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Understanding racial/ethnic meaning making: Narrative analysis of STE[A]M doctoral student experiences

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Abstract:

Purpose

The purpose of this paper is to examine the racial and ethnic aspects of the doctoral socialization to provide a meaningful insight into the belief systems and decision-making processes related to academic success and degree completion. This paper addresses a gap in literature focusing on the racial and ethnic aspects of the doctoral student experience as they relate to student agency.

Design/methodology/approach

This narrative research of four doctoral students uses a postmodern active interview method to foreground the role of a doctoral agency as manifested in the ways students make meaning of their experiences as members of the science, technology, engineering, agriculture and math academic community. A dialectical approach to the traditional socialization models provides the framework for understanding the meaning-making processes within a critical context of academia.

Findings

Findings present the intrinsic foundations for a doctoral agency and forces that shape key decision-making processes for doctoral students.

Research limitations/implications

Implications for research and practice provide guidance for faculty, graduate school administrators and organizations interested in supporting degree completion for historically marginalized doctoral students.

Originality/value

This study examines doctoral socialization as a meaning-making process of racial/ethnic students in engineering and agricultural programs. Narrative research design provides depth into the individual experiences and the role of racial/ethnic histories in students' socialization (meaning-making) processes in a predominantly White academic environment.

There is a need for STE[A]M not just STEM – to address agriculture in the discussions of diversity and inclusion. – Hispanic first year PhD student in agriculture, 2013.

Historically marginalized groups at the doctoral level of the American higher education are underrepresented in science, technology, engineering and mathematics (known as STEM) fields (Museus et al., 2011; Sowell et al., 2008, 2009) as well as in agriculture programs (Kantrovich, 2010; Morgan, 2000; Talbert et al., 1999)[1]. Council of Graduate Schools (Allum, 2014) find that out of total graduate enrollment in the USA only 5.4 per cent Black or African American, 7.5 per cent Hispanic or Latino and 0.5 per cent American Indian or Alaska Native were enrolled in biological and agricultural science in the fall of 2013.

Similarly, small total enrollment percentage is evident in engineering: 5.3 per cent for Black or African American, 8.2 per cent for Hispanic or Latino and 0.3 per cent for American Indian or Alaska Native (Allum, 2014). Furthermore, doctoral completion rates remain significantly low for historically underrepresented racial/ethnic doctoral students (Council of Graduate Schools, 2008a, 2008b; Golde, 2005; Lovitts and Nelson, 2000; National Science Foundation, National Center for Science and Engineering Statistics, 2015). These figures represent American doctoral programs and doctoral students studying in the USA.

Literature suggests that faculty and departmental cultures play a paramount role in students' academic experiences and retention (Antony and Taylor, 2001; Austin, 2002; Bair and Haworth, 2004; Barnes and Austin, 2009; Davidson and Foster-Johnson, 2001; Felder, 2010; Gardner, 2008, 2009; Gardner and Barnes, 2007; Girves and Wemmerus, 1988; Hall and Burns, 2000; Lechuga, 2011; National Science Foundation, 1998). However, institutional/ academic practices continue revolving around the traditional academic socialization models that operate from the assumptions of cultural assimilation and integration (Weidman et al., 2001; Weidman and Stein, 2003). Traditional socialization models may overlook possibilities of individual student differences and are likely to

generate value clashes, particularly, for historically marginalized students (Antony and Taylor, 2001; Davidson and Foster-Johnson, 2001; Golde and Dore, 2001; Walker et al., 2008). These clashes may serve as hindrances to doctoral student socialization specifically related to how students interpret their racialized selves within their graduate programs specific to their disciplines.

To examine students' experiences regarding these clashes within socialization processes, we position this work as a departure from the modernist assumptions and historical legacies of assimilation and integration in doctoral processes in science, technology, engineering, agriculture and mathematics (STEAM) to better understand the role of race and ethnicity within doctoral student socialization. This conceptualization means that we consider the influence of some wide-scale and far-reaching effects of the systemic and cultural trends shaping the doctoral process and experiences of historically marginalized students in the USA. For students in STEAM doctoral programs, we address the culture of these disciplines, often characterized as being sanitized of race (Emdin, personal communication, February 2016), to understand students' ways of making sense of their doctoral experiences. This work, thus, conceptualizes doctoral socialization as a meaning-making process involving broader social contexts, academic environments, institutional and disciplinary culture and interactions with faculty and peers (McDaniels, 2010; Portnoi et al., 2015). With that conceptual focus, we aim to understand students' capacity to act (or agency) within STEAM doctoral programs. The following three questions guide this study:

- (1) What are the racial/ethnic socialization processes associated with STEAM doctoral programs and how do they support or hinder student agency?
- (2) What racial/ethnic meanings do STEAM doctoral students ascribe to their agency?
- (3) In what ways may racial/ethnic meaning making processes of doctoral student agency support or hinder their doctoral student socialization and success?

Literature review

We acknowledge the critical context in which individuals undergo their socialization experiences. The review of the literature, therefore, pertains to the following:

- a larger context shaped by the issues of inequalities in higher education access (historical and present) in the USA;
- an institutional context shaped by the normative institutional/structural arrangements operating from the assumptions on integration and acculturation; and
- individual accounts of the problematic academic and social experiences of underrepresented populations of students within STEAM disciplines in the American higher education.

Since the historic Brown vs Board of Education (1954) legal case until modern days, higher education access and success of historically underrepresented racial/ethnic minority students in the USA has been at the center of critical discussions of inequalities and analyses of the legal courts, academic structures and public perceptions (AERA et al., 2015; Fisher vs University of Texas, 2009, 2011, 2012a, 2012b). Inequalities in minority student access and success in higher education stem from economic and/or cultural and social realities (Bowen et al., 2005; Garces, 2012; Gladieux et al., 2005; Gurin et al., 2002; Hu and St. John, 2001; Paulsen and St. John, 2002; Pryor et al., 2007; Shaw, 2005; St. John, 2002, 2006a, 2006b; St. John and Musoba, 2011; St. John et al., 2005). To be specific, historically marginalized students in the USA represent the largest percentage of low-income population attending colleges and universities (Hu and St. John, 2001; Paulsen and St. John, 2002). Only one-third or less of those from the low socioeconomic stratum enroll in four-year colleges, and a smaller number of students enroll in the prestigious institutions (Gladieux et al., 2005; Paulsen and St. John, 2002). As St. John (2002) noted,

the opportunity gap widened for African American and Hispanic students as a direct result of the changed financial aid policies since the 1980s. The underrepresentation of racial/ethnic groups at four-year and selective institutions creates a problem of the insufficient pool for diverse student participation in graduate education. Analyses of GRE scores reveal differences between racial/ethnic minority groups and Whites (Harper and Porter, 2012; Patton, 2013).

