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Relational Cultural Theory and Mentoring in a Science Support Program

Kathleen Buehler
DePaul University, kitty.buehls@gmail.com

Relational Cultural Theory and Mentoring

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Kathleen Rebecca Buehler

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Department of Psychology

College of Science and Health

DePaul University

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Thesis Committee

Bernadette Sanchez, Ph.D., Chairperson

Ida Salusky, Ph.D.

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Biography

The author was born in Columbus, Ohio, April 29, 1991. She graduated from Bishop Watterson High School in 2009 and received her Bachelor of Science in Psychology from Fordham University in 2013.

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Abstract

Increasing the number of Latinx students in science, technology, engineering, and mathematics (STEM) fields is a national priority, but statistics show that Latinx students are still underrepresented in these fields (U.S. Department of Education, 2014). Mentoring interactions are thought to be integral to the retention and success of STEM students (George & Neale, 2006) and a contextualized mentoring model that both supports growth in STEM fields and also meets the needs of underrepresented groups is essential. This study used relational cultural theory (RCT; Ragins & Fletcher, 2007) to examine non-hierarchical relational mentoring approaches within STEM contexts. Using qualitative data from a larger investigation that evaluated a university-based hands-on research and mentoring program designed to build a pipeline for Latinx students pursuing higher education in science and biomedical research, the study sought to answer three research questions: What do relational mentoring relationships look like in a science mentoring program for Latinx high school and college students? What are the relational outcomes of relational mentoring relationships in a science mentoring program for Latinx high school and college students? What are the gender differences in the use and expression of relational abilities and outcomes? The results support the relevance of RCT to science contexts and to Latinx science students and their mentors. Relational abilities and outcomes were discussed by program students, graduate student mentors, and faculty advisors, and often manifested in ways that were specific to the scientific context. Program students most frequently mentioned relational abilities. There were some group differences in the discussions of relational outcomes. Gender differences in content also arose, meaning men and women discussed and exhibited some relational abilities and outcomes in different ways. This study is a unique contribution to the STEM mentoring literature and suggests that RCT mentoring could be an important framework for future program trainings.

Introduction

Increasing the science, technology, engineering, and mathematics (STEM) workforce has become a top priority for the United States. The U.S. Bureau of Labor Statistics (2014) projects an increase of about one million STEM jobs between 2012 and 2022 and the STEM Education Coalition in Washington, D.C. claims, "The future of the economy is in STEM" (p. 3). However, there are not currently enough students pursuing STEM degrees to meet the increasing demand and, in order for the United States to be competitive in the global economy, the number of undergraduate students pursuing degrees and careers in STEM fields will need to increase by 34% (Olson & Riordan, 2012; U.S. Department of Education, 2014). In a country that is becoming increasingly more racially and ethnically diverse, equal representation is essential in meeting this goal, but statistics show that Black and Latinx students are underrepresented (U.S. Department of Education, 2014). According to the U.S. Department of Education (2014), in 2009-2010, Latinx individuals made up 3-12% of individuals receiving Associate degrees or above in STEM fields, compared to 16% of the U.S. population in 2010 (U.S Census Bureau, 2010).

In 2014, the U.S. Department of Education reported that, although Latinx students have been shown to be equally as likely as White students to major in STEM fields, only 16 percent of Latinx students who entered college in 2004 with a STEM major graduated with a STEM degree. More recent reports show that, although the number of Latinx students earning credentials in STEM has increased over the past four years, the percentage of credentials conferred to Latinx students was small; 2% of all institutions awarded 33% of credentials to Latinx STEM graduates (Santiago, Taylor, & Calderón Galdeano, 2015). Conferral of credentials is occurring mainly at colleges and universities which identify as Hispanic-Serving Institutions (HSIs; Santiago, Taylor,

& Calderón Galdeano, 2015). Little research currently exists on HSIs, especially in regards to the protective resources that Latinx students may receive from them (Park, Flores, & Ryan, 2015). Furthermore, Latinx individuals who are eventually employed in STEM fields work predominantly in STEM service positions (e.g. technicians or surveyors) rather than professional occupations (e.g. engineers, chemists, or statisticians; Santiago, Taylor, & Calderón Galdeano, 2015). An increase in the number of Latinx students in STEM is essential to meeting the projected needs of STEM occupations, and so increased focus on program implementation is needed.

Research suggests that mentoring may be one of the most effective ways of supporting Latinx students in academic settings (Cole & Espinoza, 2008; Phinney, Campos, Cidhinnia, Padilla Kallemeyn & Kim, 2011; Sanchez, Esparza, & Colón, 2008; Zalaquett, & Lopez, 2006). For instance, research has been done on positive outcomes for minority youth in mentoring outside of the context of science; mentoring relationships can help youth develop critical thinking skills as well as a protective sense of responsibility and agency (Larson & Angus, 2011; Salusky, Larson, Griffith, Wu, Rafaelli, & Sugimura, 2014). In order for mentoring programs to be effective, however, a contextualized mentoring model that both supports growth in STEM fields and also meets the needs of an underrepresented group is essential.

Mentoring in the Sciences for Underrepresented Groups

Mentoring interactions are thought to be integral to the retention and success of STEM students (George & Neale, 2006). Students who persist in science majors report greater science career mentoring than those who eventually switch out of their science majors (Packard, 2004). Mentoring interactions may be particularly important for those from underrepresented groups (Adams, 1992; Packard, 2012; Patton, 2009; Schultz et al., 2011). For instance, successful Black

STEM faculty members consistently cite mentoring and faculty-student interactions as vital to their success (Griffin, Pérez, Holmes, & Mayo, 2010). Literature has supported the importance of mentoring for Latinx students in academic contexts, as well (Anaya & Cole, 2001; Phinney et al., 2011; Sanchez et al., 2008; Zalaquett, & Lopez, 2006). In STEM fields specifically, faculty support and encouragement has been positively connected to STEM retention and GPA of Latinx college students (Cole & Espinoza, 2008; Hernandez, 2000; Schultz et al., 2011). In a sample of undergraduate students, graduate students, and post-doctoral fellows, a majority of whom were Latinx, Chemers, Zurbriggen, Syed, Goza, and Bearman (2011) found that instrumental mentoring, or mentoring that focuses on skill acquisition, was positively related to science self-efficacy and identity as a scientist, which were both strong supporters of commitment to science careers. Although the importance of mentoring is well-established, few studies focus specifically on Latinx students in STEM fields.

Evaluations of STEM support programs shed some light on the characteristics of mentoring relationships. At the Benjamin Banneker Scholars Program (BBSP), a STEM program at a historically Black university, student surveys indicated that mentoring had the largest impact on academic performance (Kendricks, Nedunuri, & Arment, 2013). In their evaluation of the BBSP, Kendricks et al. (2013) reported that the STEM faculty mentors “served as extended family” (p. 40), performing not only their typical advising duties, but also assisting scholars with roommate conflicts, speaking with them over the phone during breaks and holidays, and providing clothes for formal events. The average cumulative grade point average (GPA) of the BBSP scholars increased over the 15 week study and all scholars were retained in a STEM discipline (Kendricks et al., 2013).

Wilson et al. (2012) evaluated the Howard Hughes Medical Institute (HHMI) Professors Program Hierarchical Mentoring Model at Louisiana State University (LSU), a program which aimed to increase the number of undergraduate students, particularly students from underrepresented groups, graduating with STEM degrees. This program integrated mentoring and academic interventions, such as involvement in research and a series of undergraduate success courses (Wilson et al., 2012). Mentees in this program must also mentor their peers, an aspect of program designed to reinforce specific "survival" skills (Wilson et al., 2012). The LSU–HHMI Professors Program Scholars were predominantly White and African American and analysis compared retention rates for students of all races and ethnicities to retention rates of African American students. This evaluation found that the program lead to greater retention and STEM graduation rates for all students, but particularly African American students (Wilson et al., 2012).

