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Career Choice among First-Generation, Minority STEM College Students

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We qualitatively investigated ways in which undergraduates unpacked their perceptions of STEM careers after attending a seminar series that introduced them to diverse scientists. Using Social Cognitive Career Theory (SCCT) as a guiding framework, we explored how culturally-specific realities impacted students' career choices. Our findings suggest that familial ties and cultural expectations played key roles in determining how students navigated career choice. Our results have implications for how institutions navigate career pursuit discussions with students.

INTRODUCTION

Nationally, there are well documented struggles to attract and retain underrepresented minorities (URMs) in STEM careers (1, 2, 3). Fifty-three percent of URM students who are unsuccessful in their introductory STEM classes fail to leave the university with a degree in hand (4). Several reasons have been proffered for this woeful retention rate, including a reduced sense of belonging (5, 6) among URMs and a pedagogical culture in STEM disciplines that is selective and exclusive (7). The broader context of how students choose careers, however, can affect the ways in which they engage with or disengage from the classroom experience. College students often make career choices in STEM before matriculating into higher education (8). The factors that govern these choices include the breadth and structure of secondary STEM curricula and the social environment of the students' home communities (9, 10, 11). For underrepresented students in STEM fields, especially those who are first in their family to attend college (first generation), social environment factors can play a role in how they think about future careers (12). Lack of exposure to STEM professionals during K–12 schooling can result in a false belief that individuals from their particular demographic generally do not go on to be scientists (13). This

lack of representation in STEM careers is well-documented (14) and has spurred more aggressive attempts by institutions of higher education to attract more URM students into STEM majors (15, 16). First generation (FG) students matriculating into this environment come with unique social contexts. Some FG students may not receive the informed parental encouragement or targeted advice needed for the persistence necessary to succeed in STEM fields (17, 18). Access to social capital impacts both STEM career choice and the students' entire college experience. The ability of family members to leverage networks, and the nature of those networks, potentially informs the future decisions that students make with respect to college attendance and academic behavior once there (19, 20). Where STEM careers equate to economic mobility for the student, and potentially the extended family by extension, career pursuits can result in college becoming a high-stakes exercise for the student. The student might be aware, even if implicitly, that the future economic fortunes of their immediate and sometimes extended family ride on their relative success in their STEM career pursuit (21).

Social cognitive career theory

Lent *et al.*'s (9) Social Cognitive Career Theory (SCCT) provides a useful model for thinking about the mental processes that students employ with respect to STEM careers. Rooted in Bandura's (22) Social Cognitive Theory (SCT), SCCT posits that the development of career-related interest is based on 1) self-efficacy, 2) outcome expectations, and 3) the goals of the student.

Self-efficacy focuses on mindset (23). Students' determination of their ability within a subject might be informed by

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specific historical performances in the subject. An incoming freshman to college may believe that they are not a “science” person and use this belief to make choices of major and/or career (24). What the individual may actually be referring to is a specific set of underperformances in secondary school that convinced them they lacked ability in the area.

Developing students also possess particular perceptions of the social context of careers. Their developing perceptions may affect expectations of their career outcomes. If these beliefs are fixed, they may develop a sense of *fait accompli* regarding the value of their efforts in a class or major. Assuming that people of color simply “don’t become X,” students may migrate to a major where they perceive their likelihood of career attainment is higher (25).

The third tenet of SCCT describes the degree to which students are clear about establishing goals for themselves (short-term or long-term), and their ability to backward design from those goals to engage in behaviors that allow them to be successful in attaining them. A student who is clear about maintaining a particular GPA or ending up in a specific profession may be more driven to adopt more aggressive study habits and manage their time efficiently.

Confluence: Where life and science meet

This study was conducted at a Hispanic-Serving Institution (HSI, 67% Hispanic; school size 55,000) located in Miami, Florida. The institution offers a wide variety of STEM majors and has postgraduate programs in engineering and medicine. We created a program called Confluence: Where Life and Science Meet (26). Though Confluence was open to students from the entire university, it was primarily attended by students within the Department of Biological Sciences, where it was housed. This was a seminar series where scientists in different fields and from all walks of life visited the campus and engaged with students. The goal of the program was to expose students to social and intellectual diversity in science and allow them to hear the authentic life stories of these individuals. Invited scientists were asked to give an hour-long seminar that briefly summarized their work or research program, and spend the remainder of their speech time describing their personal journeys to their current career point. The stories of the invited speakers were incredibly diverse, and most speakers focused on personal and professional barriers they surmounted to attain their professional goals. Depending on the speaker’s background, these barriers were often deeply connected to their social identity.