However, some increase in total representation of racial/ethnic minority groups across all graduate programs in the USA is evident (Bell, 2011; Ginder and Mason, 2011). The concern though arises over the higher attrition rates for racial and ethnic minority groups (Allum and Okahana, 2014; Council of Graduate Schools, 2008a, 2008b; Golde, 2005; Lovitts and Nelson, 2000). Specifically, the overall doctoral students' completion rate is 57 per cent in which White students have statistically significant higher completion rates compared to the other racial/ethnic groups (Sowell et al., 2008). The Division of Science Resources Studies of the National Science Foundation (1998) suggests that research needs to emphasize faculty and departmental cultures to discern causes of low completion rates. Whether those responsible for departmental cultures that shape doctoral experiences are ready to meet, educate and retain racially/ethnically diverse students is a critical question, considering the lack of diversity among faculty (Antony and Taylor, 2001; Apple, 2009). Cumulatively, faculty in the American academia remains largely White (79 per cent of White faculty), while Blacks constitute only about seven per cent, Asian/Pacific Islanders about six per cent, Hispanics four per cent and American Indian/Alaska Native only one per cent (Snyder and Dillow, 2011).

The role of faculty is profound in doctoral socialization (Austin, 2002; Bieber and Worley, 2006; Gardner, 2009; Gardner and Barnes, 2007; Gardner and Holley, 2011; Knox et al., 2006; Lovitts, 2005, 2008; Mendoza, 2007; Schlosser et al., 2003; Weidman et al., 2001;

Weidman and Stein, 2003). Doctoral students from racial and ethnic groups report the importance of faculty members as their mentors/advisors or socialization agents (Beoku-Betts, 2004; Felder, 2010; Gildersleeve et al., 2011; Johnson-Bailey et al., 2009; Matton et al., 2011; Patton, 2009). The overarching theme across these groups' perceptions conveys the significance of support from faculty in developing students' sense of academic success and gaining integration to their professional roles (Felder, 2010; Holley, 2011; Patton, 2009; Gildersleeve et al., 2011).

Some studies, however, problematize socialization practices that emphasize students' reliance on their advisors (Gail and Jo, 2003; Hall and Burns, 2000; Robinson, 2009; Sallee, 2011). Hall and Burns (2000, p. 58) suggest:

Power relations between mentors and students, as they are conceived in traditional mentor–protégé models, often lead students to believe they have little choice but to comply with certain ideological positions or risk failure.

As other studies reveal, students, who do not gain characteristics prescribed by their departments or faculty, may find themselves feeling isolated, incompetent and marginalized (Cruz, 1995; Davidson and Foster-Johnson, 2001; Gasman et al., 2004; Gay, 2004; Johnson-Bailey et al. 2009; Robinson, 2009). To address issues of marginalization, Cole (2007) notes the importance of understanding the role of students' race and ethnicity in student–faculty relationships. Other scholars (Davidson and Foster-Johnson, 2001; Diangelo, 2006; Gonzales, 2006; Hollins, 2011) suggest that the underrepresentation of minority faculty and incompatibility of values of minority students as well as unbalanced power distribution within the predominantly White academia in the USA may cause various difficulties for minority students. Gonzales et al. (2002, p. 554) suggest that graduate students may confront the issues of forced assimilation by viewing departmental cultures as “not something to accept and internalize, but rather something to challenge and negotiate”. The authors conclude that the goals of racial/ethnic minority

students could be “not to become socialized members within the academy, but rather to be change members within it” (p. 554), which supports the need of understanding student meaning making (i.e. agency) in the analysis of doctoral socialization of historically underrepresented groups.

Theoretical frame

Traditional socialization literature suggests that socialization is a process and an outcome (Austin, 2002; Gardner, 2008, 2009; Gardner and Barnes, 2007; Gardner and Mendoza, 2010; Golde and Dore, 2001; Lovitts, 2008; Mendoza, 2007; Weidman et al., 2001). As a process, socialization is inevitable and unavoidable in doctoral education: It is inherent in students’ academic experiences. As an outcome, socialization facilitates an academic and social success of doctoral students towards completion of their degrees and development of a professional affiliation with their disciplines. Through the literature review we uncover that historically marginalized students (Hurtado et al., 1999) face numerous challenges and problems during their socialization experiences. Together with McDaniels (2010) and Tierney (2008), we argue that to inform and improve socialization experiences for STEAM doctoral students, we need to conceptualize the socialization phenomenon as a dialectical process (Azizova, 2011, 2013, 2016, p. 89), that is, to aim at understanding students’ will and capacity to act within a constraining or enabling structural context. Tierney further adds that socialization is “an interpretive process” of creating meanings to “make sense of an organization through their [historically excluded doctoral students in our study] own unique backgrounds and the current contexts in which the organization resides”. Therefore, the aim of this framework is to build such conceptual possibilities to analyze doctoral student socialization in a new way and to foreground student meaning making as a socialization process and student agency as a socialization outcome.

Specifically, we focus our research on understanding how an individual agency occurs and what an individual agency looks like through the meaning-making process of our participants and, at the same time, we acknowledge the role of the socialization context and forces shaping the process of a student agency. Using the dialectics between contextual forces and action/agency is possible by blending three theoretical orientations. First, we follow phenomenology of social interactions (Schutz, 1967/1932), which assumes that individuals participate actively in social interactions with the world out there to create own meanings and apply these meanings to a course of action and construction of everyday life. This theoretical lens enables us to treat socialization as a subjective meaning-making process and outcome and discover what may happen (possibilities) as a result of one's active act in socialization rather than what is expected and fails to happen (deficiencies) when viewed from the objectivist/deterministic assumptions of normative socialization theories. For example, Girves and Wemmerus (1988, p. 185) observe, "Typically, the adviser establishes the standard of performance and the behavior norm for his or her advisee". Analyzing such observation from a meaning-making/interactional perspective helps us focus on kinds of meanings that the advisees produce to decide a course of action for themselves rather than conclude whether the advisees adopt or fail to adopt these norms.

