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The Role of Resilience in the STEM Identities of Post-Secondary Students: A Qualitative Metasynthesis

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Purpose of Study

- To utilize the findings from a larger study to explore the relationship between science, technology, engineering and mathematics (STEM) identity and resilience in racially and ethnically diverse undergraduate and graduate students
- To contribute to the current qualitative literature on STEM identity development research in racially, ethnically diverse undergraduate and graduate students
- To synthesize findings across multiple qualitative studies to consider the role of STEM identity in contributing to student resilience

Rationale for Study

- Current qualitative research is limited and much of the literature focuses on quantitative studies of K-12 students
- Current research findings are not easily integrated or aggregated across the different disciplines
- There is a need to better understand how diverse students navigate STEM learning environments

Definitions

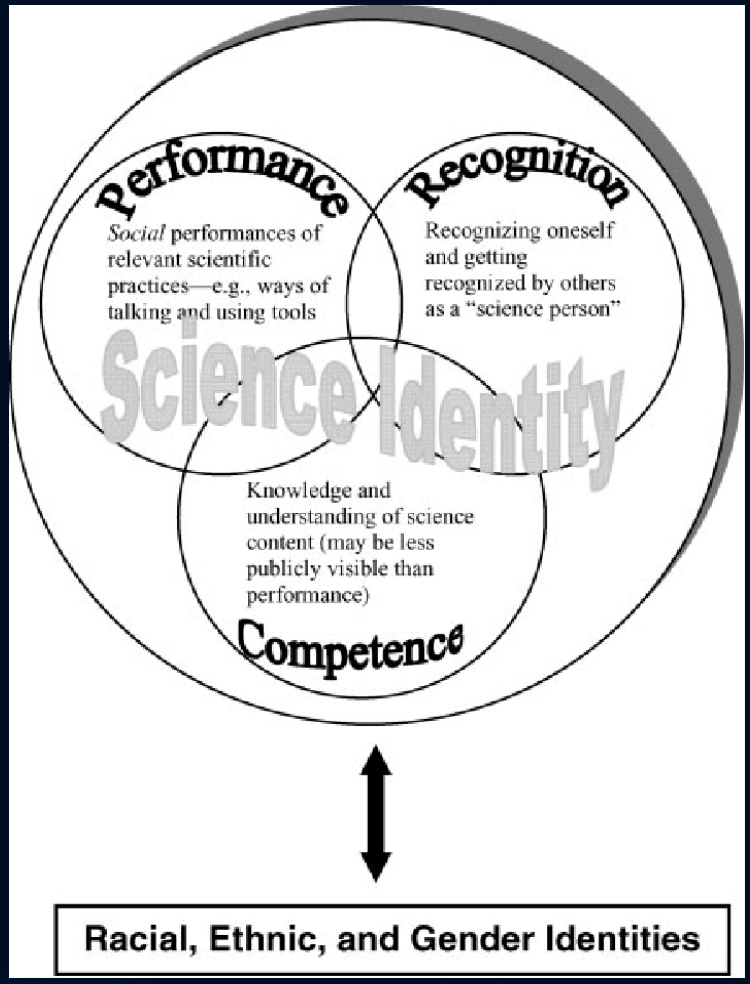
- Resilience
  - Defined as "patterns of positive adaptation" when individuals are faced with challenging or adverse situations and have recovered (Masten & Powell, 2003)
- Identity
  - Construct that addresses the role of individual in relationship to others (Gee, 2001)

Theoretical Frameworks

- Study utilizes two frameworks to understand the relationship between science identity and student resilience
- Social identity theory
  - Is an area of social psychology that explores the self in relationship to group membership and group behavior (Kernis & Goldman, 2003)
- Science identity
  - Included as a type of social identity because it encompasses group membership and affiliation with those who engage in or seek to engage in the study, practice, or employment in a STEM field
  - Aligned with the National Science Foundation's definition of science and engineering that is broad and includes the biological, computer, mathematical, physical, and social sciences, in addition to psychology and engineering (NSF, 2019)

Theoretical Frameworks

- Carlone and Johnson's Model of STEM Identity
  - Three dimensions- performance, recognition and competence



Carlone & Johnson, 2007

Research Question

- How does STEM identity contribute to resilience in the pursuit of STEM degrees in diverse undergraduate and graduate students?