We were interested in how minority students would internalize the social messages they heard, especially as these pertained to their own mental constructs around career choice. To this end, we sought to document the ways in which students personally connected with the stories of invited scientists, through their oral reflections on the seminar series. We utilized the SCCT framework to help unpack the ways in which students considered their own career pursuits in STEM.

DATA COLLECTION AND ANALYSIS

We used a qualitative methodology to assess the impact of the Confluence series on student career thought process and its relationship to the SCCT framework. We were specifically interested in determining how the elements of the SCCT framework were expressed through students’ internalization of the speakers’ narratives. To capture the students’ voices, we conducted a single focus group of seven students for two consecutive hours. Institutional review board approval for Human Subjects research was obtained from the institution where the series was conducted (IRB # 071708-02). Each seminar was attended by approximately 60 students, mostly from the Department of Biological Sciences. Students were asked to sign an attendance sheet upon entry. Most of the attendees came to the entire seminar series. A general request for volunteers to partake in the focus group was sent out to all the attendees, with the appropriate consent documents. We accepted the first seven volunteers. The seven volunteers met with the interviewer for one continuous group conversation. We limited the number of students to seven to allow all participants an opportunity to offer multiple contributions to the conversation. Questions used as prompts for the semi-structured interview were constructed based on the stated goals of the program (see Appendix I). The students were interviewed by coauthor Reid, with the questions serving as starting points for a broader conversation. The students were allowed to develop their thoughts as they saw fit, resulting in a conversation naturally touching on a number of related elements. The interviewer inserted herself in the conversation only to move on to a subsequent question, taking care to avoid priming particular responses. During the conversation, all participants spoke at least once, with most participants making several contributions. Additionally, participants responded to new points raised by other students, or responded to direct questions raised as counters to the original question. The entire conversation was recorded for transcription and analysis.

The recorded conversation was transcribed into text manually and entered in NVivo for qualitative coding. We conducted a conventional thematic analysis using SCCT as a guiding framework for establishing codes. In this vein, we used what Ryan and Bernard (27) refer to as coding using “theory-related material,” SCCT, in this context, being the lens through which the transcript was interpreted. However, coders remained open to unique things that emerged from the free-flowing conversation. While the focus group was primarily guided by a list of questions concerning students’ impressions of the speakers, themes we gleaned from the discussion were not restricted to the nature of the question, as the conversation evolved to incorporate broader social contexts. After an initial coding of a small part of the transcript (10 initial lines), we measured inter-rater reliability (IRR) to ensure that there was agreement on the themes that emerged from the transcript. Inter-rater reliability was

calculated using a percent agreement method, where the number of agreed upon themes between three coders was summed and then divided by the total number of themes identified. The IRR result was 85% for this process. The three coders then discussed disagreements between them and finalized a single codebook. They then coded the rest of the transcript individually. One of the coders (author Dewsbury) founded the Confluence series, and another coder (author Reid) conducted the interviews. The third coder (author Viamonte) was not affiliated with the Confluence series in any way. Coders reassembled to ensure agreement on the content analysis, and the resulting codes were then used to identify emergent themes apparent from the transcript (Table 1). The identification of these emergent themes occurred within the SCCT framework. The transcript was then re-read several times to ensure agreement between the coders with respect to the clarity of the narrative emergent from the transcript. Our analytical approach focused on thematic agreement and not theme frequency. This was a deliberate choice since, as Hannah and Lautsch (28) argue, high frequency can bias overrepresented codes. We aimed in this context to elucidate as clear a narrative as we could objectively determine.

RESULTS

Transcript analysis showed that, pertaining to their own career pursuits, student reflections on the impact of the seminar series coalesced around three major themes: career paths, family, and diversity. We report below only on the themes that emerged from the transcript.