Next, we add a critical layer to recognize that social interaction/meaning-making act takes place within a critical structural and historical context and, therefore, is mediated by power-driven relationships/structures/arrangements (immanent social order, substantive conditions) (Foucault, 1977; Johnson, 2006; Ladson-Billings and Tate, 1995; Miller, 2008; Solórzano and Yosso, 2002; Solórzano et al., 2000). Gubrium and Koro-Ljungberg (2005, p. 711) assert that to follow the premise of phenomenology of social interactions and meaning-making, researchers need to pay attention to "a particular historical and cultural context", which is also a fundamental concern of the critical race theories (Solórzano and Yosso, 2002). For example, various accounts confirm that interaction with faculty is one of the most important socialization practices

(Diangelo, 2006; Felder, 2010; Cruz, 1995; Johnson- Bailey et al., 2009; Gasman et al., 2004).

Yet, critical cultural disconnect exists between students of color and predominantly White academic departments (and institutional ideologies) on campuses (Apple, 2009; Davidson and Foster-Johnson, 2001; Diangelo, 2006; Gay, 2004; Hollins, 2011), which needs to be included in understanding and interpretations of students' meanings and decisions to act in their own interests. Faculty and their positions of power, campus cultures, institutional-regulatory structures and histories of student exclusions are all elements of the social order – a top-down force in student socialization processes. To reconcile the sociological divide between the social action and social order (Azizova, 2016), we follow the postmodern assumption that “neither takes precedence over the other” but “like two sides of the coin, interpretative artfulness and substantive conditions mutually inform one another” (Gubrium and Holstein, 1997, p. 212).

Therefore, finally, we incorporate postmodernist epistemological and methodological orientations to de-center marginalized dimensions of individual meaning making (Gubrium and Holstein, 1997; Holstein and Gubrium, 2000; Koro-Ljungberg et al., 2013; St. Pierre and Pillow, 2000). De-centering assumes the analytical focus on an individual act placed at the border of historical realism/structural determinism (critical theory and critical race theory) and human agency (re-constructivist power of an individual) without privileging one over the other. Guba and Lincoln (1994, p. 110) note that critical theory can be divided into substrands such as poststructuralism, postmodernism and a mix of these two. Ontologically, critical theory stands as historical realism, which accounts for structures that are shaped by “a congeries of social, political, cultural, economic, ethnic and gender factors” and taken as “real” if, the authors further clarify, there is the absence of a conscious insight. The absence of the insight is, however, not possible in the wave of postmodernism. Holstein and Gubrium (2000), citing Patti Lather, remind us that the following:

Postmodernism is born out of the uprising of the marginalized [. . .] our sense of the limits of Enlightenment rationality, all creating a conjunction that shifts our sense of who we are and what is possible (p. 56).

Holstein and Gubrium (2000) characterize the shifts of the senses as the crisis of confidence (p. 57). Yet, following the optimistic tone, the authors (Gubrium and Holstein, 1997; Holstein and Gubrium, 2000) further suggest that affirmative postmodernists hold that there is a potential of confronting the crisis of confidence, which requires ongoing transformation and re-construction of selves, as conscious agents and re-positioning in what was previously taken as real. Their concept of the postmodern constructivist act of a transformative self corresponds with Guba and Lincoln's (1994) explanation of the connection between critical theory's assumptions of historical realism and postmodern constructivist's assumptions of subjective social realities "that are products of human intellects, but that may change as their constructors become more informed" (Guba and Lincoln, 1994, p. 110). Thus, we acknowledge that the participants may position themselves within the racial history and social context and we want to maintain the critique of the oppressive structural provisions and historical realities. Yet, we also look at the participants' capacity of patrolling the invisible border between own meaning-making act and structural forces, possibly resulting not only in an act of resistance (Solórzano and Yosso, 2002) but also in an act of re-creation of their doctoral self from the objects of social structures to the active actors of their realities of doctoral success and producers of self (Miller, 2008). We find analytical and methodological possibilities in the works of Holstein and Gubrium (2000, p. 232). Holstein and Gubrium (2000) identify their research methodologies postmodern for the focus on "[de-centered] subjects [who] are reflexively working out [agency] who and what they are as they articulate and ramify the myriad self-narratives of contemporary life". We further emphasize that discursive practices and individual narratives construct and convey individual meanings of self, which shape the narrative research design of the study.

Thus, taken altogether, we draw the following four basic presuppositions of the doctoral socialization as a dialectic process:

- (1) Socialization is an imperative process in doctoral education.
- (2) Socialization is a meaning making process that may involve racial and ethnic perspectives essential to one's will and capacity to engage in the doctoral process (Felder et al., 2014).
- (3) Socialization is regulated by a pre-existing context, takes places in cultures and value systems.
- (4) Socialization is regulated by a pre-existing organizational system, takes places within certain structural arrangements and historical conditions.

This theoretical approach enables us with the simultaneous micro- and macro-levels of analysis of the data, taking into account both an individual subjective (purposeful) act and social determinism (Azizova, 2016).

Methods

We used narrative practice to be the research methodology for activating participants' personal narratives that construct their meanings as they speak (Gubrium and Holstein, 1997; 2000). We used postmodern active interview (Gubrium and Holstein, 2001; Holstein and Gubrium, 2000) as a particularly relevant data collection technique in the research of narrative construction because it assumes the possibility of narrative activation and, thus, fosters one's meaning making act. Koro-Ljungberg (2008, p. 430) clarifies that statement, suggesting that postmodern active interviews serve as "dialogical performances, social meaning making acts and co-facilitated knowledge exchanges".

Participants and site

Holstein and Gubrium (1995) caution that selecting individuals as opposed to representatives of the population is the essential philosophical underpinning in the active interview method because it opens the possibilities of inviting people with the alternative, often marginalized and excluded standpoints to construct different realities. Furthermore, Holstein and Gubrium (1995, p. 28) define purposefully selected participants as narrators of experience and narratively activated people, who own “experience, emotion, opinion and expectation” to tell their stories and share their subjective meanings related to the research topic. Thus, we invited individuals who possessed the following attributes relevant to the focus of the study:

- a student of the ethnical/racial background other than White;
- a student in the status of a currently enrolled doctoral student; and
- a student with an assigned or student-identified academic mentor/advisor.

Four participants were from the College of Engineering and the College of Agriculture and Natural Resources of a predominantly White research institution in the Midwest (MRU) of the USA, with the high research activity offering comprehensive doctoral programs. The main campus situated within a north central community of the mid-Western state in the USA.

According to the USA Census Bureau (2012), the population of the community estimated about 46,000 residents with the Whites constituting about 80 per cent and Asians; Black; Hispanic or Latino; American Indian and Alaska Natives; and Native Hawaiian and Other Pacific Islanders constituting 5.6, 4.7, 4.3, 3.9 and 0.1 per cent, respectively. Much like its community, the university lacked a racial and ethnic diversity mass among graduate students and faculty on its campus.

