientist Identity (EMSI) scale was also significantly correlated with Commitment to a Science Career (r = .270, p < .001).

Discussion

The focus of the current study centers on the adaptation of an existing identity development measure: the MEIM-R (Roberts, et al., 1999), used to measure the strength of ethnic identity. In the current study, two measures were adapted to measure Scientist Identity and Ethnic Minority Scientist Identity (EMSI), with item-by-item parallels to the MEIM-R items.

Scientist Identity

Our first research question asked: Can the MEIM-R be adapted to develop a scale measuring Scientist Identity? Our exploratory factor analysis showed that the adapted measure fit a two-factor structure with factor loadings for the parallel items still falling cleanly in line with the factor-structure obtained by Roberts et al. (1999). Our participants scored high on each domain and the overall strength of their identity as scientists. This is

not surprising, given that all participants were undergraduates who were in attendance at a research conference. Their levels of Scientist Identity would reasonably be expected to be higher than the average undergraduate. We found some support for adapting the MEIM-R for use to measure Scientist Identity: however, the poor reliability of the Exploration subscale is problematic. One possible solution to this problem would be to use a one-factor solution, since the total score demonstrated good reliability. Another could be to refine the items, retaining only those that contribute to greater reliability. Additional research is needed to establish the validity of the adapted scale, and to measure other forms of reliability given that the current study examined only internal consistency and with mixed results. We examined the association between Scientist Identity as measured by our adapted scale and found that each subscale and the total scale score were significantly correlated with Commitment to a Science Career, which lends additional support for the use of this scale as a measure of the strength of identification with being a scientist.

Ethnic Minority Scientist Identity

Our second question was: Can the MEIM-R be adapted to develop a scale measuring intersectional identity? A similar process was undertaken in evaluating whether an Intersectional scale could be adapted from the MEIM-R items. Parallel items were developed that mirrored the MEIM-R, but referred to identity "as a Latinx scientist" or "as a Native American scientist," incorporating both identity labels into one. We have found provisional support for the use of the intersectional scale. Our study supported the use of a one-factor structure; however, given the inconsistencies in factors structure of the

original MEIM-R, it is possible that the factor structure of the current scale may vary across studies. Phinney and Ong (2007) accounted for the inconsistency in factor structure by arguing that ethnic identity is one construct composed of two related dimensions, and thus both the one-factor or two-factor approach to interpretation are appropriate. Given this and the fact that the adapted scales have not yet been tested in other studies, we performed analyses on the two-factor structure as well as the one-factor structure. The commitment subscale of the Ethnic Minority Scientist Identity subscale (completed at Time 5) was positively correlated with Commitment to a Career in the Sciences (completed about six months later, at Time 6). This lends support for the importance of developing an intersectional sense of identity, especially given that the MEIM-R alone did not significantly relate with this outcome.

Orthogonal vs. Intersectional Measurements

Our final research question was: How do the orthogonal and intersectional scales compare, when completed by our sample of high-achieving Native American and Latinx undergraduate STEM majors? In an orthogonal model of identity development, the strength of Scientist Identity and the strength of ethnic identity (MEIM-R) would be expected to vary independent of one-another (Oetting & Beauvais, 1990-1991). In our review of the literature, we discussed the assertion that universities tend to be heavily influenced by White American cultural norms (Castillo et al., 2004, 2006) and noted empirical studies demonstrating that students with lower levels of ethnic identity tend to experience greater well-being than those with strong ethnic identity navigating the culture of higher education (Castillo et al., 2004, 2006; Schwartz et al, 2013; Torres, 2003).

Taken together, one might infer from this that stronger ethnic identity may link to lower Scientist Identity. However, the arguments of some identity development theorists suggest that this may not be the case. Some contend that identity development across multiple cultural contexts can occur without a great deal of conflict (Cross & Cross, 2007; Frable, 1997; Howard, 2000; Oetting & Beauvais, 1990-1991). Some even argue that a strong sense of identity in one domain can facilitate the development of a strong sense of identity in another (Fuller-Rowell et al., 2013). Our results support the argument by Fuller-Rowell et al. We observed a significant positive correlation between identity development as a scientist and ethnic identity.

Our results do not negate the possibility that an orthogonal model is appropriate when it comes to considering the development of different dimensions of identity; however, with the strong positive correlation we did not find support for an orthogonal model. The correlations observed suggested that ethnic identity (MEIM-R), Scientist Identity, and Ethnic Minority Scientist Identity (EMSI) varied together. We did find significant differences among the three measures, through a series of Repeated Measures ANOVAs. The students' strength of identification was strongest for their Scientist Identity and weakest for their Ethnic Minority Scientist Identity, with each identity being significantly different than the other two. The differences among the scores could suggest that an orthogonal model makes sense. They may also be taken to mean that their intersectional identity represents a dimension of identity development that is more than merely the sum of ethnic identity and scientist identity, consistent with Bowleg's (2008) assertions.

EMSI was consistently the lowest score of the three measures. This could reflect that an orthogonal model is a better fit for the students in this sample. Another explanation could be that, even in this sample of high-achieving minority STEM majors, developing a cohesive identity that incorporates both ethnic identity and scientist identity may be more challenging than developing either of these identities alone. Recall that the EMSI was highly correlated with the MEIM. A simple explanation could be that ethnic identity development is prerequisite to developing an identity that encompasses both ethnic identity and scientist identity.

Implications

Our results suggest that developing an intersectional identity that incorporates both ethnic identity and identity as a scientist is more challenging for underrepresented minority students than developing either of these identities in isolation. Given the tendency for underrepresented minority students to under-enroll in STEM majors or to switch to majors in the social sciences (Syed et al., 2011), this finding seems important. The ability of STEM curricula to foster intersectional identity development may be even more vital in the retention and success of those students who tend to switch majors than for the current sample, who are highly committed to careers in science.

Limitations

It is important to note that the students sampled in this current study may be very different from the average minority student in STEM. They scored higher in their identity development as a scientist than in their ethnic identity. They may be among those

students who experience lower levels of conflict and less prejudice and discrimination as they navigate higher education.

The context of the study could provide insight into the results obtained as well. All participants had attended an intersectional conference (one specifically meant for Latinx and Native American scientists). They may already be far along in the process of developing a coherent sense of identity. It could be that these students are fortunate enough to have contact with mentors who employ a culturally competent approach, which may narrow the gap between cultures for these students and make navigating STEM and higher education less daunting, less foreign, and more welcoming. Indeed, these same students completed measures at Time 4 in the larger longitudinal study that suggested they worked with mentors with high levels of similarity to them when it came to communication styles, values, and other characteristics that may be reflective of cultural competence (Enno et al., 2018). Given that the Time 4 measure was completed about 6 months prior to the scales examined in this current study (completed at Time 5) and that a significant positive correlation was found between the degree of similarity and the strength of Scientist Identity, it seems likely that their scores on the scales in the current study represent the outcomes of effective mentoring.

