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Hispanic/Latinx Anti-racism, Diversity, Equity, and Inclusion in STEM

A Commissioned Paper

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Introduction

The following summary paper outlines key themes identified in a literature review conducted for the National Academies of Sciences, Engineering, and Medicine Committee on Anti-Racism, Diversity, Equity, and Inclusion in STEM Organizations. The summary paper begins with a statement on my positionality as a researcher and is followed by a description of the methodology I utilized to identify the scholarly works for the literature review. I then describe the caveats for this literature review before elaborating on the themes that emerged from it. In the process of identifying the presence of themes, the absence of topics and research areas also stood out. These ideas form the basis of the final section of this paper that includes recommendations I make to the Committee with the hope that these suggestions will inform next steps in the committee's work.

Researcher Positionality

This literature review was conducted and written, and therefore influenced by, the perspective that I bring as a scholar: I am a second-generation college-educated woman who studied biology at predominantly White-serving institutions for baccalaureate and doctoral training. I initially trained as a developmental biologist before pursuing additional training in education and social science at minority-serving institutions in the southwestern and western United States. I am from a middle-class family where I was raised speaking English as my primary language. I am a descendant of many generations who resided in the northern New Mexico and southern Colorado geographic areas. My heritage can be traced to Spain, and my recent ancestors do not have an immediate history of migration to the United States.

Methodology

A review of the literature was conducted utilizing Boolean searches with variance on the demographic terms Latin[a|e|o|x|@] series, Chican[a|e|o|x|@] series, and Hispanic along with STEM and anti-racism, diversity, equity, and inclusion. Stanford Searchworks (includes searches

for books, media, journals, databases, government documents) and GoogleScholar were utilized to conduct this review. Additionally, it was required that the search terms were included in either the title or abstract and the results were available in English. With the recognition that definitions of the search terms are evolving and societal use is an ever-shifting landscape (Pew Research Center, 2020), constraints were placed on years of the literature review as 2016-2022. Any particularly noteworthy publications between 2012-2015 were included. A first pass to eliminate studies were those emphasizing primary or secondary education, except in cases where a longitudinal study was started in primary/secondary years and the outcomes measured among college students. Additional limitations required that articles or publications had undergone peer review (which eliminated theses and dissertations on ProQuest), though summary papers generated by non-profit organizations were also considered.

Caveats

The current literature review was conducted with the understanding that similar reviews were underway for other minoritized demographic groups in STEM. Though initial constraints for the review required that demographic terms were included in the abstract, many of the studies identified reported demographics of participants as “Hispanic” and were combined with other groups. Any studies that did not generate specific findings pertaining uniquely to the demographic group (e.g., Hispanic) were eliminated. In many studies that were eliminated in this step, demographic groups were combined, and results were reported for the combined groups, a practice used likely to strengthen statistical findings. Additional studies that may have yielded interesting results may have utilized a variety of descriptors including, but not limited to,

“historically underrepresented”, “students of color”, “traditionally underrepresented” to capture multiple demographic groups under the same umbrella. Although the focus of this review is on Hispanic/Latinx communities, a few of the studies included considered combined demographic groups (e.g., Hispanic and African American). These were included in the event that they were not already known by the committee, as they stood out during the review process.

Findings

Within the results meeting the criteria, there were clear themes that emerged regarding the type of study or report, context within which the study took place or discrete identity the study focused on, and research methodology or conceptual framework used to guide the study.

Study Typology

A study typology was constructed by categorizing the types of studies or reports descriptively based on the approach of the study or theme of the report. Multiple subthemes emerged including advocacy, meta-analysis, descriptive, and experimental (see Table 1). In a few cases, a single study may have qualified for more than one of the study typology themes.

Fifteen studies qualified as “advocacy”: a term describing studies that encourage action based on the conclusions. The subthemes within this group included authors giving advice based on personal experience (e.g., reflections on “what I learned in mentoring students”), members of a professional society calling for engagement with communities, shifting language away from traditional metaphors (e.g., *pipeline*), critique of current practices or process and call for transparency within STEM culture (e.g., faculty search process or career pathways within STEM), and finally, suggestions for conducting studies utilizing diversity, equity, and inclusion data. One reference was categorized as a Meeting Summary as it described the activities from a workshop that attended to career progression for women in STEM (Hansen, 2020). Though this meeting summary is not specific to Hispanic/Latinx experience, the challenges listed are timely in regard to the pandemic effects and relates to a topic described in another section of this review: intersectionality.

Eight studies identified were literature reviews or meta-analyses that in some cases provided recommendations, which would double-qualify as Advocacy (e.g., Nardi, et al., 2021). Other studies that were considered literature reviews were descriptive of the current status regarding a particular description (e.g., “Factors Associated with College STEM Participation of Racially Minoritized Students: A Synthesis of Research”, Bottia, et al., 2021).

Nine studies qualified as having an intentional experimental design or examined effects of an intervention. These studies investigate various aspects of STEM trajectories including the impacts of specific pedagogies (e.g., active learning), programs or experiences (e.g., undergraduate research, “bridge” programs), sociopsychological interventions for social belonging, or training (e.g., inclusive teaching practices, science communication).