Data collection and analysis

Two sources provided the data for the analysis: eight face-to-face interviews with four participants and the researchers' reflection notes. Each interview incorporated a twostage

conversation accompanied with the researchers' field notes, in agreement with the postmodern active interview method (Holstein and Gubrium, 1995). This interview method assumed an interpretative/meaning-making practice that involved the researcher and the participant. The interpretative exercise required considering two important elements: the how and what during the meaning-making process (Gubrium and Holstein, 1997; Holstein and Gubrium, 1995). Similar to Gubrium and Holstein (1997), Riessman and Quinney (2005) also clarify that narrative research needs to extend its analytical focus from a mere examination of the content of language to the question of how stories get assembled.

The data analysis was a three-staged conceptual process due to the theoretical and methodological complexities of the research design (Figure 1) (Azizova, 2015). In this table, we presented each analytical/writing voice (Lawrence-Lightfoot and Davis, 1997; Luttrell, 2010) to emphasize the evolving nature of each writing voice and growing complexity of every step of the data analysis, from simple (representational/narrative activation/ descriptive analysis) to complex (theoretical reinterpretations/analysis). We used few analytical strategies such as analytical reflexivity (Gordon, 2005; Gubrium and Holstein, 1997; LeCompte, 1987; Luttrell, 2010) and narrative construction (Borland, 1991; Gordon, 2005; Gubrium and Holstein, 2009).

Stage 1: Data representation			
Writing voice: The voice in dialogue	Purpose: The researcher's voice intermingled with the voice of the participants – orienting to activation	Tools: Summaries of interviews, detailed excerpts of transcripts to represent narrative activation	Criteria: reliance on detailed transcripts, acknowledgment of dialogic nature of narrative
↓			
Stage 2: Data interpretation			
Writing voice: The voice as interpretation	Purpose: The researcher's attempt to make sense of the data – orienting to meaning making	Tools: Topical representation, narrative linkages	Criteria: attention to structural features of discourse, interpretations of similarities and differences among the participants' stories
↓			
Stage 3: Data analysis			
Writing voice: The voice of preoccupation	Purpose: The researcher's theoretical and intellectual assumptions – orienting to narrative composition	Tools: Analytic reflexivity	Criteria: focus on language and context of production (historical and structural conditions)

Figure 1. Data analysis

Findings

Upon completion of the first stage of data analysis, four different narrative portraits emerged for each of the participants in this study (Table I). In their stories, the participants talked about their identities, academic experiences and roles of organizational members, which we summarized along, what Portnoi et al. (2015) call, socialization strands, such as a disciplinary socialization, departmental culture, role of faculty and influence of peers. We also followed Austin's (2002) premise that socialization assumes at least two simultaneous role attainments: to a specialized discipline and role of graduate student. We allocated the participants' socialization to a role of graduate student to the departmental culture strand. Moreover, the participants' stories prompted us to include the role of other socialization agents (i.e. institutional advisors, faculty

and mentors from other departments or institutions) in addition to faculty and peers. The second stage of the data analysis entailed our interpretations and comparisons of all four narratives. Although each narrative was uniquely different, all together these narratives merged into the trends of meanings that the participants created. We organized these trends into the themes, two of which we discussed below: othering and intrinsic foundation and forces of the agency.

Othering

Othering emerged out of a closer examination of each participant’s narration of their academic paths and their explanations of why they experienced certain interactions in academia the way they did. Comparisons of all four stories revealed a stark contrast in the participants’ meaning making of their perceived social positioning within the academic community. While binary categorizations of us-them were apparent in the narratives of all three students of color from the economically disadvantaged backgrounds, they were absent in Matt’s narrative, the only one who thought he was perceived as a “normal White American”. This contrast stressed a significant role of the larger socio-economic and historical context as a meaning-making base of the participants of color.

Participant profile	Socialization to discipline	Socialization to departmental and/or institutional culture
Matt, narrative portrait “I am extremely lucky in a unique position” Native American, third-year PhD student in electrical engineering	<p><i>Role of faculty:</i> Formal and informal frequent interactions with the academic advisor/PI; research lab affiliation through the advisor’s sponsored research; close match between Matt and advisor/PI’s research specialization and lab project; emphasis on mentor-mentee relationship with the advisor/PI</p> <p><i>Role of peers:</i> Team membership in the sponsored research project under the supervision of his advisor/PI;</p>	<p><i>Role of faculty:</i> Formal “check-in” meetings on degree requirements and matriculation (i.e. required sequence of coursework and scheduling of comprehensive exam); formal paperwork between student, advisor and graduate college; informal frequent interactions in the lab and other social events (i.e. lunch and coffee hour) to clarify academic expectations on the degree progress (i.e. whether journal publication is expected) and to discuss an</p>

Participant profile	Socialization to discipline	Socialization to departmental and/or institutional culture
Uniel, narrative portrait "If I succeed, the department will succeed," Black, first-year PhD student in mechanical engineering	<p>frequent peer interactions in and out the research lab; matching research interests with peers <i>Role of others outside of the department or institution:</i> Strong mentorship received at the Master's program in electrical engineering from a different institution</p> <p><i>Role of faculty:</i> Loose interactions with the assigned faculty advisor and other faculty within the department; no lab affiliation; no membership in a sponsored research team given mismatch between Uniel's research interest/ professional goals and existing research projects in the department <i>Role of peers:</i> Lack of disciplinespecific peer interactions due to a lack of lab affiliation and matching research interests <i>Role of others outside of department or institution:</i> Interactions with faculty from College of Education</p>	<p>alignment of professional goals and program academic expectations <i>Role of peers:</i> Not emphasized <i>Role of others outside of department or institution:</i> Graduate college rules and regulations; formal check-in deadlines and processes (i.e. submitting plan of study, registering for comprehensive exam and filing other progress documents) <i>Role of faculty:</i> Classroom interactions with faculty members within the department <i>Role of peers:</i> Not emphasized <i>Role of others outside of department or institution:</i> Formal and informal interactions with institutional advisors from a scholarship office; graduate college rules and regulations; degree sheets and requirements (i.e. required coursework sequence)</p>
Juanita, narrative portrait "There is a need for STEAM, not just STEM", Hispanic, first-year PhD student in agricultural education	<p><i>Role of faculty:</i> Occasional formal interactions with the assigned academic advisor; classroom interactions with other faculty members within the department; no matching research interests and projects with the faculty and advisor; some interactions with faculty along the teaching assistantship lines <i>Role of peers:</i> Interactions with other teaching assistants</p>	<p><i>Role of faculty:</i> Classroom interactions with faculty through the required coursework <i>Role of peers:</i> Frequent interactions with second-year doctoral students in the program <i>Role of others outside of department or institution:</i> Graduate college rules and regulations; degree sheets and requirements</p>