The generalizability of this study to other STEM students may, therefore, be limited. It may be more appropriate to view the current study as a measure of how identity development for STEM students can look under ideal conditions, with culturally competent mentoring and involvement in organizations (e.g., SACNAS) that support the integration of identities. In fact, it could be that one factor in the success of the students

in this sample is their association with an organization that emphasizes the integration of these two identities, fostering the development of their identities in both domains and in the interaction of the two. Alternatively, the study could be viewed as a measure of how identity development looks for STEM students who are currently more highly engaged with their career identity development than their ethnic identity development. The pattern could be very different for students who are currently equally engaged in both processes, more highly engaged with ethnic identity development, and/or actively seeking a major that more easily facilitates their intersectional identity development.

Perhaps an emphasis on intersectional identity development could better bridge the gap, particularly for students who may have a harder time resolving conflicts between their ethnic identity and developing scientist identity. To better assess this, the scales should be tested with a sample that shows more variability in the strength of ethnic identification and more variability in their engagement with research. Another useful strategy that has been used in scale development for the MEIM-R (Phinney & Ong, 2007) would be conducting focus groups of undergraduate STEM majors to get their reactions to the orthogonal and intersectional measures.

Galliher et al. (2017) emphasized that intersectional identity models in psychology require attention to the forces of power and privilege, and should not be construed as a simple examination of multiple dimensions of identity without incorporating historical and sociopolitical context. For example, discrimination influences ethnic identity for Latinx (Cislo, 2008; Fuller-Rowell et al., 2013; O'Brien, Mars, & Eccleston, 2011; Tajfel & Turner, 1986; Umaña-Taylor & Guimond, 2010) and

Native American STEM students (American Indian College Fund, 2003; Bergstrom, 2009; Brandt, 2008) and plays an important role in fostering identity conflict and reducing retention (Fry, 2004; Gross et al., 2015). The current study did not incorporate any measures of experiences with discrimination, so it is difficult to assess the context around these developing identities when it comes to some of these experiences. We have discussed some contextual information, as discussed above (for example, their participation in the SACNAS conference, their experiences of mentorship) that can inform interpretation and this contextual information lends strength and richness to our examination of their experiences.

Another limitation of the current study is the use of the MEIM-R from Roberts et al. (1999). Phinney and Ong (2007) developed a shorter version of this scale. They deleted two behaviorally-based items from the commitment subscale, adding two new items to the exploration subscale ("I have often done things that will help me understand my ethnic background better." "I have sometimes wondered about the meaning or implications of my ethnicity.") and rewording some items to make them applicable to a past tense interpretation (where previously they were phrased to reflect only present tense). The items were further trimmed to create two equal subscales containing three items each, and the affirmation/belonging subscale was renamed commitment. Future studies should consider adapting the shorter MEIM-R from the 2007 study, especially considering that using both the Scientist Identity EMSI adaptations would triple the number of items completed.

Another weakness of this study lies in the MEIM-R itself. The items are

composed in such a way that they do not account for the experience of multiracial individuals who may identify more than one ethnic group as their own, and experience varying levels of identity in each cultural context. Identity development is viewed orthogonally in the sense that acculturation to the dominant (White American) culture is not considered inextricably linked to rejecting one's own culture. However, the scale does not provide room for participants to rate their identification with multiple minority cultures separately. Given that 14 (n = 12.4%) of these participants reported multiple ethnicities, and that multiracial ethnicities are particularly common for Native Americans, this seems like an important area of exploration for future studies.

In addition, although the development of the intersectional scale incorporating multiple identities is a move toward greater complexity and intersectionality in the measurement of identity, the scope of the current study focuses on the intersection of just two identities: Latinx and/or Native American ethnicity and status as an undergraduate in STEM. As such, it is more of a bridge between multidimensional and intersectional models than a leap into an intersectional model of these students' experiences. There are other identities and contexts that are also highly relevant to individuals' experience of higher education (for example, gender, family history in higher education, language, generational status). Indeed, studies have shown gender differences in the function of ethnic identity in impacting Latinx STEM students' experiences (Navarro et al., 2014). As Bowleg (2008) noted, this is often a significant limitation in traditional survey measures and in statistical methodology when it comes to truly capturing intersectionality. Our scale represents only small step in the direction of an intersectional

model but falls far short of a truly intersectional study.

Summary

In sum, focus of the current study centers on the adaptation of an existing identity development measure: the MEIM-R (Roberts, et al., 1999), used to measure the strength of ethnic identity. In the current study, two measures were adapted to measure Scientist Identity EMSI, with item-by-item parallels to the MEIM-R items. We found support for the use both adaptations: The Scientist Identity scale and the EMSI. We observed a significant positive correlation between identity development as a scientist and ethnic identity in our sample of high-achieving Latinx and Native American undergraduate science majors, supporting the assertion by Fuller-Rowell et al. (2013) that developing a strong sense of identity in one domain may facilitate identity development in other domains. Significant differences were observed in the relative strength of identification, with the strongest identification with Scientist Identity, ethnic identity falling in between, and intersectional (Ethnic Minority Scientist Identity) being the weakest. The results suggest that even in this sample of high-achieving minority STEM majors, developing a cohesive identity that incorporates both ethnic identity and scientist identity may be more challenging than developing either of these identities alone. We also found a significant correlation between Scientist Identity and Commitment to a Science Career; and between Ethnic Minority Scientist Identity Commitment, and Commitment to a Science Career, suggesting that intersectional identity development (in addition to development of an identity as a scientist) may play an important role in the retention of underrepresented minority students in STEM.

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CHAPTER 4

SUMMARY AND CONCLUSIONS

The purpose of this study was to examine normative identity development for high-achieving Latinx and Native American undergraduate students in Science, Technology, Education, and Math (STEM) fields. Participants were enrolled in colleges and universities from all over the U.S., including Puerto Rico. They were recruited from a database of attendees at the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) 2011 national conference. Longitudinal data that include six time-points across 2 years were collected as part of a larger study. The current study examined survey measures completed at Time 4, Time 5, and Time 6. We examined the two aspects of these students' experiences that have been posited to play a central role in the persistence and success of underrepresented minorities in STEM: similarity with mentors and the development of a cohesive identity incorporating identity as a scientist and ethnic identity.

Similarity with Mentors

Many theories point to the importance of similarity between mentors and mentees, with some researchers highlighting the potential role of ethnic identity (Darling, Bogat, Cavell, Murphy, & Sanchez, 2006) and the value mentees place on similarity (Rhodes, Reddy, Grossman, & Lee, 2002; Syed, Goza, Chemers, & Zurbriggen, 2012) in mediating outcomes related to similarity with mentors. Others have highlighted that there may be differences in mentee preferences for "surface-level" and "deep-level" similarity

(Harrison, Price, & Bell, 1998). The current study found that a distinction between surface-level and deep-level similarity may map on to the experiences of Native American and Latinx students when they think about how they compare with their mentors. A new scale was introduced that measured mentees' preferences for similarity along these dimensions (with subscales termed Ideal Surface Similarity and Ideal Depth Similarity) as well as their perceived actual similarity (with subscales called Perceived Real Surface Similarity and Perceived Real Depth Similarity). In our sample, deep-level similarity was more highly valued than surface-level similarity; however, the two subscale scores were interrelated, suggesting that Kammeyer-Mueller, Livingston and Lao's (2011) assertion that surface-level similarity may be associated with greater deep-level similarity may be accurate. The new scale is unique in its measurement of similarity in that it takes a continuous approach to measurement as opposed to considering similarity in terms of match or no match (as is done in much of the extant literature to date). Stronger ethnic identification was indeed linked with stronger preference for both surface-level and deep-level similarity with mentor, as has been predicted. The current study did not include an evaluation of outcomes (such as persistence in STEM) as they relate to similarity with mentors, so future research should examine the possible influence of deep-level and surface-level similarity on outcome variables.