Finally, the highest number of references (64) were characterized as “descriptive” due to the predominant focus on providing the status of the question under investigation. Specifically, studies were observational and focused either on assets or deficits of the group. For those studies focusing on assets or strengths, the topics included resistance, persistence, spiritual activism, and attitudes toward science learning. The studies focusing on deficits described gaps that exist between two groups (e.g., majority and Hispanic) in their persistence, performance, outcomes, representation, or student experience and perceptions of campus climate. A separate theme that emerged characterized barriers including: lack of social connections, exclusionary

experiences or impediments to belonging; microaggressions or invalidations; and stereotype threat or societal messages. Barriers were also described at the institutional level (e.g., university), and the lack of role model representation (e.g., faculty).

Study Frameworks

One qualitative observation in this literature review were the variety of conceptual lenses or theoretical frameworks used by the study authors to undertake the study. Several of the frameworks could have been applied to other communities or studies, though a few were specific to the cultural values and assets of Hispanic/Latinx communities. The frameworks specific to Hispanic/Latinx communities included *familismo* (“social patterns in which decisions, interests, and actions are influenced by relatives to the point that relatives’ opinions and thoughts take priority over a student’s own individual priority” from Rodríguez et al., 2021), *nepantla* (from the Nahuatl for “the space between two bodies of water, the space between two worlds”), and LatCrit (Latinx Critical Race Theory). The frameworks that have been applied more broadly to other communities include community cultural wealth, cultural capital, critical race theory, critical race feminism, critical science agency, cumulative (dis)advantage, equity ethic, intersectionality, planned approach to change, psychosociocultural model, resilience theory, social cognitive career theory, and science identity development. Among these frameworks, a subset included an asset-based lens or re-conceptualized an existing framework to be asset-based (e.g., “cultural capital” to “community cultural wealth”).

Study Context or Focus

The context within which questions were studied is the most significant theme within this literature review. For many of the studies, a particular context or social identity was the focus of the research study. For example, studies investigated student experience at different types of educational institutions such as degree attainment at 2-year or 4-year institutions, as well as students who transferred from 2-year to 4-year college. Another trend within some of the studies was to specify a subdiscipline within STEM (e.g., engineering) or further narrowing to bioengineering or computer science within engineering. Many studies also focused in on a particular career stage: undergraduate student, PhD student, postdoctoral appointment, or faculty. Only four studies addressed issues within the current STEM workforce (Anderson et al., 2022; Pickering, 2020; Smith et al., 2021; Tilghman et al., 2021).

One of the contexts in a few studies was Hispanic Serving institutions, though students who took part these studies were clustered as “underrepresented minority” rather than Hispanic. These studies were among the exceptions to the initial constraints set on this literature review. A subset of social identities that are unique to the Hispanic/Latinx community included traditional gender roles within the community or intersectional identity, with studies predominantly focused on Latinas. Other social identities that were the focus of studies included

immigration status, college going experience of individuals or families (e.g., first generation or continuing generation), linguistic diversity (heritage Spanish speakers or bilingual Spanish speakers).

Recommendations based on literature review

To support the committee’s future work, recommendations based upon this literature review are included below. The recommendation topics are positionality, inter-disciplinary partnership, demographic descriptors, and regularly requesting scholarly literature review.

Positionality as part of research

In the context of performing a literature review on STEM education research theoretical frameworks, Bussey, et al. (2021) recognized a set of practices that were present in many of the studies examined. To capture this trend, the authors propose a “framing triangle” which helps to circumscribe the disciplinary work. The framing triangle has three vertices: the literature within which the scholarly work is situated, the theoretical frameworks or perspective taken by the researchers, and the methodology of the work. I wish to elaborate upon the framing triangle given the current literature review, to incorporate a critical element noticeably missing from most references contained herein: positionality of researchers. While one of the vertices includes theoretical frameworks or *perspective*, Bussey, et al. do not describe “perspective” as the lived experience of the researchers.

To that end, the first recommendation is to **require a positionality statement** as part of grant proposals, in Institutional Research Board (or similar) applications, and on manuscripts submitted for peer-review. The requirement is not intended to privilege one group over another for carrying out research, rather it would serve as an opportunity for author-researcher reflection. Including the positionality of researchers will provide additional context for the research, including the motivation for the research question as well as the biases, experiences, and perspectives of the researchers that may affect interpretation of data and development of conclusions.

Partnering across disciplinary divides

Many descriptive studies in this literature review were for purposes of program evaluation and provided statistics regarding Hispanic/Latinx representation or participation. While many of the researchers likely have worthy intentions when designing, implementing, and evaluating programs, the tendency to rely on describing gaps and holding a deficit-based framing of the challenges is prevalent. In research studies that follow, this “gap gazing” must be shifted to more productive directions of scholarship while attempting to utilize asset-based approaches and frameworks.

At the minimum, if programmatic outcomes or evaluation data are being analyzed, **researchers who are not trained in social science research should be required to partner with social scientists** as part of the proposal, award, and publication cycle. These cross-disciplinary partnerships will enrich this cycle by providing additional perspectives with which to consider the research questions, and empowering learning about promising practices regarding which language to utilize (asset-based).