Participant profile	Socialization to discipline	Socialization to departmental and/or institutional culture
Winston, narrative portrait “Don’t let them strip off your confidence”, Black, graduating PhD student in plant and soil sciences	<p>or advanced doctoral students; no matching research interests with peers</p> <p><i>Role of others outside of department or institution:</i> Informal interactions with faculty from the related field in other institutions whose research echoed Juanita’s research interests; formation of mentor-mentee relationships with these outside faculty</p> <p><i>Role of faculty:</i> Frequent formal and informal one-on-one interactions with the faculty advisor; affiliation with research lab and sponsored research project under the supervision of his faculty advisor/PI; coauthorship of research papers; matching research interests and areas of specialization between Winston and his faculty advisor/ PI</p> <p><i>Role of peers:</i> Frequent interactions in the research lab, matching researching interest with peers</p> <p><i>Role of others outside of department or institution:</i> Previous interactions with a faculty advisor and no affiliation with research lab and sponsored research in a different institution where Winston “failed” his dissertation defense</p>	<p><i>Role of faculty:</i> Frequent informal interactions with all faculty members within the department and within the college; formal paperwork between student, advisor and graduate college (i.e. degree progress and plan of study)</p> <p><i>Role of peers:</i> Not emphasized</p> <p><i>Role of others outside of department or institution:</i> Graduate college rules and regulations; degree sheets and requirements</p>

Table I. Graduate college rules and regulations

Matt, a Native American student, shared his story that portrayed in detail the crux of meaning construction of his complicated relation to, and identity with, the category of a racial/ethnic

minority. Four different elements competed to shape his identity: a demographic category per the family roll cards, “second hand” connections with American Indian culture, scholarship opportunities for minority groups and perceived Whiteness. Being a 28th Creek Native American, he was listed as a minority student in the institutional records and for the scholarship purposes. He acknowledged that “we were minority Native Americans” and that was the selection criterion for the participation in the Minority Participation Program and for becoming a recipient of the full right scholarship from Melinda and Bill Gate Foundation. At the same time, he maintained loose connections with American Indian culture and shared his awareness that he was perceived as “a normal White American”, clarifying that “I really never felt like I was treated differently because I was an American Indian, maybe because I don’t look like American Indian”. Matt was the only participant who did not have a lived experience as a racial/ethnic minority other than being identified through the institutional records. Nor did he face any access and financial struggles throughout his studies in higher education.

In contrast, the participants of color, Juanita, Uniel and Winston maintained their strong sense of racial/ethnic identities. All three of them perceived their social positioning within academia in terms of the difference as a binary category of others. To them, others meant those who either enjoyed privileges of their upper economic class standing or who were in the authoritative positions in academia or school system. Juanita was explicit to address Whiteness, when describing her perception of the cultural assumptions in her academic department, “I’ve started to realize how middle-class White this whole structure is”. Uniel tried to avoid explicit references to a race of the others, but he reflected about his racial identity in the program, “I am a minority” and clarified that only two per cent of minorities like him pursued PhDs in engineering nationwide. He also shared his perception of what his race meant to the department, “If I do well, the program looks good; if I success, they succeed”. Winston was more reflective about his interactions within an “old boy school” composition of others at the southern university that he

had attended before coming to WRU. Others included peers who, as Juanita compared herself with her schoolmates, were not from low-income backgrounds and did not have to endure the same degree of struggle during their academic experiences. Others also reflected the authoritative roles within educational institutions, such as schoolteachers, faculty or administrators.

Bensimon and Bishop (2012) and Harper (2012) point to the structural/institutional racism in their explanation of a social positioning of racial/ethnic minorities. Moreover, Johnson (2006) takes a broader stance in his conceptual framework to explain that othering is a broad social construct of a social system understood through the matrix of privilege and power simultaneously grounded not only in race but also class, gender, age, disability and status. Following Johnson's conception, we were able to discern that the participants' meaning-making of their difference from others stemmed from a particular social and historical context related to the intersection of race/ethnicity, low-income status and first generation background in higher education. The perception of power and privilege in their categorization of others was rather explicit as all three participants spoke about "White middle-class biases", privileged peers in the programs, and authoritative advisors and administrators who prescribe norms and values in academia.

Undertaking his critical examination of such a construction of difference, Johnson points to the critical implications of "how people notice and label and think about such differences and how they treat other people as a result depend[ing] entirely on ideas contained in a system's culture" (p. 19). This premise corresponds with Scheurich and Young's (1997) argument that personal epistemologies develop out of the histories of certain social groups. Similarly, the significance of contextual nuances in the construction of categories such as us-them is explicit in Foucault's (1977) writings. He asserts that context and culture create "a roof" under which various categories "coexist" (p. xvi). He observes that the order of the categories is an outcome of

humans' "pure experience of order and its modes of being" (p. xxi) in a given cultural context. Social relations creating social categories have their specific "times, places and situations" (p. xiii.), which influence the process of social construction and exclusion or inclusion practices. A predominantly White higher education institution became such a roof for the participants' meaning construction of others. The participants' perception of self in relation to the others implied that there was a sense of exclusion from the mainstream context. Their meanings of self in othering reflected Johnson's (2006) and Foucault's(1977) theoretical assumptions about the deterministic power of the social order.

However, Johnson (2006) extends his arguments to the ideas that social/cultural systems control individuals, but these systems themselves are a product of human creation. Johnson (2006, p. 125) further asserts that "if we are going to make ourselves part of the solution [for the diversity of inclusion and justice], we have to see how we belong to categories of oppression and oppressed". He calls for attention to co-creative possibilities and reflective practices of the individuals. This acknowledgment of a reflective actor highlights Holstein and Gubrium's (2000, p. 232) stance to view "subjects who are reflexively working out who and what they are as they articulate and ramify the myriad self-narratives of contemporary life". Indeed, this reflective practice was evident as all of the participants spoke about their purpose of a doctoral pursuit, end goals of their education, individual choices and actions and desired qualities in their consciously constructed meanings of a doctoral self. This transition from the perception of self in relation to the others to the creation of self placed each participant's reality at the center, navigating an invisible border between the social order and individual action. This creation of self offered an intriguing possibility of discerning qualities of a doctoral self/agency.