Intersectional Identity Development

As theories of identity development have progressed from stage-based and linear models to increasingly complex and dynamic conceptualizations, the concept of

intersectionality has been incorporated with more frequency into the understand of young adult identity development (Galliher, McLean, & Syed, 2017). Much of the literature on the development of underrepresented minorities in STEM, however, still takes an orthogonal or multidimensional approach. The current study sought to present an initial step toward a more intersectional approach to understanding identity development, through the adaptation of an existing measure of ethnic identity development, the MEIM-R. The scale was adapted to develop parallel measures to capture Scientist Identity development as well as intersectional identity termed Ethnic Minority Scientist Identity (EMSI). We found support for the use of Scientist Identity and EMSI scales. Significant differences were observed in the strength of identification in each of these domains, with Scientist Identity being the strongest for the current sample and intersectional identity the weakest. This could suggest that an orthogonal model is a better fit, or that developing a cohesive intersectional identity is more challenging than developing scientist identity and ethnic identity separately. Although the strength of identification differed, the scales were correlated, suggesting that identity development in one domain may indeed foster development in other domains as was hypothesized by Fuller-Rowell, Ong, and Phinney (2013). We also examined the relationship between these identity development domains and commitment to science careers. It appears that in our sample, ethnic identity alone did not relate to commitment to science. Scientist Identity was associated with greater commitment to science, as was Ethnic Minority Scientist Commitment.

Development of Identity in Context

Prior research has established that Latinx and Native American students are less likely to be interested in STEM fields at the outset of their higher education, less likely to switch from another major to a STEM major, and more likely to switch from STEM to humanities and social sciences (Syed, Azmitia, & Cooper, 2011). It has been argued that fostering students' development in domains other than academics, such as "their emotional, cultural, and resource needs" (Gross, Iverson, Willett, & Manduca, 2015) leads to better retention. This has been explained by identity theorists as a function of the interpersonal and contextual nature of identity development (Syed et al., 2011), which is thought to enhance or hinder intersectional identity development (e.g., identity as a Mexican-American biologist or a Shoshone engineer). The results of the current study support this notion, demonstrating that ethnic identity, identity as a scientist, and intersectional identity as an ethnic minority scientist are interrelated constructs that vary in part as a function of similarity with mentor. Likewise, the importance that mentees place on similarity does appear to be related to the strength of their identity development. In the current sample of high-achieving Native American and Latinx STEM undergraduates, we found support for the importance of culturally competent mentoring in fostering the identity development of these emerging scientists. This was true even though the current sample demonstrated higher levels of Scientist Identity than identification with their ethnic groups or intersectional identities. The current study was an examination of the strengths and resources in a group of highly committed science majors. It seems likely that these implications could be applied even more so in the

experiences of students who more strongly identify with their ethnic group and may be less developed in their sense of identity as a scientist.

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APPENDICES

Appendix A

Initial Informed Consent

SACNAS PATHWAYS TO SCIENCE PROJECT

SACNAS Pathways to Science Project (SP)^2: Project - Pre-conference 2011

Thank you for your interest in this research project, a partnership between SACNAS and the University of California Santa Cruz, funding by the National Institutes of Health.

Why participate in this study? We are investigating how involving students in professional experiences helps them succeed in the sciences. By sharing your experiences, you will help SACNAS learn how to best support its student members. Your participation will also contribute to improving the experiences of science students across the country. In addition, you will receive a $50 gift certificate for each of two years of participation, as a token of our appreciation for your time.

Details about this survey. This 15-minute on-line survey consists of multiple-choice and open-ended questions about undergraduate students' academic and mentoring experiences. It is the first of several on-line questionnaires to be completed over a 2-year period. Each year, participants will spend about an hour completing surveys regarding their professional and educational experiences.

Confidentiality. We are concerned about your confidentiality. Your name will be kept separate from your responses to the survey. All information you provide will be kept confidential. No personally identifiable information will be disclosed to anyone, including members of the SACNAS organization.

Risks. There are no foreseen risks associated with participating in this study. You may skip any items you may not wish to answer, and you are free to withdraw from participation at any time without penalty.

Questions. If you have any questions about the research at any time, please contact the project director, Sergio Queirolo, by e-mailing sergioq@ucsc.edu or calling (831) 459-1029. If you have any questions about your rights as a participant in a research project, please call Caitlin Deck at the Office of Sponsored Projects, UCSC, (831) 459-4114, cddeck@ucsc.edu.

Your participation in this study is voluntary. You may refuse participation in any portion of the study without interfering with your participation in SACNAS. <check-box to indicate informed consent>

Appendix B

Follow-Up Informed Consent

SACNAS Pathways to Science Project (SP)^2: March 2012 Survey

Reminder About this Study

Thank you once again for your participation in this research project, a partnership between SACNAS and the University of California Santa Cruz, funded by the National Institutes of Health. We appreciate your responses to the five previous questionnaires. This sixth survey is the last one you will receive during your second year of participation in this series of surveys.

Why participate in this study? We are investigating how involving students in professional experiences helps them succeed in the sciences. By sharing your experiences, you will help SACNAS learn how to best support its student members. Your participation will also contribute to improving the experiences of science students across the country. In addition, you will receive a $50 gift certificate for each of two years of participation, as a token of our appreciation for your time.

Details about this survey. The 20-minute on-line survey consists of multiple-choice and open-ended questions about undergraduate students' academic and interpersonal experiences. This is the sixth of a series of on-line questionnaires to be completed over a 2-year period. Each year, participants will spend about an hour completing surveys regarding their professional and educational experiences.

Confidentiality. We are concerned about your confidentiality. Your name will be kept separate from your responses to the survey. All information you provide will be kept confidential. No personally identifiable information will be disclosed to anyone, including members of the SACNAS organization.

Risks. There are no foreseen risks associated with participating in this study. You may skip any items you may not wish to answer, and you are free to withdraw from participation at any time without penalty.

Questions. If you have any questions about the research at any time, please contact the project director, Sergio Queirolo, by e-mailing sergioq@ucsc.edu or calling (831) 459-1029. If you have any questions about your rights as a participant in a research project, please call Caitlin Deck at the Office of Sponsored Projects, UCSC, (831) 459-4114, cddeck@ucsc.edu.

Your participation in this study is voluntary. You may refuse participation in any portion of the study without interfering with your participation in SACNAS. <check-box to indicate informed consent>

Appendix C

Measure: Perceived Real Similarity

Perceived Real Similarity

Please indicate the degree to which YOU believe you and your mentor are similar.

Please complete the following sentence for each item:
From my perspective, my mentor and I are **similar** in...