While none of these programs specifically endorsed a particular theory, certain program values and relationship qualities were consistently described as important across programs. For instance, the evaluation of the BBSP emphasized the cultural competence, caring nature, and willingness to go "beyond the call of duty" among the mentors (Kendricks et al., 2013), abilities that necessitate an understanding of systemic social identity and power, emotional competence, and authenticity. Similarly, one of the topics addressed in the undergraduate success courses in the LSU–HHMI Professors Program was recognizing racial and academic identities and their roles in the success of STEM students (Wilson et al., 2012). There was also a focus on a "strategic progression towards reciprocal responsibility on the part of each student" (Wilson et al., 2012, p. 150), in which mentees also act as mentors and tutors themselves, emphasizing the skills and talents that mentees also possess. These qualities, whether intentionally implemented or not, are key components of mentoring approaches that focus on connection and relationships, which may be important in the development of STEM support programs and the eventual correction of STEM representation. Therefore, more research is needed in order to understand these mentoring approaches in STEM contexts.

Relational Cultural Theory

The current study uses relational cultural theory (RCT) to examine non-hierarchical relational mentoring approaches within STEM contexts. The RCT model of mentoring is rooted in Fletcher's 1998 article on the feminist reconstruction of work. Fletcher (1998) argued that the prevailing idea of "work," characterized by rationality, cognitive complexity, and the production of marketable goods and services, created a socially constructed gendered divide between public life (in which the main actor is male) and private life (in which the main actor is female). Ideas of individualism, independence, and separation, which are associated with the public sphere and therefore with men and masculinity, dominate the modern understanding of adult growth, productivity, and achievement, whereas ideas of connection, emotionality, and self-in-relation, which are associated with the private sphere and therefore with women and femininity, are absent from these ideas and often devalued in work settings. Fletcher (1998) argues that a relational model of growth, development, and achievement provides an alternative to the patriarchal construction of work and disrupts the gender-power dynamic inherent in Western discourse. Nine years later, Fletcher and Ragins (2007) developed a relational model of mentoring and expanded Fletcher's (1998) concept of gender-based identity and power to include other forms of social identity and power, such as race and white supremacy.

In contrast to the RCT model of mentoring, traditional mentoring is characterized by a hierarchical relationship in which one-directional learning occurs, meaning that mentor is teaching and the mentee is learning from the mentor. The goal of this kind of mentoring relationship is for the mentee to develop skills that will eventually allow them to work independently from the mentor and advance in their career (Fletcher & Ragins, 2007). However, this idea of individual achievement is a myth perpetuated by a culture characterized by unequal power structures (e.g. gender, race, and class), in which a more privileged person can accomplish something while ignoring the people who helped or were further disadvantaged in the process. Relational mentoring discards this idea and instead allows for two-sided, reciprocal relationships that involve mutual learning and influence, ultimately leading to outcomes that “reflect the ability to operate effectively in a context of interdependence and connection” (Fletcher & Ragins, 2007, p. 375). In traditional mentoring relationships, providing mentorship to undergraduates in a research lab is often viewed as detrimental to research productivity, even though research shows that both postgraduate mentors and undergraduate mentees can be positively influenced by the undergraduate research experience (Dolan & Johnson, 2010).

Fletcher and Ragins’ (2007) relational concept of mentoring characterizes high-quality mentoring relationships as non-hierarchical and interdependent. Just as Fletcher’s (1998) relational concept of work values traditionally feminine abilities and competencies, RCT mentoring relationships manifest in series of interactions in which these traditionally feminine abilities and competencies help foster growth in both the mentor and mentee. The development of these skills is posited to lead to similar outcomes as traditional mentoring, such as career advancement and efficacy, but these benefits are afforded to both the mentor and the mentee (Fletcher & Ragins, 2007).

Fletcher and Ragins (2007) identify seven relational skills and competencies necessary for growth-fostering mentoring relationships (see Table 1). The development and use of these relational skills predicts the quality of the mentoring relationship (Fletcher & Ragins, 2007).

Table 1

Relational Abilities and Competencies (Fletcher & Ragins, 2007; Fletcher, 1998)

Ability/Competency [a]	Description [a]
Authenticity	The ability to access and express one's own thoughts and feelings.
Fluid Expertise	The ability to move easily from expert to non-expert mode and acknowledge help and give credit to others with no loss of self-esteem.
Empathic Competence	The ability of understand other's experiences and perspectives.
Emotional Competence	The ability to understand, interpret, and use emotional data.
Vulnerability	The ability to admit "not knowing" and to seek help and expertise with no loss of self-esteem.
Holistic Thinking	The synthesis of thinking, feeling, and acting.
Response-Ability	The ability to hold onto one's own perspective while at the same time fully engaging with another's to allow mutual influence.

a. Note. Adapted from Fletcher, J.K. & Ragins, B.R. (2007). Stone center relational cultural theory: A window on relational mentoring. In B.R. Ragins & K.E. Kram (Eds.), *The handbook of mentoring at work: Theory, research, and practice* (pp. 373-399). Thousand Oaks, CA: SAGE Publications.; Fletcher, J. K. (1998). Relational practice: A feminist reconstruction of work. *Journal of Management Inquiry, 7*, 163-186.

Fletcher and Ragins (2007) also identify five outcomes of growth-fostering interactions, which they refer to as the "five good things" (p. 386; see Table 2). According to RCT theory, both members of the mentoring relationship should experience these outcomes in order for growth and connection to occur.

Table 2

The "Five Good Things" (Fletcher & Ragins, 2007; Fletcher, 1998)

Outcome of RCT Mentoring [a]	Description [a]
Zest	Connection with the other that gives both members a sense of increased energy and vitality.
Empowered Action	Motivation and ability to put into practice some of what was learned or experienced in the relational interaction.
Increased Sense of Worth (Self-in-Relation Esteem)	Increased feelings of worth that come from the experience of having used one's "self-in-relation" to achieve mutual growth in connection.
New Knowledge	Learning that comes from the ability to engage in "fluid expertise," fully contributing one's own thoughts and perspective while at the same time being open to others.
Desire for More Connection	A desire to continue this particular connection and/or establish other growth-fostering connections, leading to a spiral of growth that extends outward, beyond the initial participants.

a. Note. Adapted from Fletcher, J.K. & Ragins, B.R. (2007). Stone center relational cultural theory: A window on relational mentoring. In B.R. Ragins & K.E. Kram (Eds.), *The handbook of mentoring at work: Theory, research, and practice* (pp. 373-399). Thousand Oaks, CA: SAGE Publications.; Fletcher, J. K. (1998). Relational practice: A feminist reconstruction of work. *Journal of Management Inquiry, 7*, 163-186.

As the mentor and mentee grow and develop these skills and experience these outcomes, the relational competence (or "the ability to operate effectively in a context of connection and interdependence") achieved is considered to be "transferable," or put into play in other relationships and contexts (Fletcher & Ragins, 2007, p. 387).