Intrinsic foundation and forces of doctoral student agency

The second theme portrayed an intrinsic foundation and forces of participants' agency, such as exceptionality, confidence, potential for self-actualization and professional self-worth, which

stimulated and guided participants' actions and decisions in academia. The interconnectedness of the individual forces constituted the participants' agency, which was the core of their doctoral self (Figure 2). Participants' meaning of Blackness or Whiteness or other ethnicity originated from the larger, historical and social context where racial/ethnic minority was historically associated with the issues of college access, low-income class, academic preparedness, prejudice or discrimination (Baker and Velez, 1996; Bowen et al., 2005; Hu and St. John, 2001; Olivas, 2006; Pryor et al., 2007, St. John, 2002, 2006a, 2006b). As all of them were connecting their stories directly or indirectly with the historical and social contexts (Figure 3), they each tended to imply that they were an exception rather than a norm in academia. In such a manner, the meaning of a sense of exceptionality emerged from the participants' interpretations of the role of their racial/ethnic and socioeconomic background in their academic journeys and experiences.



Figure 2. Socialized self: the intrinsic foundation and forces of doctoral agency

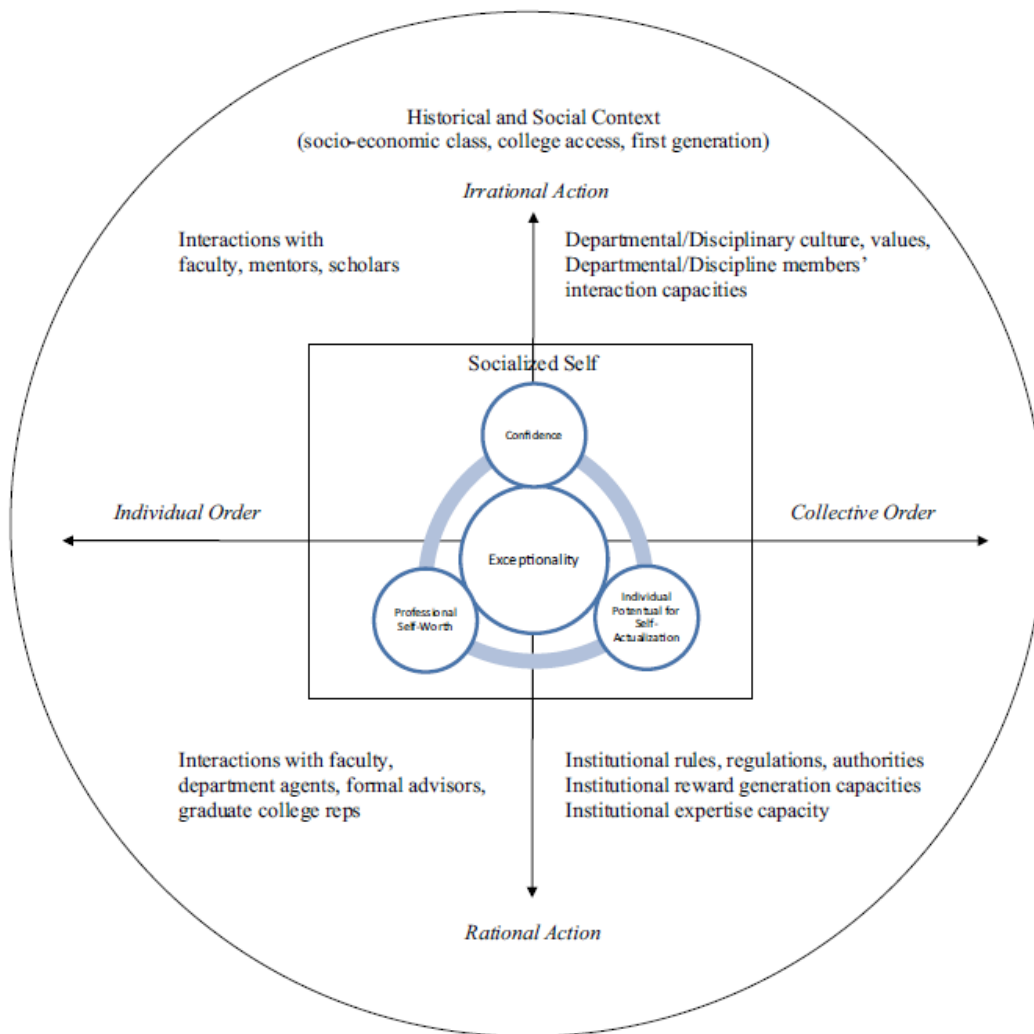


Figure 3. Academic socialization as a meaning-making act of historically marginalized students

Exceptionality. Reaching the highest level of education or finishing doctoral studies was the overarching meaning of the participant's exceptionality; however, each had differing and shifting emphases behind that meaning. While stories about being "extremely lucky" and "uniquely talented" or having a "proud mentality" and outgoing personality were the most explicit manifestations of Matt's and Winston's sense of exceptionality, perseverance, "hard if not harder" work, purposeful scaffolding of academic experiences and good-quality research were the features of Uniel's, Juanita's and Winston's exceptionality. Describing his situation as one

being “extremely lucky” in getting funding and support in the program, Matt implied that those provisions for his education were rather exceptionally generous and unusual compared to what other students of similar background could have. He frequently emphasized, “I feel like I am part of my group, which is my colleagues that are under my supervisor.” Winston’s sense of exceptionality originated from his intentional address that he was not a product of American history and culture; rather, he was a foreign-born and culturally mature young adult at the time when he entered the American higher education. His race consciousness was stimulated through his reflections about racial experiences in the social context of American higher education as well as through his observations of domestic students of color. Winston maintained, however, that having his unique cultural origins granted him some sense of exceptionality among the groups of other people of color in regard to their racial experiences, “Race is never an issue to us [Jamaicans]”, yet, at the same time, he urged “you can’t be naïve that it [racial discrimination and prejudice] doesn’t exist every day here [the USA]”.

In Uniel’s and Juanita’s stories, academic and financial struggles and minority scholarship support reinforced their interpretation that being of an ethnic/racial minority was an explanation for their academic experiences, positive and negative alike. In their narratives, they emphasized the relationship between the socioeconomic class and racial/ ethnic categories, which, in turn, translated into their specific understanding why certain experiences were particularly harder, compared to anyone else in academia. “They don’t understand that we [minority students] are not on the same page”, was Uniel’s call to the university and faculty to pay attention to the issues of academic preparedness of first generation low- income students of color. He clarified:

We [minority students] don’t have parents who go to college. So those parents know these things already. So I think the assumption needs to be reduced that everybody is on the same level because everybody is not coming from the same level.