	0 = Not at all similar 10 = Completely similar											Not Applicable or I Don't Know
how long we, or our families, have been in the United States	0	1	2	3	4	5	6	7	8	9	10	N/A
our biological sex	0	1	2	3	4	5	6	7	8	9	10	N/A
our masculinity/femininity	0	1	2	3	4	5	6	7	8	9	10	N/A
our sexual orientation	0	1	2	3	4	5	6	7	8	9	10	N/A
our family history in higher education	0	1	2	3	4	5	6	7	8	9	10	N/A
the type of community we grew up in *(e.g. big city, small town, reservation)*	0	1	2	3	4	5	6	7	8	9	10	N/A
our ethnicity	0	1	2	3	4	5	6	7	8	9	10	N/A
how important it is for me to live out the traditions of my culture	0	1	2	3	4	5	6	7	8	9	10	N/A
the holidays we observe	0	1	2	3	4	5	6	7	8	9	10	N/A
our values about the importance of family	0	1	2	3	4	5	6	7	8	9	10	N/A
our thoughts about how to show respect	0	1	2	3	4	5	6	7	8	9	10	N/A
our use of eye contact in communication	0	1	2	3	4	5	6	7	8	9	10	N/A
our comfort or discomfort with physical closeness or physical contact	0	1	2	3	4	5	6	7	8	9	10	N/A
how much we talk (e.g. quiet or talk a lot)	0	1	2	3	4	5	6	7	8	9	10	N/A
the vocabulary we use	0	1	2	3	4	5	6	7	8	9	10	N/A
our reasons for pursuing a career in science	0	1	2	3	4	5	6	7	8	9	10	N/A

Appendix D

Measure: Ideal Similarity

Ideal Similarity

Please tell us how IMPORTANT it is to you have a mentor who is similar to you in each of these areas:

It's important to me that my mentor and I are similar in…

	0= It is not at all important to me 10= It is extremely important to me											Not Applicable or I Don't Know
how long we, or our families, have been in the United States	0	1	2	3	4	5	6	7	8	9	10	N/A
our biological sex	0	1	2	3	4	5	6	7	8	9	10	N/A
our masculinity/femininity	0	1	2	3	4	5	6	7	8	9	10	N/A
our sexual orientation	0	1	2	3	4	5	6	7	8	9	10	N/A
our family history in higher education	0	1	2	3	4	5	6	7	8	9	10	N/A
the type of community we grew up in *(e.g. big city, small town, reservation)*	0	1	2	3	4	5	6	7	8	9	10	N/A
our ethnicity	0	1	2	3	4	5	6	7	8	9	10	N/A
how important it is for me to live out the traditions of my culture	0	1	2	3	4	5	6	7	8	9	10	N/A
the holidays we observe	0	1	2	3	4	5	6	7	8	9	10	N/A
our values about the importance of family	0	1	2	3	4	5	6	7	8	9	10	N/A
our thoughts about how to show respect	0	1	2	3	4	5	6	7	8	9	10	N/A
our use of eye contact in communication	0	1	2	3	4	5	6	7	8	9	10	N/A
our comfort or discomfort with physical closeness or physical contact	0	1	2	3	4	5	6	7	8	9	10	N/A
how much we talk (e.g. quiet or talk a lot)	0	1	2	3	4	5	6	7	8	9	10	N/A
the vocabulary we use	0	1	2	3	4	5	6	7	8	9	10	N/A
our reasons for pursuing a career in science	0	1	2	3	4	5	6	7	8	9	10	N/A

Appendix E

Measure: Revised Multigroup Ethnic Identity Measure

Revised Multigroup Ethnic Identity Measure
(MEIM-R; Roberts, et al., 1999)

	1 = strongly disagree 4 = strongly agree			
I have spent time trying to find out more about my ethnic group, such as history, traditions, and customs.	1	2	3	4
I am active in organizations or social groups that include mostly members of my own ethnic group.	1	2	3	4
I have a clear sense of my ethnic background and what it means for me.	1	2	3	4
I think a lot about how my life is affected by my ethnic group membership.	1	2	3	4
I am happy that I am a member of the [ethnic] group I belong to.	1	2	3	4
I have a strong sense of belonging to my own ethnic group.	1	2	3	4
I understand pretty well what my ethnic group means to me.	1	2	3	4
To learn more about my ethnic background, I have often talked to other people about my ethnic group.	1	2	3	4
I have a lot of pride in my ethnic group and its accomplishments.	1	2	3	4
I participate in cultural practices of my own ethnic group, such as special books, movies, food, music, or customs.	1	2	3	4
I feel a strong attachment towards my own ethnic group.	1	2	3	4
I feel good about my cultural or ethnic background.	1	2	3	4

Appendix F

Measure: Scientist Identity

Scientist Identity

adapted from the revised Multigroup Ethnic Identity Measure
(MEIM-R; Roberts, et al., 1999)

	1 = strongly disagree 4 = strongly agree			
I have spent time trying to find out more about my chosen career.	1	2	3	4
I am active in organizations or social groups for people in my chosen career.	1	2	3	4
I have a clear sense of what I want to do for a career.	1	2	3	4
I think a lot about how my life will be affected by my career choice.	1	2	3	4
I am happy that I am a member of a community of scientists.	1	2	3	4
I have a strong sense of belonging to the community of scientists.	1	2	3	4
I understand pretty well what it means to be a scientist in my chosen field.	1	2	3	4
To learn more about my chosen career, I have often talked to other people about it.	1	2	3	4
I have a lot of pride in the field I've chosen to go into, and what has been accomplished in my field so far.	1	2	3	4
I participate in practices of my profession, e.g. reading special books and journals, attending conferences or scientific lectures.	1	2	3	4
I feel a strong attachment towards my chosen field of study.	1	2	3	4
I feel good about my chosen field of study.	1	2	3	4

Appendix G

Measure: Ethnic Minority Scientist Identity

Measure: Ethnic Minority Scientist Identity

adapted from the revised Multigroup Ethnic Identity Measure
(MEIM-R; Roberts, et al., 1999)

	1 = strongly disagree 4 = strongly agree			
I have spent time trying to find out about people of a similar ethnicity to me in my chosen career.	1	2	3	4
I am active in organizations for people of a similar ethnicity to me in my chosen career.	1	2	3	4
I have a clear sense of what it means for someone of my ethnicity to pursue the career I've chosen.	1	2	3	4
I think a lot about how my life is affected by my ethnicity because of my career choice, or how it is affected by my career choice because of my ethnicity.	1	2	3	4
I am happy that I am a scientist and a member of my ethnic group.	1	2	3	4
I have a strong sense of belonging to the community of scientists of similar ethnicity to me.	1	2	3	4
I understand pretty well what it means to be a scientist of my ethnicity.	1	2	3	4
To learn more about being a scientist of my ethnicity, I have talked to other people about it.	1	2	3	4
I have a lot of pride in the accomplishments of scientists of my ethnicity.	1	2	3	4
I participate in practices of my profession that are specific to people of a similar ethnicity to me, e.g. reading special books and journals, attending conferences or scientific lectures.	1	2	3	4
I feel a strong attachment toward being a scientist of my ethnicity.	1	2	3	4
I feel good about being a scientist of my ethnicity.	1	2	3	4

Appendix H

Measure: Commitment to a Science Career

Commitment to a Science Career

(Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011)