Speaking the “truth” of data

To better understand the landscape of promising practices for supporting Hispanic/Latinx students pursuing STEM degrees or professionals in the STEM workforce, at least two strategies must become part of data collection and interpretation. **Demographic data must simultaneously offer individual descriptors as well as common descriptors to be optimally useful across studies.**

From the perspective of this literature review, searching for every variation on a particular common demographic group descriptor (e.g., Latina, Latine, Latino, Latinx, Latin@) to locate pertinent research studies was challenging for someone motivated to discover as much as possible. For those who are unfamiliar with common demographic descriptors—and considering the evolving nature of demographic descriptors—the library of possible demographic descriptors should be made available in the proposal, award, and publication cycle of research. These demographic descriptors might eventually live in the metadata of the research publication, for example, such that search engines will successfully locate these studies. However, in the spirit of ensuring that individuals who participate in studies are well-represented by the demographic descriptor, participants should also have choice in how to describe their social identities (individual demographic descriptors that are open-ended, for example).

Additionally, while aggregating data for statistical power is a known practice, researchers should be encouraged to also include and discuss this “true” representation of the data. The attempt to individualize data for individual demographic groups would support a better understanding of promising practices and recognizes the complexity of individual experiences as well as the intersectionality impacting these experiences.

Literature reviews as regular progress indicators

Literature reviews and meta-analyses contribute significantly to scholarship within a discipline. The current literature review did not identify many literature reviews nor meta-analyses, though there is a regular practice of presenting a brief literature review as an introduction to a research study. Perhaps due to a perception that literature reviews and meta-analyses as standalone products represent a type of scholarship that is not as well-respected

compared to experimental or observational research that “create” knowledge. Additional **literature reviews and meta- analyses about people who are Hispanic/Latinx in STEM must be requested at regular intervals to track progress.**

As a specific example, Basile and Lopez (2015) examined federal education policy briefs related to STEM education and coded the language used to describe students of color. Regular re- examinations and revisions of studies would indicate whether and how policy advancements have affected practice and outcomes.

Table 1. Study Typology

Theme	Relevant References
Advocacy	Bancroft, 2018; Bhatti, 2021; Bowen & Cooper, 2022; Campos et al., 2021; Estrada et al., 2016; Hagman, 2021; Long & Mejia, 2016; McGee, 2020; McWhirter & Cinamon, 2021; Miles et al., 2022; Miriti, 2020; Nardi, 2021; Olzmann, 2020; Scott & Elliott, 2020; Tilghman et al., 2021.
Descriptive	Acevedo et al., 2021; Aguado & Porras, 2020; Anderson et al., n.d.; Bisson et al., 2022; Bolger & Ecklund, 2022; Bright et al., 2021; Burn et al., 2019; Burt et al., 2020; Bustos-Works et al., 2022; Camacho et al., 2021; Conchas & Acevedo, 2020; Contreras Aguirre et al., 2020; Cross et al., 2021; Davis et al., 2022; DeCuir-Gunby et al., 2013; Esquinca et al., n.d.; Ford et al., n.d.; Frederick et al., 2020; Gámez et al., 2021; Gonzalez et al., 2022; Grineski et al., 2018; Jones et al., 2018; Kendall et al., 2019; Kent et al., n.d.; Landivar, n.d.; Lee et al., 2020; A. M. López et al., 2021; E. J. López et al., 2019; Lopez et al., 2013; Lord et al., 2013, 2014; Lord & Camacho, 2013; Lunn et al., 2021; Main et al., 2020; Martin et al., 2013; McGee & Bentley, 2017; Mead et al., 2020; Mein et al., n.d.; Mendez et al., 2021; Miles et al., 2022; Ohland et al., 2015; Okahana et al., 2018; Orr et al., 2014; Park et al., 2021, 2022; Pickering, 2020; M. Preuss et al., 2021; M. D. Preuss et al., 2020; Riegle-Crumb et al., 2019; Rincón, 2020; Rincón & Lane, 2017; Ro & Loya, 2015; S. Rodriguez et al., 2021; S. L. Rodriguez & Blaney, 20200312; Roksa et al., 20210722; Ross et al., 2020; Silbiger & Stubler, 2019; Skrentny & Lewis, 2022; Smith et al., 2021; Velez et al., n.d.; Villa et al., 2020; Wendt et al., 2019; Whitcomb et al., 2021; Whitcomb & Singh, 2021
Experimental Design or Intervention	Ballen et al., 2017; Bancroft et al., 2020; Ben-Zeev et al., 2017; Byars-Winston & Rogers, 2019; Crane et al., 2022; Estrada et al., 2019; LaCosse et al., 2020; O’Brien et al., 2015; Wendt et al., 2019
Meeting Summary	Hansen, 2020
Meta-analysis	Alfred et al., 2019; Bottia et al., 2021; Martin et al., 2019; McWhirter & Cinamon, 2021; Miles et al., 2022; Nardi, 2021; Ong et al., 2020; Winterer et al., 2020

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