Although not specific to STEM contexts, indices of relational mentoring have been developed in the past. Liang et al. (2002a) developed and validated the Relational Health Indices (RHI) in order to study women's relationships across three different kinds of connections: peers, mentors, and community. A study using the RHI-M found that mentoring relationships high in relational qualities were associated with higher self-esteem and less loneliness (Liang, Tracy, Taylor, and Williams, 2002b). Even more recently, Liang, Tracy, Kenny, Brogan, and Gatha (2010) developed the Relational Health Indices for Youth (RHI-Y) and their growth-fostering relationships, which also comprises three scales: Friend, Mentor, and Community. Interestingly, mentor relationships with youth were not related to self-esteem, but were related to decreased stress. Although relational abilities have been shown to be associated with these positive outcomes, they have not been examined in STEM contexts.

Another reason it is important to study RCT mentoring in STEM contexts, especially when diversifying STEM contexts is a national priority, is because traditional mentoring may not fit the needs of underrepresented group members due to its emphasis on individual achievement and its devaluation of relational abilities (Fletcher & Ragins, 2007). Underrepresented group members may develop strong relational abilities “in order to be attuned to and anticipate the needs, desires, and implicit requests of the more powerful” (Fletcher & Ragins, 2007, p. 390), which contorts these abilities into something both necessary for survival and indicative of powerlessness. In reality, these abilities may be the key to growth and connection in mentoring relationships, leading to outcomes such as empowered action and new knowledge. Additionally, traditional mentoring has failed to acknowledge cultural differences in the past. A study exploring the experiences of the mentors of underrepresented undergraduate students in a research laboratory found that “most of the mentors had an incomplete understanding about how differences in culture could contribute to underrepresented students’ experience in the laboratory” (Prunuske, Wilson, Walls & Clarke, 2013, p. 403).

RCT and Latinx Students

RCT has been specifically suggested as a culturally relevant model for working with Latinx individuals. While it has not been studied in the context of STEM mentoring, Ruiz (2005) has discussed the relevance of RCT for clinicians working with Latinx clients. For instance, Ruiz (2005) points to the cultural value of *collectivism* as mirroring the RCT tenant of growth in connection with others. As Latinx students may be likely to see the value in collaborating with others, mentoring that emphasizes interdependence and mutual achievement may be more relevant than mentoring that emphasizes individual achievement without regard for (or perhaps even at the expense of) others. Similarly, *personalismo*, or "the appreciation of the uniqueness of each individual and the qualities that give a person a sense of worth" (Ruiz, 2005, p. 39), allows for fluid expertise and mentoring relationships in which both mentor and mentee bring unique viewpoints and abilities to interactions, fostering mutual growth and accomplishment. Furthermore, Ruiz (2005) points out that not using an RCT approach might actually cause harm in a relationship, as a hierarchical mentoring relationship between a White mentor and a Latinx mentee reinforces harmful power structures of racially and ethnically-based marginalization in society. Additionally, overrepresented group members, who are not used to using or recognizing the use of relational abilities, may intentionally or unintentionally exploit an underrepresented group member's ability to empathize and be vulnerable (Ruiz, 2005) by forcing them to perform emotional labor which is not reciprocated. Because Ruiz (2005) writes theoretically and frames RCT in the context of clinical work, however, more research is needed to examine RCT as it relates to Latinx students and mentoring in non-clinical settings.

Furthermore, RCT shares some common features with Lerner, Lerner, Bowers, and Geldhof's (2015) relational developmental systems model of positive youth development.

Positive youth development focuses on the relationship between the individual and the individual's context, positing bidirectional influences between youth and their environments. Therefore, the introduction of positive and sustained adult-youth relationships improves the environment, allowing for positive growth (Lerner et al., 2015). The bidirectional influences also apply to the relationships between the adult and youth. Similar to RCT, both the supportive adults and the youth benefit from the adult-youth relationship. In adult-youth collaborations in organized activity contexts, youth contributions have been linked to goal attainment and meaningful change in policy (Ramey & Rose-Krasnor, 2012). The benefits of positive youth development, specifically in out-of-school organized activities, for Latino youth have been established (Fredricks & Simpkins, 2012; Riggs, Bohnert, Guzman, & Davidson, 2010), but the existence of bidirectional benefits has not been explored in science contexts.

The Current Study

Because of the pressing need to increase the number of Latinx students in STEM in order to meet the projected needs of STEM occupations, it is important to study alternative methods of mentoring and academic programs to encourage Latinx students both to enter into and continue through STEM programs. Given that RCT-based mentoring has been related to positive outcomes for Latinx youth in other fields, it may be a key factor in increasing Latinx students' presence in STEM. RCT-based mentoring has not yet been explored in the context of a science support program and current literature lacks an in depth examination of how relational abilities and competencies might manifest in science mentoring relationships, which this study addresses. This study also has implications for the development of training programs for science-support mentoring programs, which have been identified as an important recommendation for STEM departments (George & Neale, 2006). The present study sought to address the following research questions:

Research Question I: What do relational mentoring relationships look like in a science mentoring program for Latinx high school and college students?

Research Question II: What are the outcomes of relational mentoring relationships in a science mentoring program for Latinx high school and college students?

Research Question III: What are the gender differences in the use and expression of relational abilities and outcomes?

Methodology

Context and Program Overview

The present study was part of a larger investigation that evaluated a university-based hands-on research and mentoring program designed to build a pipeline for Latinx students pursuing higher education in science and biomedical research. The program, which was in its fifth year at the time of the evaluation, is a full-time paid summer program that takes place over a 10-week period every summer. It offers Latinx high school and undergraduate students employment in research labs at the university, exposure to academic and career options in the sciences, and coursework designed to support the development of science skills and knowledge. The program also serves as a long-term, intensive mentoring program, in which students are assigned a faculty advisor and a graduate student mentor each summer. Eligible students, high school sophomores with a 3.0 GPA, join the summer before their junior year and return every summer until they graduate from a 4-year university.

Participants and Recruitment

All current and former faculty advisors, graduate student mentors, and program students (*N*=55) were approached for participation in the study. These individuals included 18 faculty advisors, 14 graduate student mentors (9 current and 5 former), 20 program students (15 current and 5 former), and 3 program staff. Potential participants were recruited through a presentation by researchers at the program or by phone and email. Seventy-one percent of individuals approached for recruitment participated in the study. The sample for the proposed study excludes 3 program staff as they did not participate as mentors or mentees.

The final sample for this study is 36 participants total, which includes 13 faculty advisors (36%), 12 graduate student mentors (33%), and 11 program students (31%).

Faculty advisors. Faculty advisor participants included 9 male (69%) and 4 female (31%) participants. Ages ranged from 37 to 64 years old (M = 51.92, SD = 8.96). Faculty advisor participants reported the following race/ethnicities: 11 White (85%), 1 Asian/Pacific Islander (8%), and 1 Latino (8%).

Graduate student mentors. Graduate student mentor participants included 7 male (58%) and 5 female (42%) participants. Ages ranged from 25 to 35 years old (M = 28.92, SD = 3.06). Graduate student mentor participants reported the following race/ethnicities: 8 White/non-Latino (67%), 2 Asian/Pacific Islander (17%), 1 Indian (8%), and 1 Latino/White (8%).

Program students. Program student participants included 6 male (55%) and 5 female (45%) participants. Ages ranged from 16 to 21 years old (M = 18.00, SD = 1.84). All program student participants reported their race/ethnicity as Latino (100%).

Procedure

Informed consent was conducted with all participants over the age of 18. Assent was conducted for participants under the age of 18. Parental consent forms, which were available in both Spanish and English, were also distributed and returned for all participants under the age of 18.

Data was collected using one-on-one semi-structured interviews and post-interview surveys. Researchers met with participants at the program university in private rooms. Former graduate student participants were interviewed via phone or video call due to location constraints. The interviews ranged from 30 to 145 minutes in length (M = 78.41, SD = 27.95) and were recorded and transcribed for data analysis. Immediately after each interview, participants completed a short survey that took approximately 15 minutes to complete. All participants were compensated with a $25 gift card to Target at the conclusion of the interview.