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I intend to work in a job related to science.	1	2	3	4	5
2. I see the next steps in the field of science, and I intend to take them.	1	2	3	4	5
3. I will work as hard as necessary to achieve a career in science.	1	2	3	4	5
4. I expect a career in this field will be very satisfying.	1	2	3	4	5
5. I feel that I am on a definite career path in science.	1	2	3	4	5
6. I definitely want a career for myself in science.	1	2	3	4	5
7. Science is the ideal field of study for my life.	1	2	3	4	5

Appendix I

Permission Letter to Include Articles in Dissertation

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

PSYCHOLOGY DEPARTMENT
SANTA CRUZ, CALIFORNIA 95064

July 28, 2018

Angela Enno
Department of Psychology
2810 Old Main Hill
Logan, UT 84322-2810

Dear Dr. Enno:

You have my permission to use in your dissertation the manuscripts from the research you completed under the auspices of **Grant Number R01GM071935 from the National Institute Of General Medical Sciences**, for which I was Principal Investigator. This includes:

For Dissertation title: Contextual Factors in the Identity Development of Native American and Latinx Undergraduates in STEM Fields

Chapter 2, Paper 1: Native American and Latinx Undergraduate Science Majors' Similiarity with Mentors

Chapter 3, Paper 2: Intersectional Identity Development in Native American and Latinx Undergraduate Science Majors

Sincerely,

Martin M. Chemers, Ph.D.
Professor Emeritus
Psychology

CURRICULUM VITAE

ANGELA M. ENNO

Department of Psychology
Utah State University

2810 Old Main Hill
Logan, Utah 84322-2810
angela.enno@gmail.com

EDUCATION

2018 **Doctor of Philosophy** **Utah State University**
Combined Clinical/Counseling Psychology Ph.D. Program
Dissertation in Progress: Contextual Factors in the Identity Development of Native American and Latinx Undergraduates in STEM Fields
Chair: Renee V. Galliher, Ph.D.

2012 **Master of Science** **Utah State University**
Counseling Psychology
Thesis: The Intersection of Multiple Oppressed Identities: Implications for Identity Development
Chair: Renee V. Galliher, Ph.D.

2006 **Bachelor of Science** **Utah State University**
Major: Psychology, Minor: Sociology
Honor's Thesis: The Effects of Context on Ethnic Identity
Chair: Renee V. Galliher, Ph.D.

2002 **Associate of Science** **College of Eastern Utah**
Major: English

HONORS

2017 National Psychologist Trainee Register Credentialing Scholarship
National Register of Health Service Psychologists

2014-15 Fredrick Q. Lawson Fellowship
($6,250) EEJ College of Education and Human Services
Utah State University

2009 Dr. Richard A. Rodriguez Division 44 Student Travel Award
($500) American Psychological Association Convention

2009 Joint APA Ethics and Division 44 Student Travel Award
($1400) National Multicultural Summit

2006 Graduated Magna Cum Laude

2006	Graduated with Honors in Psychology
2006	Outstanding Student Award, Department of Psychology Utah State University
2006	Finalist: Woman of the Year (University-Wide) Utah State University
2006	Psychology Department Nominee: Scholar of the Year EEJ College of Education and Human Services Utah State University
2003-06	Dean's List (Every Semester), Utah State University
2003-Present	Psi Chi National Honor Society in Psychology

CLINICAL INTERESTS

- Theoretical Orientations/Approaches: Feminist, Multicultural, Acceptance and Commitment Therapy, Dialectical Behavior Therapy, Motivational Interviewing, Positive Psychology

- Presenting Concerns: Trauma, self-injury, suicidality, chronic illness, identity development, sexual issues, women's issues, grief, acculturative stress, marriage/relationship concerns

- Other Topics: Ethics, posttraumatic growth, spirituality, indigenous healing methods/ceremonies (e.g. Sweat Lodge), holistic approaches (e.g. integrated behavioral health & primary care; mind/body), activism and social justice

- Populations: Adults, Racial/Ethnic Minorities (especially Native Americans), Immigrants, LGBTQQIA+, Individuals with Multiple Oppressed Identities, First Generation College Students

CLINICAL EXPERIENCE

Providing Individual Therapy

08/17-Present Predoctoral Intern in Psychology
University Counseling Center, University of Oregon

- Intake assessments, brief psychotherapy, supervision of two graduate-level practicum interns, group psychotherapy, outreach and consultation
- Training and Supervision Rotation
- Presenting problems: depression, anxiety, identity concerns, sleep problems, sexual issues, relationship issues, trauma, ADHD, alcohol and other substance abuse, psychotic disorders,

LGBTQQIA+ concerns, bereavement, gender identity, international students, first generation college students, internalized racism, transphobia, and sexism

Supervisors: Liz Asta, Ph.D., Ron Miyaguchi, Ph.D., & Mariko Lin, Ph.D.

05/17 - 08/17 Practicum Student Therapist
Urban Indian Center of Salt Lake City

- External placement in a community setting for Native Americans
- Intake assessments, brief psychotherapy, group therapy, report writing, community outreach, service coordination with health program, law enforcement, and other community agencies
- Presenting problems: alcohol and other drug abuse, Major Depressive Disorder, Posttraumatic Stress Disordered

Supervisors: Melanie Domenech-Rodriguez, Ph.D. & Shauntele Curry-Smid, L.C.S.W

08/16 - 05/17 Practicum Student Therapist
Acceptance & Commitment Therapy Anxiety Clinic, Utah State University

- In-house practicum, community clinic setting
- Acceptance & Commitment Therapy interventions; intake assessments
- Presenting problems: Anxiety, panic, Posttraumatic Stress Disorder, Autism Spectrum Disorder

Supervisor: Michael Twohig, Ph.D.

10/15 - 05/16 Student Therapist
Student Health and Wellness, Utah State University

- External placement providing behavioral health in primary care
- Intake assessments, brief psychotherapy, service coordination with primary care providers and psychiatrists, crisis consultation
- Presenting problems: depression, anxiety, identity concerns, sleep problems, hypothyroidism, sexual issues, relationship issues, trauma, ADHD, substance abuse, psychotic disorders, LGBTQQIA+ concerns

Supervisor: Scott DeBerard, Ph.D.

05/14 - 10/14 Student Therapist
Utah State University Community Clinic

- In-home community clinic, provided psychological services and conducted assessment
- Presenting problems: depression, anxiety, identity concerns, Borderline Personality Disorder, internalized racism,

internalized homophobia, and acculturative stress
- Conducted assessment for Vocational Rehabilitation using the Wechsler Adult Intelligence Test (WAIS-IV) and the Woodcock-Johnson III

Supervisor: Scott DeBerard, Ph.D.

08/13 - 03/15 Practicum Student Therapist
Up to 3, Center for Persons with Disabilities, Utah State University
- External placement providing psychological services through home visits for families of children under 3
- Individual therapy: parent training

Supervisor: Gretchen Peacock, Ph.D.