Juanita's most explicit statement of exceptionality was "Getting here [PhD level of education] is hard, finishing is phenomenal". Making it to the doctoral level of education despite all odds was a result of their purposeful actions and decisions that were grounded in a larger professional purpose to help other people of minority communities. That way, they shared another similar belief that their purpose of pursuing their PhDs was rather exceptional, as it was bigger than just a private gain. Uniel, for example, wanted to advance engineering education to underserved high school students in urban schools. He shared that there are "a lot of kids in my work and they count on me" in his goal "to develop future engineers".

As all of the participants spoke more about their academic experiences, their sense of exceptionality crystallized more as their foundation from which their intrinsic forces had grown to drive their actions and decisions in their pursuits of doctoral education. Three intrinsic forces emerged profoundly from the sense of exceptionality in the narratives of all four participants: confidence, potential for self-actualization and professional self-worth.

Confidence. O'Meara et al. (2013) conceptualize confidence as an emotional competence in the category of self-awareness that doctoral students and faculty displayed in the study about advisor-advisee relationships. Students in that study emphasized a need of self-awareness (emotional self-awareness, accurate self-assessment and self-confidence) in a program that lacked structure and clearly stated requirements. Similarly, confidence had a profound significance in the narratives of the participants in this study. The conceptual meaning of confidence in this study seemed to be similar to the O'Meara et al.'s (2013) findings. However, rather than treating confidence merely as a personal competence, we saw confidence of all four participants as the quality of their self-consciousness deep seated in their sense of exceptionality. Like a competence, though, confidence had a driving power in the participants' agency and was the most explicitly stated intrinsic force that each of the participants treasured in themselves.

Each participant's interpretation of their confidence had shifting emphases. While Matt maintained confidence because of the exceptionally generous provisions in his funded doctoral experience, the rest of the participants emphasized confidence as the desired quality of their doctoral self to justify certain decisions they made and particular courses of action they followed. Matt's confidence stemmed from his "all so [exceptionally] positive" experiences in academia. Ironically, Winston's, Uniel's and Juanita's confidence originated from their difficult or marginalized experiences. The more obstacles they had to overcome, the stronger their belief was that their confidence was of the utmost importance to persevere in their exceptional situations. Moreover, Uniel and Juanita felt growing confidence when connecting their actions with the idea that their pursuit of doctoral degrees had a special, exceptional purpose or mission to serve as a role model or advance their communities. Their purpose tied with the career goals became that point of validation and source of confidence that in turn activated their human agency, as evident, for example, in Juanita's statement "I was motivated differently, not like others". Uniel clarified his meaning of confidence:

Confidence. Self-esteem [. . .] Prime example, I wrote eight pages, and I sent it and they were like "yeah, that's not what I was looking for, so try again". So it's like how do you not respect that? PhD is not for someone who is weak within themselves. It takes strong individuals to endure these things to get finish [sic]. And that's what I tend to do.

Potential for self-actualization. Participants' actions maintained the goal of finishing their PhD degrees and the vision of how to achieve that goal. The unifying vision for them was to cultivate their individual potential for self-actualization to reach their end goal. The degree meant more than a piece of paper; the degree itself was rather strongly tied to their professional goals which implied that there were certain skills and knowledge associated with the professional goals and the PhD title. Thus, the potential for self-actualization meant acquisition of certain abilities, knowledge, research skills, expertise and accomplishments geared toward the attainment of the

degree as an ultimate validation of self-actualization. Striving to cultivate their potential, the participants wanted to assure themselves that they were capable of achieving the title.

To cultivate these abilities and, thus, eventually become self-actualized, each of the participants purposefully initiated and celebrated certain actions that they had been able to undertake.

Availing themselves of the opportunities and capitalizing on a special support outside of the program or funded research groups were Juanita's and Matt's mechanisms that directly contributed to their potential for self-actualization. Looking for effective mentoring relationships and appreciating the input of inspirational people were Juanita's and Uniel's sources fueling the positive driving power to cultivate their potential. Juanita, Uniel and Winston also described similar actions, such as learning how to create positive interactional opportunities within their programs, evaluating the effect of unfavorable situations and being proactive about it, and deciding their course of events in their academic pursuits (i.e. choice of a research project or agenda, participation in scholarship activities outside of their programs and the like). For example, Juanita interpreted certain academic practices such as lack of guidance, as the department's mainstream cultural assumptions that overlooked the needs of minority students like her. To secure her progress and development, she was looking for an academic support from the faculty and scholars outside of the department and institution. That way helped her find interactions that contributed to her academic development, provided emotional support and validation of her academic choices. Black doctoral students in Ellis's (2001) study reported about their strategies of looking for outsiders for the academic support. Similarly, Ellis concluded that these outsiders helped the doctoral students of color to fill gaps in their academic departments.

Winston articulated clearly the desired provisions for his successful academic experience, which he was looking for in his search for a doctoral program. These provisions, in his view, had to include an externally funded research, reward capacities (i.e. coauthored publications in

addition to the faculty's nods of approval) and transparency of institutional rules and regulations in doctoral education (i.e. coursework approval, dissertation committee roles and responsibilities and the like). Externally funded research, according to Winston, served as an accountability platform for faculty to treat doctoral students fairly and help them achieve their academic potential. Winston coauthored some articles. His narrative was particularly illustrative of a strategic choice making to support the importance of his actualizations of doctoral self.

Professional self-worth. Each participant had clear professional goals associated with the attainment of the PhD. Achieving self-actualization through the development of a desired knowledge and expertise, and the attainment of the PhD title conveyed the meaning of getting closer to their professional goals. Therefore, individual potential for selfactualization was closely connected with another intrinsic force such as their sense of professional self-worth. The participants cited various instances that could validate their sense of professional self-worth. Giving back to their communities, serving their career field, advancing other minority groups, serving as a role model to other minority students or merely finding the job of their dream were those instances. Juanita was very elaborate in creating the meaning of her professional self-worth:

I would really like to work in the profession that helps with that [diversity issues in agricultural education] from the perspective of being a minority and recruiting minorities and also educating non-minority, the majority, how [to] work with diverse groups.

Promoting engineering careers to minority high school students was Uniel's call. Overall, all of the participants indicated that finding their professional self-worth would be their highest reward for their unique or exceptionally hard journeys through the PhD studies.

All in all, while all of the participants shared their strong understanding that the interactions with their advisors could be most powerful in determining student success (Austin, 2002; Ellis, 2001; Gardner, 2009; Girves and Wemmerus, 1988; Golde, 2005; Lovitts, 2005; Maher et al., 2004),

their interaction was a two-way dialectical exercise, where they played an active meaning-making role.