Measures

Interview protocol. During the interviews, faculty advisor and graduate student mentor participants were asked questions about their roles as mentors in the program and how they think students are benefiting from being in the science support program. Questions regarding mentoring included:

1. How would you describe your relationship(s) with your mentee(s)?
2. Can you please tell me about your mentoring style?
3. Is there an experience/moment in your relationship with your mentee that you felt like you were really making a difference in your mentee? Please elaborate.
4. How do you think your relationship(s) with your mentee(s) have influenced you?

5. Tell me about a time in a mentoring relationship when you and your mentee were struggling with an issue in the relationship.

Program student participants were asked questions about their activities in the program, their relationships with their mentors, faculty advisors, and peers in the program, and how they are benefiting from being in the science support program. Questions regarding mentoring included:

1. Who has been the most influential person in the INSPIRE program?
2. How would you describe your relationship(s) with each of these individuals?
3. What has been most important about your relationships with your grad student mentor and faculty advisor?
4. Is there an experience/moment in your relationship with your mentor/advisor that you felt like they were really making a difference for you as a science student? Please elaborate.
5. Tell me about a time in a mentoring relationship when you and your mentor or faculty advisor were struggling with an issue in the relationship.

All participants were asked to share what they like about the program and how they think the program could be improved.

Survey. Faculty advisor, graduate student mentor, and program student participants were asked to complete a short survey that asked about demographic information, including age, gender, and race/ethnicity.

Data Analysis

Interview transcripts were coded and inductively analyzed using a modified grounded theory approach (Auerbach & Silverstein, 2003; Kelle, 2007). This modified grounded theory is a systematic approach to qualitative analysis in which emerging themes are identified (Auerbach & Silverstein, 2003). There were multiple phases in the coding and two to four researchers were involved in each phase. In the bottom-up phase, researchers read every interview transcript and selected any relevant text related to the research questions using Dedoose software. While certain sections of the interview related directly to mentoring, the entire transcript was read and highlighted for relevant text. Next, these researchers identified repeating ideas in these selections of relevant text (Auerbach & Silverstein, 2003). Relevant text was then grouped into repeating ideas, which were further grouped into larger and more abstract themes. If separate but related themes emerged within one set of repeating ideas, these were categorized as “sub-themes” within the larger theme (Auerbach & Silverstein, 2003). The researchers coded the transcripts individually and then shared the coding with one another to determine agreement or disagreement.

In the top-down phase, the relevant themes generated from the bottom-up phase were linked to “theoretical notions” (Kelle, 2007, p. 207) found in RCT. This framework included both the taxonomy of relational abilities, the taxonomy of RCT outcomes, and other aspects of RCT, such as a non-hierarchical mode of influence between mentor and mentee and acknowledgement of systemic social identity and power. Definitions provided by RCT were revised based on the data to provide more empirical content that described how these concepts actually functioned in the mentoring relationships. Any theoretical notions that were not found in the data were omitted from the framework, but listed in a separate document for continuing consideration throughout the coding process. Themes that were not necessarily linked to RCT but were present in the data, or “common sense categories” (Kelle, 2007, p. 207), were also incorporated into the coding framework.

The traditional grounded theory approach described by Corbin and Strauss (1990) requires that researchers only allow themes to emerge naturally from the data and resist forcing "pet" theories, onto the data. However, Kelle's (2007) modification of grounded theory presents a method of coding which allows for the use of existing theories without forcing a theory onto data. Kelle (2007) suggests using existing theoretical categories for heuristic purposes rather than definitive purposes. This can be accomplished through the use of theoretical notions with low empirical content. For example, RCT describes the relational ability of emotional competence, which is defined as the "ability to understand, interpret, and use emotional data" (Fletcher & Ragins, 2007). This definition lacks empirical content in that it does not define what this ability might look like in practice. Because of this lack of empirical content, this concept can be used to sensitize the researcher to potentially relevant phenomena, as opposed to strictly defining a mentoring activity. Additionally, Kelle (2007) suggests the use of common sense categories, which can be generated from knowledge of the study context. In this case, ideas such as "types of mentoring support" are considered common sense categories because the science-support program aims to support students through mentoring and the large study was designed to evaluate the program.

After coding was completed, a confirmatory review was conducted, in which each code and its corresponding excerpts was reviewed for consistency within the theme and agreement with the definition. Relevant excerpts were recorded to determine whether or not RCT relational abilities and outcomes are prominently present in the data and to present examples of how RCT relational abilities and outcomes manifests in the program.

Enhancing Credibility of Findings

A criterion used to determine the quality of qualitative findings is the extent to which the themes reflect the experience of the participants (Lincoln & Guba, 1986). We utilized triangulation, memos, and member checking in order to enhance the credibility of our results.

Triangulation. In order to establish the credibility of the findings, triangulation was conducted. Triangulation is the involvement of multiple researchers in all steps of the data collection and coding process (Lincoln & Guba, 1986). This serves to not only guard against bias, but also engage in discussions that might lead to new ideas or criticisms regarding the framework (Cutcliffe & McKenna, 1999). Five researchers were involved in the data collection as interviewers and two to four researchers were involved in each phase of the coding process. The research team as a whole met weekly to discuss the interviews, coding process, and preliminary findings. Appleton (1995) also suggests enlisting the help of an expert. Dr. Bernadette Sanchez, an accomplished researcher in the field of mentoring, also participated in the coding and attended all coding meetings.

Memos. Memos are also used to in order to establish an “audit trail,” as suggested by Lincoln and Guba (1986). This creates a log of the decisions made by the researchers in the coding process so that other researchers can review them for clarity and consistency. The coding team used the memos to record questions to discuss during meetings and note any confusing text to be reexamined during the confirmatory review.

Member checking. Finally, focus groups were used to establish credibility. Lincoln and Guba (1986) suggest the process of member checking, or presenting results to those who were studied in order to confirm that the results match their thoughts and experiences. After all the interviews were complete and preliminary analysis of the interview data was conducted, participants were asked to participate in feedback sessions in which preliminary results were presented by the researchers. The codes were translated into lay terms and were presented as both data that emerged from the transcripts and also suggestions for improvement. One focus group session was conducted for each stakeholder group: program students, graduate student mentors, faculty advisors, and staff. Preliminary themes were shared with them in advance and then the researchers provided an overview of the themes during the session. The focus group participants were asked whether the themes reflected their experiences in the program. Participants confirmed or elaborated on the findings and asked questions about themes or ideas that were not clear.

Results

Relational Abilities in a Science Mentoring Program

The relational abilities defined by Fletcher and Ragins (2007) include authenticity, fluid expertise, empathetic competence, emotional competence, vulnerability, response-ability, and holistic thinking. All relational abilities were present in the data except for holistic thinking, which did not map on to any of the original coding. Although the definitions provided by Fletcher and Ragins (2007) worked well for the data, the relational abilities often manifested in ways that were specific to the scientific context, with some differences between program roles.

Authenticity. Authenticity, defined by Fletcher and Ragins (2007) as the ability to access and express one’s thoughts and feelings, was found in the science support context in both personal and science-specific ways. Graduate student mentors, faculty advisors, and program students were willing to share personal details about their lives in order to cultivate relationships. For instance, Riaz, a graduate student mentor, explained that engaging in an honest exchange of personal thoughts helped cultivate a familial relationship with his mentee: “With [my program student] it's almost like brotherly relationship. I try to tell him everything honestly what's going on in my life and I'll ask him what's going on in his life." Similarly, Antonio, a program student, recognized his faculty advisor's ability to be authentic in their interactions and approach to relationship building with genuine interest in the student's life and interests: "Then I see Dr. Sun and we just pick up a conversation…I guess that approachableness. I just keep realizing that it's not a façade."