08/12 - 05/13 Graduate Assistant Therapist
Counseling and Psychological Services (CAPS), Utah State University
- External placement providing psychological services in a university
- Individual therapy, group therapy, crisis consultation
- Provide weekly clinical supervision of undergraduate REACH Peer (undergraduate REACH peers provide individual psychoeducation sessions to clients and organize outreach workshops)
- Psychoeducational Workshop: Healthy Sexuality
- Other Outreach: Office of International Students presentation on CAPS services, campus-wide depression and anxiety screens, invited guest lectures on psychological health for several classes on campus

Supervisor: David Bush, Ph.D.

08/11 - 05/12 Practicum Student Therapist
Counseling and Psychological Services (CAPS), Utah State University
- External placement providing psychological services in a university
- Individual therapy, group therapy, crisis consultation and campus outreach
- Typical presenting problems included: depression, anxiety and concerns regarding identity, relationships and life transitions.
- Groups: Dialectical Behavior Skills Training, Understanding Self & Others
- Psychoeducational Workshop: The Joy of Happiness
- Other Campus Outreach: Psychology 1010 class presentation on CAPS services

Supervisor: LuAnn Helms, Ph.D.

04/10 - 05/11 Practicum Student Therapist
Student Health and Wellness, Utah State University
- Provided behavioral health services within a primary care setting
- Intake assessments, brief psychotherapy, behavioral consultation, crisis consultation and collaboration with primary care providers
- Presenting problems included: depression, anxiety, identity concerns, sleep problems, sexual issues, relationship issues, trauma, ADHD

Supervisor: Scott DeBerard, Ph.D.

08/09 - 08/10 Practicum Student Therapist
Utah State University Community Clinic
- In-home community clinic, provided psychological services and conducted assessment
- Intake assessments, brief psychotherapy provided to child, adolescent, and adult community population
- Provided parent-training with a co-therapist using PMTO model
- Provided psychoeducational assessments to adults and children using the WAIS IV, WISC IV, & Woodcock Johnson
- Typical presenting problems included: depression, anxiety, ADHD, learning disabilities, and PTSD

Supervisors: Susan Crowley, Ph.D.; Kyle Hancock, Ph.D.

Group Facilitation

09/17 - Present LGBTQ+ Group (Support & Process-Based Group)
University Counseling Center (UCC), University of Oregon
Supervisors: Kendall Thornton, Psy.D. & Alisia Caban, Ph.D.

05/17 - 08/17 Coyote Thinking (Psychoeducational Therapy Group)
Native American culturally-informed Cognitive Behavior Therapy group for Substance Abuse
Urban Indian Center of Salt Lake City, Utah
Supervisors: Melanie Domenech-Rodríguez, Ph.D. & Shauntele Curry-Smid, L.C.S.W.

01/13 - 05/13 Dialectical Behavior Skills Training (Psychoeducational Therapy Group)
Counseling and Psychological Services (CAPS), Utah State University
Supervisor & Co-Lead: Chris Chapman, Ph.D.

08/12 - 05/13	Healthy Sexuality (Psychoeducational & Process-Based Workshop) Counseling & Psychological Services Lead Independently Supervisors: David Bush, Ph.D. & LuAnn Helms, Ph.D.
08/12 - 12/12	Understanding Self & Others Group (Process-Based Therapy Group) Counseling and Psychological Services (CAPS), Utah State University Supervisor & Co-Lead: Eric Everson, Ph.D.
01/12 - 05/12	The Joy of Depression (Positive Psychology Psychoeducational Workshop) Utah State University Community Clinic Supervisor & Co-Lead: David Bush, Ph.D.
01/12 - 05/12	Healthy Sexuality (Psychoeducational & Process-Based Group) Conducted as part of a peer's dissertation research Utah State University Community Clinic Supervisor: Renee Galliher, Ph.D.
09/11 - 12/11	Understanding Self & Others Group (Process-Based Therapy Group) Counseling and Psychological Services (CAPS), Utah State University Supervisor & Co-Lead: David Bush, Ph.D.
08/10 - 05/11	Inclusive Spaces Training for Educators in Department of Education at Utah State University Inclusion Center for Community and Justice, Salt Lake City Co-Lead: Hande Togrul, Ph.D.

Specialized Trainings & Certifications

05/15	Gatekeeper Instructor Certification; Q.P.R. Institute on Suicide Prevention Certification to provide Q.P.R. Gatekeeper Trainings (expires 05/2018)
04/14	Understanding and Treatment of Psychological Trauma - Trauma and the Brain by Bessel van der Kolk, Ph.D. Utah State University Counseling and Psychological Services
04/13	Supershrinks: Learning from the Field's Most Effective Practitioners by Scott D. Miller, Ph.D. Utah State University Counseling and Psychological Services

04/12	The How, What and Why of Happiness: The Science of Interventions Aimed at Increasing Well-Being by Sonja Lyubomirksy, Ph.D. Utah State University Counseling and Psychological Services
04/12	Getting Started as a Successful Proposal Writer and Academician Workshop by Stephen W. Russell, D.V.M, Ph.D. Utah State University
06/10	Inclusion Summit Human Relations Retreat Week-long retreat with workshops about oppression; discussions on social issues and multiculturalism, and how they affect communities, homes, and workplaces.
11/09	Navajo Nation Human Research Review Board Presentation: Pre-conference session on that Research Approval and Dissemination Process at Window Rock, AZ
04/09	Acceptance and Commitment Therapy Experiential Training Conducted by Steven C. Hayes at Utah State University
10/07	Bridges Out of Poverty Group Facilitator Certification Salt Lake City, Utah
01/07	Nonviolent Crisis Intervention Certification, Crisis Prevention Institute (Originally certified 04/03, recertified 04/04 & 01/07)
01/07	Q.P.R. (Question, Persuade, Refer) Gatekeeper Certification, Q.P.R. Institute on Suicide Intervention
04/06	Becoming Culturally Competent by Teresa LaFromboise, Ph.D. Utah State University Counseling and Psychological Services
04/05	Allies on Campus training on sexual minority issues Utah State University

OTHER PROFESSIONAL EXPERIENCE

06/14 - 07/16 **Multicultural Program Coordinator** (full-time, paid position)
Access & Diversity, Utah State University

- Secured funding from Deans/Department Heads. Organized first ever Native Aggie Day (100 Native American high school students attended workshops on admissions, financial aid, academic resources, majors, student involvement, etc.)
- Organized first-ever Dia de los Muertos celebration

- Planned annual powwow
- Advised the Native American Student Council and Latino Student Union.
- Awarded over 100 scholarships: evaluated applications, oversaw scholarship selection committee.

03/07 - 07/08 **Case Manager**
Sunrise Metro - Housing project for people exiting chronic homelessness
Volunteers of America, Utah
Supervisors: Vard McGuire, M.S.W., Mark Manazer, Ph.D.

- 32 clients
- Ethnically diverse caseload (about half racial/ethnic minorities)
- Many with substance abuse problems, posttraumatic stress, combat veterans, severe and persistent mental illnesses, psychotic disorders, and physical disabilities

GRANTS AWARDED

06/10 - 06/12 Title: *Assessing Scientific Inquiry and Leadership Skills*
Amount: $77,125
Role: Co-Investigator
Funding Source: National Institute of General Medical Science
Minority supplement to 3R01GM071935-06S
PI: Martin M. Chemers, Ph.D.