Career paths

Career path is defined as “the professional endpoint the student envisioned themselves in after obtaining a post-graduate degree” (10). Students articulated the process by which they navigated career choice as informed by their understanding of career options available in science (mostly medically related), compensation available for each, and the ways in which those choices aligned with their interests. Some students were clearly still weighing their available options but were clear on why they preferred something in the STEM fields. One student said, “I want to practice medicine. And my back-up plan will still be optometry or

PA. [...] I want to be interacting with people. I don't want to be behind [a] microscope.”

Part of the navigation process involves students' perceptions of what the preparations and rewards for STEM careers entail. They also reflected on being unaware of which skill set will end up being their strongest. For example, one student said:

It's, like, really scary because that's how I feel about my career [...] I'm in an orgo lab, I'm nowhere near as smart as these people. [...] I don't know when I could, or if I could, be good enough to do anything productive in this field. I like working with chemicals and I think it's interesting but [...] maybe I would be better at doing something else, maybe I would be a good doctor. [...] That's the one thing I hate, you can't really tell if you're gonna be good at anything.

For this student, the ideal career was something to be discovered, as opposed to the culmination of skills that were carefully cultivated over time. The ambivalence in this response reflects the reality that all the program's guests came upon their careers in relatively unique ways.

Students reflected on both the economic outcomes of different career choices within science and the financial sacrifice needed to successfully attain their goals. One student indicated that increased financial solvency for medical careers was a known fact. They said:

Everyone sees money as the main incentive to live... it boils down to that, that's what [makes someone] successful... and [when] one looks at the sciences, obviously, a doctor makes more money, so that's why [...] a scientist ranks lower than a doctor would, [and] that's why everyone's parents here are nudging—not even budging—almost forcing their kids to go towards MD rather than PhD.

Career choice in this context is a zero-sum game where financial gain is a chief determining variable impacting the choice. For some students, the stakes attached to the process supersede the intellectual fulfillment that might be derived from education.

Students reflected on major events that impacted their own career choices and recognized that many of the series'

TABLE 1.
Typology of the transcript from the Confluence focus group.

Career paths	Family	Diversity
Networking	Cultural expectations	Diversity in general
Expectations and perceptions	Family obligations	Affirmative action
Financial constraints	Family pressure and support	
Influential life experience	Personal plans	
Mentorship	Women in science	

speakers went through a similar process. Students noted the passion with which speakers engaged in their area of interest, carefully connecting it to some formative experience they had in their childhood. One student recounted their own transformation by saying:

I knew I liked animals [...] when I was little I would watch Animal Planet all the time, so I thought I wanted to be a vet, because I thought it was [...] really interesting [...]. But as soon as I got older, I actually had a moment where I myself was going through a medical problem. I had scoliosis, and it was something that was affecting me for several years and eventually it was the same doctor. We got to know each other. He found out that I was starting to pursue medicine.

Series organizers asked speakers to reflect on their growing up. This process presented a human side to scientists that resonated with the students in the focus group. Some expressed surprise at learning of some of the early struggles that scientists shared with them. Student comments reflected both their personal connection to the diverse backgrounds of the speakers and hope in the ways in which they overcame early struggles. One student stated:

One of the things that really stood out to me was that Doctor _____, he was saying that after his undergraduate degree, he had a really bad GPA and couldn't get into graduate school so he took a job [as] a technician. Somebody recommended to him, "why don't you do this," and [he] took a job and start[ed] getting involved in science, and "perhaps you could publish," and he ended up publishing some papers and eventually, obviously, now [he is at] Harvard.

The humanizing process appeared to impact students' expectations of the nature of these careers.

Family

The family theme referred to "the critical role that familial relationships, whether current or future, played in the career decision-making process" (10). Students specifically reflected on the socialization of Hispanic families. Respondents pointed out that the nature of familial ties in some Hispanic cultures, and the social demands within those families, differed from other American subcultures. Reflections were in direct response to one of the speakers, an Hispanic woman, who recounted her decision to leave her family for an extended period of time to do scientific work. Two respondents grappled with the decision, saying:

I already don't like it when people do that. And just to contribute back... and for me, just leaving

your family for a couple months, they're going to worry about you. They're going to worry if you don't come back. What kind of impact are you going to have on them... Not a really good one... I honestly don't know how she does that. It's a really big thing to give up. Especially since she's Hispanic. That's what I found surprising. It was kind of going against a cultural norm.