A science-specific way that authenticity manifested was through the graduate student mentors and faculty advisors sharing their genuine passion for science with students. This manifestation was specific to faculty advisors and graduate students mentors. One faculty advisor describes his own feelings about science and his wish to share that with the program student:

> "Science is my passion and it lights me up in the sense of wonder. I wanted [the program student] to see that you can have a career where the sense of wonder guides you and fills you much of the time." (Dr. Sun, male, 59)

Fluid expertise. Fluid expertise is defined by Fletcher and Ragins (2007) as the ability to move easily from expert to non-expert mode and acknowledge help and give credit to others with no loss of self-esteem. In the science support program, program students, graduate student mentors, and faculty advisors readily acknowledged the skills that other people brought to the table and were able to recognize areas in which they could use improvement. A program student recognized that both graduate students and faculty advisors had a lot of useful knowledge about working in science labs and that it is important to be able to approach those people for help:

> "Yeah, because you get to work with people you've never met and you need to know that sometimes they know things more than you can, so you need to ask them and then sometimes they don't know and you need to go speak to your faculty advisor." (Roberto, male, 16)

Graduate student mentors were willing to praise program students for the skills they displayed in the lab and openly admitted that students excelled in some areas that they struggled in themselves. For example, one graduate student mentor recalled that his program student was very adept at making small surgical pieces such as catheters for the animal models in their lab, while he was not as skilled at this:

> "It was one of those things that you're really for fine detail. You just gotta have the dexterity with your fingertips to be able to work with these extra-small pieces. I've always been pretty bad at it and she stepped on and was just like a natural. Every time that we needed stuff for something that we had run going, she would sit down and just fly through creating all these pieces for us. Everyone from the lab was benefitting because it's a challenging skill with your fingers, and she'd do it just amazing. She would sit down and get done what two or three or us would do at the same time, all by herself." (Matt, male, 28)

Similarly, a faculty advisor explained that, while he finds learning to use computer programs to be difficult, his program students were often quicker learners:

> "Certainly for me, learning a new piece of software as complicated as what we're using to do chemistry modeling, it's not trivial. I don't know if it's because they're young and they grew up with computers, but they learn this stuff really fast." (Dr. Greene, male, 64)

Although graduate students and faculty members are traditionally thought of as the experts, having fluid expertise means that they also acknowledge their own limitations and see the strengths and expertise of high school and undergraduate students.

Empathetic competence. Empathetic competence, defined as the ability to understand other's experiences and perspectives (Fletcher & Ragins, 2007), also appeared to be important in the science support program context. Empathetic competence was especially important for program students' development in the sciences, as they reported being able to imagine themselves in their mentors' shoes in the future or appreciate their mentors' enthusiasm for science. A student recalled how observing her graduate student mentor's love of science made her interested, as well:

> "Because I've never really worked with anybody who was doing research. I really wasn't open to that. Seeing her doing all her stuff and being – she's always talking about it. She seems like she's so in love with research. She got me into it, too." (Yesenia, female, 17)

Graduate student mentors and faculty advisors, on the other hand, used empathetic competence in a different way: to check in with their mentees while they explained difficult scientific concepts in order to make sure they were on the same page and that the student truly understood. A faculty advisor demonstrated empathetic competence when she recalled the moment that her student understood a concept:

> "I went back and I explained it all over again and then, again, I could see the light go off, 'Oh, I got it.' Then he explained it back to me in the language, in the terminology and the semantics that were appropriate for his level. I'm like, 'Yes, you completely got it.' That was really cool. You could see him go from just sort of being frustrated and lost to this little spark of, 'I'm not stupid, it connected.' That was really cool." (Dr. Schmidt, female, 46)

Empathetic competence can also take the form of cultural competence. For instance, a graduate student recognized how her student's experiences and access to resources might make it more difficult for her to persist through the science pipeline:

> "Then from what just [the program student] has told me about her school, just a lot of people drop out. Sometimes it's hard to do homework, because you don't necessarily have internet at home. Then she was telling me she was reading her paper off of her phone. I can kinda see how just not having the resources can be difficult to make it. I can understand that." (Sam, female, 28)

Emotional competence. Emotional competence is defined as the ability to understand, interpret, and use emotional data (Fletcher & Ragins, 2007). Similar to authenticity, emotional competence was often related to excitement about science, such as excitement about scientific results and possible science career paths. Emotions, particularly passion and excitement, were recognized as important parts of the scientific process. For instance, Dr. Wilson, a faculty advisor, recalled seeing and appreciating his program student's excitement about his results: "I walk in and he wants to show me the graph. He's all excited. 'Look. Look what I got.' That's a big thing."

Participants also used emotional data to create stable and pleasant lab environments and to create comfortable and open networks of communication. One program student described an instance in which she communicated her feelings about her graduate student mentor's approach to her science development, and the graduate student mentor used that information to change his behavior:

> "I told him, 'I understand that you expect a lot.' I told him, 'Trust me, I get that pressure everywhere, but I was, I wanna come to this program. I know that I'm gonna feel that pressure. I understand I have to accomplish a lot of things, but I would just like, if anything, your support, rather than you pressuring me.' Once I told him, I guess he's like, 'You know what, I'm sorry. I didn't realize I was being that hard on you.' Then he kinda eased off." (Yesenia, female, 19)

Another graduate student mentor was able to recognize her program student's happiness as a sign of her confidence and her feeling more comfortable communicating with graduate students:

> "She just was happier and smiled though—not smiled a lot, like, "Oh, gosh, look at this idiot." She just was more—you could just see she was more comfortable with saying things in response to what we were saying." (Diana, female, 32)

Vulnerability. Vulnerability, or the ability to admit "not knowing" and to seek help and expertise with no loss of self-esteem (Fletcher and Ragins, 2007), was also very important in the science setting, as "not knowing" is an intrinsic aspect of the scientific process. Mistakes and null results are seen as common and should not deter a researcher. Program students were willing to go to their mentors and advisors when they made mistakes and recognize that mistakes can be fixed. Roberto, a program student, recalled admitting his errors to his graduate student mentors and being told that they have made similar errors in the past: "When I make an error, I can tell them I did this wrong, and they're like, yeah, I've messed up there or I messed up worse." In fact, graduate student mentors and faculty advisors would often share stories of moments they were uncertain or mistakes they made in the past in order to normalize the more difficult aspects of pursuing science. When program students expressed uncertainly about their future goals, a graduate student mentor shared his own difficulties in choosing a path in the sciences:

> “They didn’t know and I got to thinking about it and the more I spent time with them and the more I thought about it and had those discussions the more I realized I didn’t know, either. I didn’t know what was out there and I didn’t know, if I had to do it over again, I probably would’ve went the physician route or the MD route.” (Andrew, male, 33)

Graduate student mentors and faculty advisors also displayed vulnerability when talking about their roles as mentors and their uncertainty about their mentoring abilities. A faculty advisor recalled that anxiousness:

> “Then there’s also the anxiousness about the student that’s gonna be in my lab; it is I’m gonna be responsible for the student. It’s different being responsible for somebody that’s in college, or grad school, or somebody that’s under 18. There’s more of a sense that if it doesn’t go well, then it’s more of my fault, and so I was a little bit worried about that, but it changed fairly quickly within a few weeks when [the program student] was here.” (Dr. Weber, male, 40)