RESEARCH INTERESTS: Intersectional identity, multiracial identity development, persistence of underrepresented racial/ethnic minorities in higher education, professional identity development, ethnic identity, gender identity, LGBTQQIA+ identity development, ethics

PUBLICATIONS

Twohig, M. P., Domenech Rodríguez, M. M. & **Enno, A. M.** (2014). Promoting the multicultural competency of psychological professionals through acceptance and mindfulness-based methods. In A. Masuda (Ed.) *Cultural Issues in Acceptance and Mindfulness-Based Approaches*. New Harbinger: Oakland, CA.

Morse, G. S. & **Enno, A. M.** (2011). The throw away boy: The case of an Eastern Woodlands American Indian adolescent. In Gallardo, M. E., Yeh, C., Trimble, J. E., & Parham, T. A. (Eds.). *Culturally Adaptive Counseling Skills: Demonstrations of Evidence-Based Practices*. Thousand Oaks, CA: Sage.

Codd, R. T., Twohig, M. P., Crosby, J. M. & **Enno, A. M.** (2011). Treatment of three anxiety cases with Acceptance and Commitment Therapy in a private practice. Journal of Cognitive Psychotherapy.

Galliher, R. V., **Enno, A.,** & Wright, R. (2008). Convergence and divergence among multiple methods for assessing adolescent romantic relationships. *Journal of Adolescence, 31,* 747-769.

CONTINUING EDUCATION TRAININGS PROVIDED

Twohig, M. P., Domenech Rodriguez, M. M., & **Enno A.** (October, 2008). Acceptance- and Values-Based Multicultural Training to increase multicultural competency and engagement in applied faculty members and graduate students. 4.5 hour continuing education training provided twice at Utah State University.

INVITED PRESENTATIONS

Enno, A. M. (July, 2016). iUtah diversity discussion II: Understanding your social location. Presentation given at the annual iUtah Undergraduate Research Program Summer Training in Logan, Utah.

Enno, A. M. (September, 2015). Culturally competent mentoring of ethnic minority undergraduates. Paper presented at the annual iUtah Diversity Conference and Fall All-Hands Meeting in Salt Lake City, Utah.

Enno, A. M. (July, 2015). iUtah diversity discussion: Understanding your social location. Presentation given at the annual iUtah Undergraduate Research Program Summer Training in Logan, Utah.

PRESENTATIONS

Enno, A. M. & Domenech-Rodriguez, M. (August, 2012). Research and the APA Ethics Code: Application and relevance in training contexts. Symposium presented at the annual meeting of the American Psychological Association in Orlando, FL.

Enno, A. M. & Galliher, R.V. (September, 2011). Community as an intervention. Poster presented at the annual meeting of the Native Children's Research Exchange in Denver, Colorado on September 9, 2011.

Domenech-Rodriguez, M. M., Farnsworth, O., **& Enno, A.M.** (2011). Ethical Challenges: What Almost 20 Years of APA Ethics Committee Reports Tell Us About Psychological Practice, Teaching, and Research. Paper presented at the annual meeting of the Rocky Mountain Psychological Association Conference in Salt Lake City, Utah.

Zhao, X., **Enno, A.,** Stevens, T., Prout, K., McCleary, E., Davies, S., Tafoya, M., Morse, G. (January, 2011). Quality of life, cultural identity, and PTSD in an American Indian sample. Poster presented at the biennial National Multicultural Conference and Summit in Seattle, WA.

Enno, A., Stevens, T., Tafoya, M., Davies, S., Prout, K., McCleary, E., Morse, G. (June, 2010). PTSD in a Native American community. Paper presented at the annual convention of the Society of Indian Psychologists in Logan, UT.

Tafoya, M., **Enno, A.,** Richards, S. M., & Galliher, R. V. (March, 2010). Generational status as a proxy measure of acculturation for Latino/a youth: Patterns of association with cultural values. Poster presented at the biannual convention of the Society for Research on Adolescence in Philadelphia, PA.

Codd, R. T., Twohig, M. P., & **Enno, A.** (November, 2009). ACT in the treatment of four different anxiety disorders: A case series. Poster presented at the annual convention of the Association for Behavioral and Cognitive Therapies in New York, NY.

Enno, A. (August, 2009). The multiple dimensions of diversity: An ethnic minority trainee's perspective in J. Barnett, *Am I Competent Enough? Latina/o Voices and Diversity*, Symposium presented at the annual meeting of the American

Psychological Association in Toronto, ON, Canada.

Enno, A., Twohig, M. P., & Domenech-Rodriguez, M. (May, 2009). Acceptance and Values-Based Multicultural Training: Measuring the Effectiveness of ACT in Increasing Multicultural Engagement and Competence among Psychology Faculty and Graduate Students in L. Fletcher, *Stigma and Prejudice: Applying Contextual Behavior Science to a Global Problem*, Symposium presented at the annual meeting of the Association for Behavior Analysis in Phoenix, AZ.

Enno, A. M, Galliher, R. V. (April, 2007). Effects of gender and ethnicity on interpersonal power and gender role attitudes in adolescent romantic relationships**.** Poster presented at the annual Society for Research on Child Development conference, Boston, MA.

Wollenzien, K. & **Enno, A.** (April, 2006). Effects of a monitoring intervention on academic performance of at-risk students. Poster presented at the annual Psychology Undergraduate Research Conference in conjunction with Utah State University Student Showcase, Logan, UT.

Galliher, R. V., **Enno, A.,** & Bentley, C. G. (March, 2006). Multi-method analysis of adolescent romantic couples' problem solving interactions: Associations with relationship quality. In B. Holmes, *Romantic Relationship Quality in Adolescence: Contributing Factors and Outcomes*, Symposium presented at the biennial meeting of the Society for Research on Adolescence, San Francisco, CA.

Enno, A. M., Galliher, R. V., and Jones, M. (July, 2005) Effects of context on ethnic identity in Native American adolescents. Poster presented at the annual convention of the Society of American Indian Psychologists and Psychology Graduate Students, Logan, UT.

PROGRAM EVALUATION REPORTS AUTHORED

Enno, A., Sanborn, W., & Callow-Huesser, C. (2006). 2005-2006 Utah Behavior Initiative Evaluation Report, Utah State Improvement Grant. Submitted to the Utah State Office of Education.

Enno, A., Sanborn, W., & Callow-Huesser, C. (2006). 2005-2006 JumpStart and Alternative Teacher Preparation Program Evaluation Report, Utah State Improvement Grant. Submitted to the Utah State Office of Education.

Enno, A., Sanborn, W., & Callow-Huesser, C. (2006). 2005-2006 New Teacher Survey Report, Utah State Improvement Grant. Submitted to the Utah State Office of Education.

Enno, A., Sanborn, W., & Callow-Huesser, C. (2006). 2005-2006 Exit Teacher Survey Report, Utah State Improvement Grant. Submitted to the Utah State Office of Education.

Enno, A., Sanborn, W., & Callow-Huesser, C. (2006). 2005-2006 Mentor Survey Report, Utah State Improvement Grant. Submitted to the Utah State Office of Education.