Discussions and implications

Ultimately, the participants position themselves within the racial historical and social context (Figure 3). MacLachlan's (2006) observation of graduate students of color in science, technology, engineering and mathematics best ratifies this finding:

Your ethnicity is from society; it affects virtually all your experiences. It is part of the American society; it is part of the consciousness of Americans. It influences the nature of your experience in graduate school, how you are perceived. It is impossible for me to separate this from graduate education. (p. 2)

The way the participants in our study apply the meanings of their situatedness within this context to their actions in academia implies that they do not portray themselves as passive objects of the social structures; instead, they were active actors in re-creating powerful meanings of their self within the mainstream contexts of academia (Miller, 2008). Specifically, racial and ethnic identity, which originated from the broader historical and social context, emerges as a very powerful concept – a trigger to the sense of exceptionality in doctoral student agency, a purpose of determination in their academic pursuits, a point of validation for a planned career or academic achievement. Belonging to the critical race thought, Solórzano and Yosso (2002, p. 26) are among few, who contended that “racialized, gendered and classed experiences” might be “sources of strengths” in individual lived experiences, which could lead to resistance, an act of agency to existing dominant social conditions.

More often within the traditions of critical and critical race thinkers, resistance implied an ongoing power struggle. In our study, the participants' ability to find personal strength, activate intrinsic driving sources, advance an individual self, build on current or alternative provisions and achieve desired outcomes shape their meaning of a doctoral student agency. As such, the

participants' agency within the structural conditions entails more than resistance; it embraces a meaning-making act that was driven by an individual's vision on how to grow within given – often limited – structural provisions for academic success. The participants help us see the specific driving forces of a doctoral student agency. However, student potential to act should not be left on the shoulders of individual students. Instead, institutions need to be in a position to cultivate such capacity. Our findings inform about the ways of “what can and what must be structurally changed if the role of individual meaningmaking act is to be enlarged” (Mills, 1959, p.174), offering few implications for academic socialization practices and policies in STEAMprograms.

First, as Harper (2010) calls for an antideficit achievement framework by shifting focus from the reasons why historically underrepresented students in science, technology, engineering and mathematics fail to why and how they excel, this study highlights the importance of the recognition that a strong individual sense of exceptionality can trigger students' internal drive to generate more powerful interactional options for themselves. Given its positive driving power, the sense of exceptionality tied to the sense of confidence and vision of self-actualization and professional self-worth should be fostered and cultivated by graduate faculty and administrators. Offering of non-traditional socialization conversations to stress individual uniqueness and exceptionality (rather than cultural conformity and assimilation) of lived experiences and academic interests may have a positive impact on persistence and completion of diverse students (Bair and Haworth, 2004). Second, faculty should also evaluate their programs for possible deficiencies in advising and mentoring and aim at building interactional opportunities for historically marginalized students outside of their home departments and institutions. For example, auditing a departmental culture is critical to discern whether it conveys positive realistic expectations of student development or whether it breeds outcome-driven competition

values adding to students' stress and anxiety about their achievements. STEM faculty member of color in Griffin et al. (2010) study shared that to replicate an effective mentoring practice:

I want students to be able to feel like they try something and push themselves a little bit. And it's okay if you fail; it's okay if you don't quite do it right. That's my job. (p. 99)

Such practice certainly emphasizes student developmental process rather than an academic achievement outcome. Another STEAM-specific area that requires an ongoing cultural audit is whether there is a lack of formal and informal conversations about a possible match between student's research interests/backgrounds and faculty members' expertise and ongoing research projects. Typically, faculty members in the doctoral programs in STEAM tend to report a greater commitment to research than teaching (Barnes et al., 2012) and are narrowly specialized in their research interests (Feldon et al., 2010). Recognizing this as a program limitation in the doctoral student development, assigned advisors may be helpful in pushing their advisees "to network, ask questions and explore research opportunities" in the earlier meaning-making stage (Griffin et al., 2010, p. 98). Scholarly interactions and mentorship beyond departmental boundaries serve as a complimentary and powerful platform for doctoral students to activate their agency (Ellis, 2001). According to Harper's (2010) research on students of color in STEM, same-race peers may be additional forms of empowering interactions.

Next, participants emphasize their drive for building their potential for a self-actualization as a researcher and professional in their discipline. To succeed means to be self-actualized as a valued member of a research team or as an innovative scholarly thinker or contributor and role model to other underrepresented students in their respected disciplines. Three of the participants make it clear that external funding plays a significance role in establishing a research team environment that cultivates this sense of self-actualization through membership and participation in the externally funded research projects. Channeling external funding into the research projects with doctoral students seems to be an impactful practice enabling student

agency and development of a doctoral self, which is also echoed in other studies on STEM doctoral experiences (Mendoza, 2007; McAfee and Ferguson, 2006). This sense of a self-actualization further translates into the sense of a professional self-worth. To further assist students in that direction, faculty and graduate student coordinators may want to create program- or department-wide opportunities, such as brown bag lunch or other scholarly gatherings, where students can showcase their development as emerging researchers and professionals, share their sense of ownership, voice their unique contribution to the discipline and program and receive a recognition from advanced peers and other faculty members. Overall, while Feldon et al. (2010) suggested the need for a performance-based rubric in STEM education, we recommend that benchmarking academic socialization along the qualities of the doctoral agency may be a new way of gauging the outcomes of doctoral socialization processes to account for the intersection of departmental/faculty responsibility (and deficiencies in practice) and individual student effort.

In conclusion, the findings of this project contribute to the larger body of literature, by offering a nuanced understanding of academic experiences of four individuals in the USA. A specific strength of this contribution stems from that fact that this study not only reveals some troubling socialization experiences and obstacles but also sheds light on the persistence characteristics and agentic qualities of the doctoral students. Our findings provide an additional puzzle to the literature (Bair and Haworth, 2004) while addressing the problems of the traditional socialization models and practices. Finally, we emphasize that individual meaning-making of historically marginalized doctoral students can and should be enlarged in theory, research and practice to enhance our understanding of their disciplinary perspectives (Okahana et al., 2016).

Note

1. The use of STEAM here is not to be confused with STEAM as “science, technology, engineering, arts, and math”, which is the most common use of the acronym. While

(Yakman, 2010) included agriculture in his framework of subjects in the STEM acronym under technology (the letter "T"), it is also not common to associate an agricultural field of study with the STEM acronym. Including as a stand-alone letter "A" into the acronym in this study was a result of the participants' emphasis and our focus on the historical underrepresentation of racial/ethnic students in this rather broad field of study.

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