And

In her presentation, she talked about finding this little monkey (lemurs). Pretty much saved the whole... all the species around. It's good that she is helping them, but also, if you don't go there and accomplish something as great as she did, then you're gonna run the risk of doing a nature show and getting your arm bitten off, and what's your family going to do about that? And what if something happens to you, your kids say... "I never got to meet mommy" or "I barely met mommy."

This statement addresses the reality that cultural expectations sometimes compete with the demands of individual careers. These conflicts reflect students' perceptions of career expectations and subsequent choices. One respondent did appear to interpret that these cultural expectations serve as an additional barrier for Hispanics and should be considered accordingly:

I would prefer the Hispanic kid that got a 0.2 less than the white kid but had to work, you know, like taking care of his brother and sister and so on and so forth, because how well would the white child have done if he had to put up with all of that. Again, that's a case-by-case scenario, that's something you would have to look into. It's an unfair advantage. If you look at it in a real-world sense, how unfair it really is.

Similarly, another respondent focused specifically on the time spent away and how it would clash with cultural expectations: "Even then, if they were to watch some of these talks like that last lady. I think my mom would take me out of science totally. Leaving your family for three months! With four kids! What?! Yeah science, I'll go (do) banking... Nah."

This statement also reflects the pressure students appeared to feel to do particular activities due to familial perceptions of how their academic time should be spent.

Diversity

This theme is defined as "the role that identity, especially an ethnic identity, played in the career pursuit process" (9). In this theme, students reflected on their

views of how institutions of higher education addressed the diversity question. Little in the discourse suggested that the respondents believed in the authenticity of these efforts. Even though students were part of a Hispanic-serving institution, they recognized that in their next academic step, they were likely to be in a numerical minority. In response to this, they had mixed feelings on what diversity meant to career opportunities. For example, one student said:

[If] you're too diverse, then they might not be able to hire you because you are too diverse. I've heard that before, so sometimes it is better to kind of mainstream yourself and be very, like... this is what I am. Then, at the same time, it's like institutions are kinda the same way, where they'd be, like, yeah, we want [one] of these because of whatever reason... but we need to also fill [...] seats. That's how I feel a lot of med schools are. They are just going to be like, "ohh... we need Hispanics... okay out of the Hispanic group."

Further internal conflicts about being diverse in a major institution were expressed by the following comment:

The thing is, even though people come from different backgrounds, I feel that schools... or even once you get accepted into a school, or accepted to a graduate school... they try to mold you into a certain kind of person that is accepted by society or that is accepted by the people in your field [...] even if someone is white, and full of tattoos and stuff, they're not going to be respected and they can be a genius, but just because of what they see aesthetically or the way they carry their lifestyle, that really changes how people view you [...] and what you can do with your tools. They do try to mold you into what they think would be best.

Mixed feelings were also expressed about affirmative action. Respondents questioned both the fairness of the program and the ways in which institutions leveraged it to diversify their student body. One student expressed their ambivalence by saying:

Let's be honest. You don't get compared to the white or Asian groups. They're gonna pick that group over there and the highest are ones that go in... you compare the scores between like the whites and the Asians and like it's a really... it's like a difference. And at the same time, it's like, you know, who's to argue what's fair [be]cause I personally want a doctor that's best, not a doctor that got in. That's kind of why I'm [a] minority, but I'm against affirmative action and I don't know if it's a bad thing, but, you know.

Furthermore, students felt that universities used the veneer of diversity to increase their public image of prestige and, in so doing, attract more resources. One respondent concluded:

It looks good on paper that you have a lot of Hispanics.... A lot of schools go for affirmative action just for title because, at the end of the day, you are going to get more applications for Harvard than you are going to get from West Palm Beach. Affirmative action helps each school get its own prestige. With more prestige, you are going to get more applications, with more applications you are going to get more money, the more prestige, you are going to get more grants. So it helps the school become more diverse, in the public's view. So I feel that's kind of a big reason why, "Oh, we want Hispanics... the more Hispanics the better." A white person has the same accolades as a Hispanic person, the Hispanic person, as ironic as it is... has the advantage. Why? because it helps the school look more diverse, to get more hue for funding.