PEER REVIEW ACTIVITIES

2017 Reviewer, grant proposals
Native Elder Abuse Innovation Awards, Center for Rural Health, University of North Dakota School of Medicine & Health Sciences

2016 Ad hoc Reviewer for Journal of Adolescent Research

2010 Reviewer, conference submissions
APA Division 45: Society for the Psychological Study of Ethnic Minority Issues
Conference: June 17-19, 2010 at the University of Michigan in Ann Arbor

2009 Ad hoc Reviewer for Cultural Diversity and Ethnic Minority Psychology

2009 Ad hoc Reviewer for Cognitive and Behavioral Practice

RESEARCH EXPERIENCE

10/09 - 05/11 Research Assistant
Assessing Science Inquiry and Leadership Skills, University of California, Santa Cruz
Supervisors: Martin Chemers, Ph.D., Barbara Goza, Ph.D., Sergio Queirolo
Responsibilities: Conduct interviews obtaining longitudinal qualitative data on ethnic minority undergraduate students in the sciences who participated in the 2009 conference of the Society for the Advancement of Chicanos and Native Americans in Science. Interviews centered on students' experiences with mentoring, their commitment to careers in the sciences, and the necessary resources and potential barriers to their success. Review transcripts of interviews for accuracy. Conducted qualitative analysis of the Native American subset of interview transcripts.

08/09 - 08/10 Research Assistant
1st Environment Research Projects, Utah State University
Supervisor: Gayle Morse, Ph.D.
Responsibilities: Assist professor in facilitating focus groups with American Indian community college students, developing measures using Q-sort methodology to examine factors contributing to the retention and success of American Indian college students.

08/08 - 12/09 Research Assistant
Supervisor: Michael Twohig, Ph.D.
Responsibilities: Organized, and evaluated the effectiveness of, an Acceptance and Commitment Therapy-based training seminar to increase multicultural engagement and incorporation of diversity in the professional activities (teaching, therapy, and research) of psychology graduate students and faculty. Supervised undergraduate student researchers, prepared manuscripts for presentation and publication, attended weekly research team meetings, data collection & management.

05/08 - 08/08 Summer Intern
Utah State Department of Human Services
Supervisors: Manuel Romero & Amanda Singer
Responsibilities: Addressed tribal councils and government representatives from American Indian tribes in Utah to gain permission to conduct interviews with tribal leaders and employees, interviewed tribal representatives as well as staff at the Indian Walk-In Center (an Urban American Indian center in Salt Lake City, Utah), gathered tribally-specific feedback on strategies for providing culturally responsive and effective case management services to American Indians in Utah, provided written reports used in a caseworker training website, attended state-level Tribal and Indian Issues Committee meetings where government to government negotiations took place among local tribal governments and the Utah Department of Human Services.

05/06 - 02/07 Data Analyst, Educational Program Evaluation
EndVision Research & Evaluation, LLC
Supervisor: Catherine Callow-Huesser, MS
Responsibilities: Quantitative and qualitative data analysis; wrote and presented program evaluation reports; met with clients; tailored reports to maximize the usefulness of data obtained, assisted in preparing grant proposals; revised instruments used in program evaluation, designed data files in Excel and SPSS; entered, matched, and cleaned data; trained other staff to use SPSS and Excel for data entry and analysis; educational assessment of Native American children's reading skills, using DIBELS on Wireless Generation.
Projects: External program evaluation of the Bureau of Indian Affairs (BIA) Reading First Grant, external program evaluation of Utah State Improvement Grant (Utah State Office of Education).

01/05 - 05/06 Research Assistant
Adolescent Couples Lab, Utah State University
Supervisor: Renee Galliher, Ph.D.
Responsibilities: Supervised team of 11 undergraduate research assistants; coded video-taped Native American, Latino, and White adolescent couple interactions on the demonstration of various communication skills; attended research team meetings; and prepared posters and manuscripts for presentation and publication.

01/06 - 05/06 Research Assistant
Latino Families Lab, Utah State University
Supervisor: Melanie Domenech-Rodriguez, Ph.D.
Responsibilities: Designed data files using SPSS, scored Child

	Behavior Checklists and Teacher Report Forms using ADM, and entered data into SPSS.
11/04 - 05/05	Research Assistant CURI Bully Intervention Project, Utah State University Supervisor: Donna Gilbertson, Ph.D. *Responsibilities*: Assisted peer mentors in teaching bully intervention strategies to junior high school students; prepared lesson materials; assisted in preparing, administering, and entering survey data on identified adolescent victims of bullying; assisted graduate student with preparing literature review for doctoral dissertation.

COMMITTEE WORK AND SERVICE

Department

11/17 - 01/18	Member, Intern Selection Committee University Counseling Center (UCC), University of Oregon
08/12 - 05/13	Student Representative, Combined Psychology Ph.D. Program
08/09 - 05/10	American Indian Support Project Assistant (Paid), Combined Psychology Ph.D. Program

University

04/05 - Present	Member, Allies on Campus, Utah State University
09/15 - 07/16	Member, Diversity Council (Paid) Division of Student Affairs, Utah State University Reviewed one-time and long-term grants submitted to Diversity Council
06/14 - 07/15	Committee Head, Scholarship Committee (Paid) Access & Diversity Center, Division of Student Affairs Utah State University
08/12 - 05/13	Student Representative, Steering Committee Allies on Campus, Utah State University
2011	Student Representative, hiring committee for Native American Student Council Advisor Access & Diversity Center, Utah State University
08/08 - 05/10	Member, Native American Student Council, Utah State University

05/05 - 05/06	Distance Education Liaison, Psi Chi Executive Council Utah State University

National

06/10 - 06/12	Student Representative, Executive Council Society of Indian Psychologists

Community

08/16 - 12/16	Founder, Aggies for Standing Rock Organized group of over 300 Utah State University students and community members. Collected donations for camps at Standing Rock in opposition to Dakota Access Pipeline, lead volunteer efforts to raise awareness locally, participated in state-wide solidarity march on the Capitol building
08/15 - 05/17	Member, Cache County Suicide Prevention Coalition Attend coalition meetings, trained and certified as a Q.P.R. Gatekeeper Trainer, provide Q.P.R. Gatekeeper suicide prevention trainings in the community

PROFESSIONAL ASSOCIATIONS

Society of Indian Psychologists, National Register of Health Service Psychologists, Psi Chi National Honor Society

TEACHING EXPERIENCE

As an independent instructor

Spring 2018 & Spring 2017	Culture and Politics of Motherhood Graduate and Undergraduate (Cross-Listed) Online course taught via Canvas Women's Studies Department, Utah State University
Fall 2017 & Fall 2016	Introduction to Feminist Theories Graduate and Undergraduate (Cross-Listed) Online course taught via Canvas Women's Studies Department, Utah State University
Fall 2016, Summer 2014, & Spring 2012	Psychological Statistics Undergraduate on-campus course Department of Psychology, Utah State University
Spring 2013 & Fall 2012	Abnormal Psychology Undergraduate on-campus course Department of Psychology, Utah State University

Spring 2010 & Fall 2009	Educational Psychology for Teachers Undergraduate course provided live to on-campus students, and via live satellite television to distance education campuses statewide
Summer 2014 & Summer 2009	Psychological Statistics Online undergraduate course taught via Blackboard Vista Department of Psychology, Utah State University