Study Design

- Qualitative metasynthesis utilizing constant targeted comparison (Sandelowski and Barroso, 2007)
- Comprehensive literature review to identify qualitative studies focused on STEM identity in racially and ethnically diverse students
- Inclusion criteria
  - Primary literature, peer reviewed
  - Qualitative or qualitative dominant mixed-methods studies
  - Publication date of 2000 or later
  - Subjects: racially or ethnically diverse students

Study Design

- 21 of 26 articles met inclusion criteria in original study
- 21 of 26 articles met credibility standards
- 8 articles used for current study
- All articles read twice by both researchers for agreement on major concepts and themes

Table 1 – Studies Used in Constant Targeted Comparison

Study Design: Summary of Articles

Author (s)	Year	Description of participants	Methodology
Burt, Williams & Smith	2018	21 Black male graduate students	semi-structured interviews
Carlone & Johnson	2007	15 Latina, Black & Native American female undergraduate students	ethnography
Gazley, Remich, Naffziger-Hirsch, Keller, Campbell & McGee	2014	49 Black, 27, Latina, 22 Native American, 4 multi-racial graduate students	semi-structured interviews
Gibau	2015	18 African American graduate (16 women and 2 men)	phenomenology
Malone & Barabino	2009	24 African American, Caribbean, African, Other undergraduate & graduate students	focus groups and interviews
Remich, Naffziger-Hirsch, Gazley & McGee	2016	25 African American, 20 Hispanic/Latino, 4 Native American, 2 Asian, 2 White/non-Hispanic undergraduate & graduate students	interviews
Sriram, Rishi & Diaz	2016	9 Hispanic, African American, East Asian, Southeast Asian undergraduate students	phenomenological case study
Villa, Wandermurem, Hampton, & Espquinca	2016	26 Hispanic undergraduate students	semi-structured interviews

Constant Targeted Comparison

- A targeted phenomenon is compared with a concept not addressed in the studies to be synthesized (Sandelowski and Barroso (2007)
- In this study, the focus was on the entirety of the results as the source of comparison rather than individual quotations or a subset of the findings
- Comparison: Study Identity (focus of studies) and Student Resilience (targeted concept)
- Findings from the 8 qualitative studies were used to create lists of "abstract phrases"
- Three themes emerged: Mutual Experiences, Coping Mechanisms, Minority Student Impediments

Findings and Analyses

- **Categories of Comparisons derived from three themes**
  - STEM Identity resilience vs. STEM Identity fatigue
  - Racially Disadvantaged STEM Identity vs. Racially Privileged STEM Identity and Student Resilience
  - Resilience and STEM Identity Membership and Belonging vs. Exclusion and Isolation
  - STEM Identity, Agency and Resilience vs. STEM Identity, Apathy and Resignation
  - Resilience in STEM Identity Validation/Recognition vs. STEM Identity Suppression
  - Resilience as a component of Gender Biased STEM Identity v. Gender Neutral STEM Identity

Highlights from Findings
(Summarized into Four Major Categories)

RESILIENCE, FATIGUE & RACIALLY PRIVILEGED AND DISADVANTAGED STEM IDENTITY

- Stereotypes, bias and need to prove ability leads to STEM identity fatigue (Burt, et.al., 2018; Gazley, et.al., 2014; Malone & Barabino, 2009)

- Robust STEM identities and competence uses to disprove stereotypes (Carlone & Johnson, 2007; Gazley, et al., 2014).

STEM IDENTITY MEMBERSHIP, BELONGING, ISOLATION, AND AGENCY

- Minority students are marginalized, made to feel invisible or hypervisible (Burt, et al., 2018; Malone & Barabino, 2009; Gibau, 2015)

- Strong social, cultural and familial networks ameliorate effects of isolation (Villa, Wandermuren, Hampton, & Esquinca, 2016)

- Agency used to forge pathways in majority institutions

Highlights from Findings

RESILIENCE IN STEM IDENTITY VALIDATION/RECOGNITION VS. IDENTITY SUPPRESSION

- Validation of STEM identity through recognition and affirmation by "important scientific others" or supportive mentors (Remich, et al., 2016)
- Self-validation occurs by defining science identity (Carlone & Johnson, 2007)
- Lack of mentors or suppression of STEM identity by mentors occurs at all levels (Burt, et al., 2018)

RESILIENCE IN GENDER BIASED VS. GENDER NEUTRAL STEM IDENTITY

- Gender bias occurs when Black male students are marginalized, denied support, and treated in a condescending manner
- Female struggle in male dominated fields and may encounter masculinized pedagogies (Burt, et al., 2018; Carlone & Johnson, 2007; Gazley, et al., 2014; Malone & Barabino, 2009)

Summary of Findings

- A strong STEM identity may help foster resilience in diverse students
- As a type of social identity, STEM identity is reliant on social interactions in STEM settings with peers and important science others (Kernis & Goldman, 2003)
- The presence of competence, performance, and recognition appear to be relevant not only in the ongoing development of STEM identity but also to support recovery from negative interactions and to maintain the resilience needed to continue STEM pursuits (Carlone & Johnson, 2007; Masten & Powell, 2003)

Summary of Findings

- Diverse students may employ a range of coping mechanisms including family and peer support systems, as well as a personal cache of innovative approaches to self-define their STEM identities and help them navigate the academic mileu.

Contribution to the Teaching and Learning of Science and the NARST Community

- Findings provide valuable insight about the relationships between a well-developed STEM identity and resilience in diverse undergraduate and graduate students
- These findings also have important implications for the teaching, learning and researching of science education
- Additional research is needed to better understand the relationship between a strong STEM identity and resilience in diverse undergraduate and graduate students

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