Response-ability. Response-ability is defined as the ability to hold onto one’s own perspective while at the same time fully engaging with another’s to allow mutual influence (Fletcher & Ragins, 2007). Due to the fact that mentors and program students were at different points in their science careers and program students often came from academic backgrounds that offered fewer resources, both groups had to engage with the others’ experiences, identify the relevant pieces, and apply those pieces to their own lives or to their teaching in appropriate ways. For instance, students explored their own options by learning about what their mentors and faculty advisors took into consideration when making academic and career decisions. One student explained how a faculty advisor’s love of remodeling houses helped him understand that he could also have multiple interests in the future:

> "So I'm like, 'Really? Why do you need to remodel houses? You're a doctor. You're gettin' paid so high.' He was like, 'Yeah, the doctor just to start me off so I could make more money, but not tryin' to say make more money, but to start me off to do my own thing so I could buy houses to remodel and sell.' I'm like, 'Whoa, you do that and you're a doctor?' I'm like, 'Wow.' I need to really get somethin' that I love, but it would be good income for me, so then I could—so not only I could be electrical engineer, so I could do somethin' else in my future." (Javier, male, 19)

For graduate student mentors and faculty advisors, response-ability was exhibited differently. Response-ability for those in mentor roles often meant "getting back to basics" in order to teach students lab techniques and explain background information that they had not needed to think about in a while. Although they held onto their advanced knowledge, they also had to allow the student's lack of knowledge to influence their teaching style and make them think about concepts in new ways. One faculty advisor recalled:

> "Going through the exercise of putting it into more simplistic language, it forces you to step back and see … how it fits into a broader, bigger picture, why it's important, but then also simplifying it so it makes sense to the rest of the world and not just the science geeks in your lab." (Dr. Schmidt, female, 46)

Similarly, a graduate student mentor described how being observed by a program student made her more aware of what she was doing, which resulted in higher-quality work:

> "It made me want to be better in what I do, because I knew they were going to be there. It made me think more about what I was doing and why … You don't always realize what you're doing, but if someone's constantly staring at you or taking notes on what you're doing, you think, 'Oh, great, I can't skip this stuff.'" (Diana, female, 32)

Relational Outcomes

The relational outcomes, or "Five Good Things," defined by Fletcher and Ragins (2007) include zest, empowered action, increased sense of self-worth (self-in-relation esteem), new knowledge, and desire for more connection. All relational outcomes were present in the data and, like the relational abilities, often manifested in ways that were specific to the scientific context.

Zest. In the outcome of zest, connection with the other that gives both members a sense of increased energy and vitality (Fletcher & Ragins, 2007). Zest manifested in a variety of ways, including an eagerness to pursue a career in science, excitement about scientific results, and excitement about being able to help others or make a difference in someone else's life. A program student described her satisfaction with interacting with both her faculty advisor and her patients:

> "When I was with [my faculty advisor] and I have the patients, it's like, I don't know, it's like you get a good feeling interacting with everybody. The parents, the kids, and informing them. 'Cuz [my faculty advisor] told me being a doctor's not just about caring for them. You also have to inform them so they could be healthy." (Yesenia, female, 19)

Participants also derived joy from seeing another person excited about the same topics that excited them and being able to share and discuss those their interests. For instance, a graduate student mentor explained:

> "I'm very much into space research. So I always talk to them about it, about something about physics or bring out all the cool stuff which I think is very cool and they find it cool, as well." (Riaz, male, 29)

Similarly, a faculty advisor described that both he and his students benefitted from him sharing his excitement about a result:

> "I really have fun when I can sit down with the students and look at the results and sometimes my lightbulb goes on too. I think, "That's a cool result." I get excited about it. I think that helps them as well." (Dr. Greene, male, 64)

Empowered action. Motivation and ability to put into practice some of what was learned or experienced in the relational interaction is called empowered action (Fletcher & Ragins, 2007). Program students described empowered actions they took as a result of the interactions they had with their graduate student mentors and faculty advisors, while graduate student mentors and faculty advisors also described how they saw the students take on more responsibility or independent projects. For example, a program student explained that he took on more leadership roles at school after participating in the program:

> "Again, I'm more of a leader now. I strive to help others. I wanna help others. My focus with NHS, now that I'm president, is going to be college, cuz I believe that it's very important that they're aware of the different kinds of colleges, and that name doesn't matter, and that there are many steps beyond college. It's built me as a individual, in terms of being a leader and somebody who wants to help others and who wants to share knowledge with other people." (Antonio, male, 17)

Mentors and advisors did not often speak of their own empowered actions, perhaps due to the fact that the interview questions focused on student development. Some graduate students indicated a desire to teach in the future based on their interactions with program students, though they had not yet taken those actions.

Increased sense of worth (self-in-relation esteem). Participants also described increased feelings of worth that come from the experience of having used one's "self-in-relation" to achieve mutual growth in connection, which is described by Ragins and Fletcher (2007) as self-in-relation esteem. Students, graduate student mentors, and faculty advisors felt more confident as a result of their interactions with one another. This confidence was often specific to the science context; for instance, students often felt more confident about their scientific abilities. A program student recalled how learning from her graduate student mentors and seeing their achievements increased her confidence in her own ability to succeed in science:

> "Since they've explained so much and I learned so much from them, it really has helped my confidence in the science field, especially at school when I'm struggling and I'm like, 'Oh, I can do this. Look at where all these other people have gotten to. They're at this point, and they were able to do all this, so I should be able to do it too.'" (Evangelina, female, 20)

While students became more confident about their science skills, graduate student mentors and faculty advisors became more confident about their teaching abilities and scientific knowledge. One graduate student mentor recalled feeling like she had done a good job teaching her program student and actually did make a difference for her:

> "I think that moment I was just like, "I did do something." Because it's on Alzheimer's. I've been teaching her about that since she came in. She knew the basics of it, which is pretty good that she was able to, in addition to learning all these techniques with her hands, she was able to retain some of the background information, too." (Sam, female, 28)

A faculty advisor described similar feelings of confidence that the program students really gained something from their interactions with him:

> "I guess you get a lot of satisfaction from—I mean, when they come in at first you realize how far they need to come to make it into this kind of a setting and actually make a contribution, get a position. As they grow through the program you get a good—a really good feeling that you've taught them something and given 'em encouragement and hopefully helped 'em along to a successful path for a better career than what they would have had." (Dr. Wilson, male, 45)

New knowledge. New knowledge is defined by Fletcher and Ragins (2007) as learning that comes from the ability to engage in "fluid expertise," fully contributing one's own thoughts and perspective while at the same time being open to others. Participants gained knowledge by participating in the science support program, often in science-specific ways. By interacting with graduate student mentors and faculty advisors and being open to the knowledge they gained throughout their career, program students gained new knowledge about science, lab techniques, and academic and career pathways. Students also developed new knowledge about their own abilities and potential based on feedback from their mentors. One student explained that his faculty advisor's confidence in him caused him to see himself as capable in the sciences:

> "[My faculty advisor] would encourage me to continue asking questions and being curious about things and how things worked. I was very—I was very scared of the unknown, when I first came here. I wasn't sure how I'd fit in in this type of environment. [He] reassured me that I have potential, which was very encouraging. He allowed me to process that I have this talent and this knack for science that I didn't realize, and that's something that has helped me look towards the future and think about pursuing this later on in life. It's something that I'm very interested in." (Antonio, male, 17)

Graduate student mentors were more likely than faculty advisors to recognize and explicitly describe new knowledge, usually related to teaching style. For instance, one graduate student mentor recalled how explaining things to her program students helped her learn as well, and taught her that she might be interested in teaching in the future:

> "It helped me learn things more so that I can explain in a simpler way and so, yeah, helped me grow more. Also, I think it helped me, too, since I enjoyed teaching them, I think I might be doing that. If not immediately after my PhD but then sometime." (Shrishti, female, 26)

Desire for more connection. Growth-fostering interactions should also result in a desire to continue a particular connection and/or establish other growth-fostering connections, leading to a spiral of growth that extends outward, beyond the initial participants (Fletcher & Ragins, 2007). This was true in this science support program. Program students, graduate student mentors, and faculty advisors wanted to continue their relationships even past the conclusion of the program. A faculty advisor described a desire to be a mentor for the program students throughout their career path:

> "My goal is to make this kind of like an apprenticeship where, to coin a phrase, my advisor said there's really no difference in you and me, but I got on the road a little earlier … I believe that for those who want it, as I'm your mentor now, I will be your mentor in 5, 10, 15 years." (Dr. Chase, female, 55)

Many graduate mentors and faculty advisors expressed an interest in staying involved in this particular science support program and mentoring more students in the future, as well. For instance, one graduate student mentor explained:

> "As for me, it just helped me, I would say, grow as a person and then getting a clear perspective per se about the possibilities that are there. I want to do it again as well because I think it's a really good platform to know your work better and to be able to interact with school children. Maybe it makes them feel good to be a part of this kind of a program, to get such an exposure; and it makes you feel good if you contribute, even in a small way, in shaping up their career in some way." (Shrishti, female, 26)

In addition to wanting to extend the mentoring relationships with their own mentors, some program students also described wanting to become leaders or mentors from other students, as well. One program student described how his faculty advisor inspired him to help others:

> "When I went into my junior year with that confidence that I discussed, and that drive to help others and tell others what I've been doing, I feel like that's something that [my faculty advisor] has given me, through my experience with him." (Antonio, male, 17)

Gender Differences

Program students. Out of all three program groups, program students most frequently mentioned relational abilities and female program students mentioned relational abilities more often than male program students. All five of the female program students mentioned authenticity, vulnerability, empathic competence, and emotional competence, while five out of six male students mentioned vulnerability and empathetic competence and three out of six male students mentioned authenticity and emotional competence.

There were some content differences in emotional competence between male and female program students. Both male and female program students discussed their own science-related emotions, but female program students also expressed feeling comfortable in relationships or feeling like they were friends with their graduate student mentors. For instance, one female program student explained that, outside of the lab setting, she feels comfortable and like a peer to her graduate student mentors:

> "Oh, in the lab, they're the ones that I respect because they know what they're doing; they really know what they're doing, but it's like outside of the lab that I can be very—I can talk with them very freely. They're good friends in that sense." (Esme, female, 17)

Female program students also appreciated those mentors who took an interest in their personal lives beyond their career interests. A female program student recalled an influential mentor who was able to use emotional data and emotional competence to check in on her when she was not feeling well:

> "She's very influential because she has two sons. I tell her how it is, how I feel, especially when I have things—she notices, cuz I guess she's a mom. She notices when I'm sad or when I'm something. She's like, 'Oh, are you okay? How's this going?' I'm like 'I'm good. Just family, my parents are sick or my grandpas are sick.' She's like, 'Okay, tell me about it.'" (Laila, female, 21)

While program students more frequently discussed relational outcomes as compared to graduate student mentors and faculty advisors, there were no obvious gender differences in terms of how relational abilities were discussed.

Faculty advisors. There were gender differences in relational abilities among the faculty advisors. Seventy-five percent of female faculty mentioned authenticity, empathic competence, fluid expertise, and emotional competence, while mentions of relational abilities among male faculty advisors ranged from 44% to 67% with no prominent patterns.

Content differed by gender in terms of emotional competence. Male faculty advisors primarily discussed emotions related to science, such as excitement. For instance, one male faculty advisor described the excitement he felt interacting with his program student and doing more hands-on research:

> Having a student who needs that interaction every day drags me back into the research part which is just a ton of fun. I really do like it. Still after all these years I love discovering new stuff. They help me get back to the things I like doing a lot. (Dr. Greene, male, 64)

Female faculty advisors, on the other hand, exhibited emotional competence related to other areas of life, as well, including students' academic and personal lives. One female faculty advisor described her emotional involvement with her program student's future and the futures of all program students:

> We're becoming emotionally involved with their welfare. Not just them but all of them. We'd love to see where they all go. From what I understand, they do provide that but I'm just more excited to see where they go, I'd like to keep in touch. (Dr. Schmidt, Female, 46)

Another female faculty advisor recalled using emotional data about her student's mother in order to design the best projects for her:

> You could see that it wasn't her passion. She was interested because her mother had thyroid cancer. The project was gonna be about pursuing thyroid cancer. I thought to myself, "If we focus on APA formatting and how do you review the literature, it's not gonna work." I mean, I don't think that emotionally she was there. (Dr. Butler, female, 60)

Female faculty advisors showed more range in their use of emotional competence as compared to male faculty advisors, meaning that they were able to extend their use of this ability outside of the science context and demonstrate more holistic interest in program students.

There were also notable gender differences concerning vulnerability. Only one female faculty advisor mentioned vulnerability, compared to four out of the nine male faculty advisors. Additionally, the ways in which the female faculty advisor was willing to be vulnerable differed from the ways in which male faculty advisors were willing to be vulnerable. The female faculty advisor described her work ethic as a weakness in her relationship with her student. Specifically, she explained that she wanted to have more time with the student, but was too busy with her work:

> "Probably more interaction. Again, I tend to be consumed and really busy and there's all sorts of—I mean, you're always busy and it's always a bad time so you just have to just realize that ten more minutes isn't going to make or break this division [inaudible] type of thing, probably putting a little more effort into face-to-face time." (Dr. Schmidt, female, 46)

The same female faculty advisor also explained that she sometimes forgets that program students do not have the same science knowledge that she does, leading her to sometimes talk over their heads:

> "I start talking biology and you can tell he doesn't have the basic biology that I'm talking about because I forget how long it's been since I've been a high school student." (Dr. Schmidt, female, 46)

While this female faculty advisor framed her vulnerability in the context of her dedication to her career and her advanced knowledge, male faculty advisors who mentioned vulnerability described their own shortcomings, most often related to mentoring. Male faculty advisors expressed anxiety about taking a student into the lab or acknowledged their own mentoring weaknesses. For instance, one male faculty advisor described his concern that he might not be capable of inspiring every student and wanting them to experience other labs:

> "We all know that there's only certain individuals that influence us strongly, and you have to luck onto them, right? If you put somebody with one person, what are the odds it's gonna be me? Low. I want them to see more." (Dr. Sun, male, 59)

Another male faculty advisor readily acknowledged that he is not the perfect mentor and hopes that his students will learn from what he did wrong in addition to what he did right:

> "Realizing that I'm not the perfect mentor, certainly as my kids will tell me. That's what I've always told them, and even to [my program student], is that even looking at the experience you have with me as a mentor, take from me the things that you thought were good, and use those when you're in a similar situation, when you're a mentor, and you're helping someone. Look at the things that I didn't do well, or did really badly, learn from those and try not to incorporate those into when you're in a leadership position." (Dr. Snow, male, 53)

While male faculty advisors demonstrated uncertainty about their abilities to be the ideal mentor, the sole female faculty advisor who mentioned vulnerability discussed weaknesses that could also be viewed as positives within the context of a science career.

In terms of relational outcomes, no obvious gender differences arose in frequency of mention or the ways in which outcomes were discussed.