DISCUSSION

Student reflections reveal complex and nuanced views of the social contexts of their choices surrounding career paths and opportunities. Their responses seem to indicate that the experience of listening to the series' speakers prompted them to reflect on the context of their own individual career decisions. Whether primed by the discussions generated by the invited speakers or not, respondents demonstrated an acute awareness of the complicated roles race, class, gender, culture, and economic status play in the pursuit of STEM careers (29). This awareness added significant elements to their internal expectations of career outcomes. Reflections on these outcomes showed students' clear awareness of their underrepresented identities, as well as the social and legal frameworks (specifically about affirmative action) established in response to issues related to underrepresentation. There was a palpable sense of distrust for the authenticity of organizations that intentionally recruit underrepresented students and uncertainty surrounding whether recruitment was based on skill set or purely on phenotype.

We conclude here that for the students in our focus group, expectations of career outcomes, a key component of the SCCT model, were critically shaped by their perceptions of 1) the social response to underrepresented minorities and 2) contingencies they perceived they needed to adhere to as a function of their identity. Purdie-Vaughans *et al.* (30) purport that this navigation plays a major role in how students handle stereotype threat for example. Responses indicated a sentiment that institutions of higher education were not interested in authentic diversity but were happy to simply increase representation. At the same time, students appeared particularly sensitive to being attractive to these

same institutions purely due to ethnicity and, as a result, were suspicious about programs that encouraged a representation model of diversity.

There was a strong response to the personal and professional choices of some of our speakers pertaining to “women in science.” Some respondents struggled with gendered expectations, anticipating that their desires for strong family connections would conflict with the career paths chosen by some of our female speakers. Contingencies associated with childbirth, child rearing, and general family responsibilities dictated responses to the desirability of certain career choices. Respondents tied these somewhat traditional views, in some cases, to cultural norms associated with the South Florida Hispanic community.

The enduring theme emerging from our study is that the sociocultural contexts of student identities strongly informed their perceptions of their individual career paths. These contexts acted as potential mediators or even determinants of those perceptions. Students were very clear on their goals and did not indicate any doubts on their abilities to attain them. They articulated that their individual pathways were guided by current and future family roles but expressed uncertainties surrounding the ways in which minority talent is viewed and supported by broader society. Existing umbilical ties to locally situated families also played a role in how students viewed their decisions. It was clear that parents, with whom they still lived, affected the nature of the choices students perceived were available to them. These realities reflect the fact that, under the SCCT model, “outcome expectations” may be the most critical component in understanding how student perceptions of career opportunities and pathways are constructed in underrepresented populations. Delineating the factors that impact these expectations would consequently be crucial to designing an educational experience that addresses their perceptions.

These findings hold implications for pedagogy, curriculum, and academic programming design, especially in STEM disciplines. Persistent underrepresentation of URM identities in STEM careers has spawned several federally funded efforts in higher education targeting increased representation as an explicit goal (31, 32). Viewed through the lens of SCCT, our study shows that, without a full understanding of the sociocultural contexts of students from underrepresented backgrounds, well-meaning diversity programs in higher education can be ineffective. Such programs may have to consider explicit ways to address the perceptions that students may have of the personal tradeoffs they interpret as necessary for success in STEM careers. More importantly, programs with stipulated outcomes pertaining to diversity should consider ways in which notions of diversity mature beyond mere representation. Students may lack mental clarity on the moral intentions of such programs and, rightly or wrongly, interpret recruitment as an affirmation of their personal value solely tied to phenotype.

Applying the SCCT framework highlights that, for our population, there is a need to think more deeply about

perceptions of diversity and the role of the current and future family. For STEM careers to attract greater representation of historically underrepresented groups, academic and social programming at the university and college level will have to be more inclusive of and sensitive to these realities.

SUPPLEMENTAL MATERIALS

Appendix I: Questions used for semi-structured interview

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