Graduate student mentors. No gender differences arose within the graduate student mentors in terms of relational abilities or relational outcomes.

Discussion

This study sought to explore RCT mentoring in a science support program for Latinx students. The need to increase the number of Latinx students in STEM, the established importance of mentoring in the sciences, and the potential relevance of RCT to Latinx students makes this study an important and timely contribution to the literature. This is the first study to explore RCT-based mentoring in the context of a science support program and the first study to explore RCT-based mentoring for Latinx science students. The results support the relevance of RCT to science contexts and to Latinx science students and their mentors.

Despite science contexts being traditionally hierarchical, relational abilities were exhibited by program students, graduate student mentors, and faculty advisors. The taxonomy of relational abilities defined by Fletcher and Ragins (2007) fit the data well and translated to the science support program context in science-specific ways. For instance, mentors utilized vulnerability to assure students that they also make mistakes or were not always sure of their career paths, which aligns with past research demonstrating the importance of normalizing struggle in the sciences (Zaniewski & Reinholz, 2016). Mentees utilized empathetic competence to put themselves in the shoes of their mentors and recognize what their mentors enjoyed about science. The Latinx program students reported the use or recognition of relational abilities more than graduate student mentors or faculty advisors, supporting Ruiz' (2005) theory that RCT may be especially relevant for Latinx persons. While Ruiz (2005) grounded her theory in a clinical setting, this study demonstrates that RCT may be culturally relevant to Latinx populations within science settings as well. For example, fluid expertise allows program students, graduate student mentors, and faculty advisors to recognize and appreciate the skills and perspectives each individual brings to the lab. This aligns with the cultural value of *personalismo* and can contribute to collectivist achievement within the research setting.

Relational outcomes were also reported in science-specific ways. The taxonomy of the “Five Good Things” defined by Fletcher and Ragins (2007) mapped onto program student outcomes well, but were not always reported by faculty advisors. Specifically, faculty advisors did not report empowered action or new knowledge. Therefore, it is possible that faculty mentors in science contexts might already feel knowledgeable and empowered and might be gaining less from the relationship, contradicting RCT theory. It is also possible that faculty might be less willing to acknowledge learning or may be less sensitive to their gains in knowledge at this stage in their career. However, the interview protocol focuses primarily on the program students and their positive outcomes, so the method may have prevented this information from being collected.

Unlike empowered action and new knowledge, the relational outcomes of zest, self-in-relation esteem, and desire for more connection were found in program students, graduate student mentors, and faculty advisors, supporting the idea of bidirectional outcomes theorized by Fletcher and Ragins (2007) and demonstrated in alternate settings in the positive youth development literature (Lerner et al., 2015; Ramey & Rose-Krasnor, 2012). Zest was often related to excitement about science and may be an important component in motivation. Mentors often expressed that excitement was important to the scientific process. It is also significant that self-in-relation esteem is an outcome in this science support context, as related concepts such as self-efficacy may contribute to the success of science students (Britner, 2008; Britner & Pajares, 2006; Lent, Brown, & Larkin,1984). While self-in-relation esteem may seem distinct from science self-efficacy, past research has indicated that social persuasion, or others' judgements that students are capable and success is attainable, is an important source of science self-efficacy (Britner & Pajares, 2006). Because self-in-relation esteem often manifested as mentees feeling more confident in their science abilities as a result of interactions with their mentors, it seems to be closely related to social persuasion and may therefore play an important role in the success and persistence of science students. Desire for more connection is also a significant outcome, as it may be indicative of or lead to increased social capital, which has also been linked to success in the sciences, particularly for underrepresented groups (Harper, 2008). This further supports the efficacy of an RCT-based mentoring approach in the sciences.

Interesting gender differences also arose in the data. Female program students reported relational abilities more often than male program students. Additionally, discussions of emotional competence differed in content between male and female program students and faculty advisors. Male students and faculty advisors showed emotional competence for emotions relating to science, which may feel safer or more masculine than other kinds of emotions. Female faculty advisors, however, showed emotional competence for emotions relating to both science and the personal lives of the students, which female students recognized and appreciated. This is consistent with the idea that RCT is most relevant to women (Fletcher & Ragins, 2007). Female faculty advisors and students may be more accustomed to utilizing emotional competence in their personal lives and transferred that skill to the science context.

As the potential success of an RCT-based mentoring program in the sciences depends on the feasibility of its implementation, one concerning gender difference in the data is that only one female faculty advisor expressed vulnerability. Furthermore, the vulnerabilities that were displayed by the female faculty advisor were "interview weaknesses," or traits that sound negative but actually serve one in their career. For instance, the faculty advisor explained that she works too hard and sometimes talks over people's heads. This suggests that perhaps female faculty advisors may be less able to express vulnerability in their field and still be respected, relating back to the reason for the development of Fletcher and Ragins' (2007) theory - the devaluation of "feminine" abilities or traits. In order for RCT-based mentoring programs to be properly implemented, both mentees and mentors would need to be willing to utilize relational abilities, which may be difficult depending on the environment.

Strengths and Limitations

A strength of this study is its use of multiple perspectives. By interviewing program students, graduate student mentors, and faculty advisors, we were able to get a more holistic view of the mentoring relationships. We were also able to see the bidirectional effects that are important to RCT. This study is also a unique addition to STEM mentoring research, as science contexts have been viewed as hierarchical in the past. The RCT framework offers a new perspective on mentoring in the sciences.

Finally, the study is very translational. Our results present specific skills that can be emphasized in trainings and used to enhance the mentoring experience for both the mentors and the mentees. The results are also contextualized within the science context, demonstrating specifically how one might utilize certain skills in laboratory settings.

This study may have been limited by the fact that the program students have demonstrated that they are already motivated, which may make them a unique sample and limit generalizability. Program students who left the program were not successfully recruited, which may have prevented negative case analysis. Skewed gender and racial distributions (e.g. majority White male faculty advisors) may also limit generalizability. Additionally, mentees and mentors can change from year to year, which limits the length of the relationship and the number of growth fostering interactions that have time to occur. Finally, we did not ask about relational abilities specifically, which may have limited the depth of the findings.

Implications and Future Directions

This study has implications for trainings. RCT mentoring is relevant to Latinx high school students and could be an important framework for future program trainings. The mentors and mentees in this science support program were not trained in RCT mentoring, so the fact that RCT relational abilities arose in the transcripts suggests that these abilities may come naturally in some mentoring relationships. While relational abilities should be taught, it is important to bolster the positive things that may already be happening in good mentoring relationships in addition to introducing them into less successful mentoring relationships. Future studies might explore what abilities or mix of abilities are most essential to developing positive outcomes in order to further inform training programs.

This study was able to identify relational outcomes in the data. However, further studies should assess the relationship between relational abilities and other kinds of outcomes, such as outcomes related to educational and career success. For instance, further research should assess whether relational abilities are related to science self-efficacy, educational attainment, and test scores. Further research should also explore differences between developmental stages, as there may be developmental differences between younger and older students in the way the RTC mentorship model functions.

Future studies would also benefit from larger sample sizes with more equal gender distribution and more faculty and graduate students of color. Because relational abilities are thought to be more developed in ethnic and racial minority individuals, an examination of potential differences in use and expression of relational abilities and outcomes between White and non-White mentors is warranted. This would also allow researchers to explore the effects of gender and race/ethnicity student-mentor matching. This study also did not find holistic thinking, or the synthesis of thinking, feeling, and acting, in the data. Because it is difficult to assess in interviews, mixed methods and direct questioning about use of relational abilities could be used in the future to explore this relational ability.

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