Insights From a Systematic Literature Review on the Role of Professional Organizations in Supporting Black Engineering Students' Persistence

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Natali Huggins is a PhD student in the Higher Education program at Virginia Tech. She holds a master's in public administration from the National Experimental University of Táchira in Venezuela. She has several years of experience in higher education administration and internal audit in Venezuela. Her research interests include diversity and inclusion in graduate education, particularly international and Latinx graduate students' persistence and development. She is interested in supporting students in their transition and adaptability to higher education in the United States.

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and the Center for Student Engagement and Community Partnerships for 11 years. Her research focuses on fostering and sustaining a specific type of cross-sector partnership, campus community partnerships. Karen's dissertation in progress is on the topic of Leader Perceptions of Campus Community Partnerships in a Community College Setting, focusing on the formation process and the value created.

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Abstract

This paper presents highlights from the first of a three-year NSF-funded project with three aims: 1) advance our understanding of the experiences of successful Black engineering graduates and the outcomes of engagement with identity-related professional organizations; 2) identify mechanisms that support student success via engagement in these organizations; and 3) produce a video series entitled, "The Wisdom Files", to disseminate stories of engagement and persistence among Black engineering graduate students. This paper will focus on highlights that emerged from the systematic literature review conducted during the first phase of the study. A systematic literature review (SLR) was used to explore and synthesize findings from existing scholarship on the role of professional organizations in supporting Black engineering students' persistence and success in their undergraduate education. The organizations of interest in this study are the National Society of Black Engineers and Black Greek letter organizations in the National Pan Hellenic Council. Extracting critical information and critically evaluating the contents of each article are important steps in conducting a SLR. This paper will present a mapping review of the 23 articles that met the inclusion criteria and a preliminary synthesis of key findings within one of the extracted categories of data. These findings not only shed light on what is already known about this topic but also present opportunities for future studies.

Overview

Black students continue to be underrepresented in engineering despite millions of federal investments used to create a more diverse engineering workforce. Although Black people represent approximately 13% of the U.S. population [1] they made up less than 4.5% of engineering degree recipients at the undergraduate, Master's and doctoral levels during the 2015-2016 academic year [2]. While most studies associated with broadening participation focus on factors that affect attrition rates of Black students in engineering [2-4], it is known that being more socially integrated on campus and being conscious of one's racial identity are factors that positively influence the academic outcomes of high-achieving Black students [5].

The purpose of this study is to investigate how identity-related organizations contribute to student success and engagement of Black Engineering students . Specifically, we will explore and document the lived experiences of Black Engineering students in the National Society of Black Engineers (NSBE) and/or membership in a Black Greek letter Organization (BGO) that ties student success and engagement. Doing so will enable us to: 1) advance our understanding of the experiences of successful Black engineering graduates and the outcomes of engagement with

identity-related professional organizations; 2) identify mechanisms that support student success via engagement in these organizations; and 3) produce a video series entitled, “The Wisdom Files”, to disseminate stories of engagement and persistence among Black engineering graduate students. Each of these advancements are critical to broadening participation in engineering to ensure a more diverse workforce.

Systematic Mapping Description

The abstracts of 442 articles were analyzed to determine eligibility for inclusion in this study. 25 articles were determined to be duplicates. Next, three hierarchical eligibility criteria were used to determine if an article would remain in this study after this first round of screening. The three hierarchical eligibility criteria were:

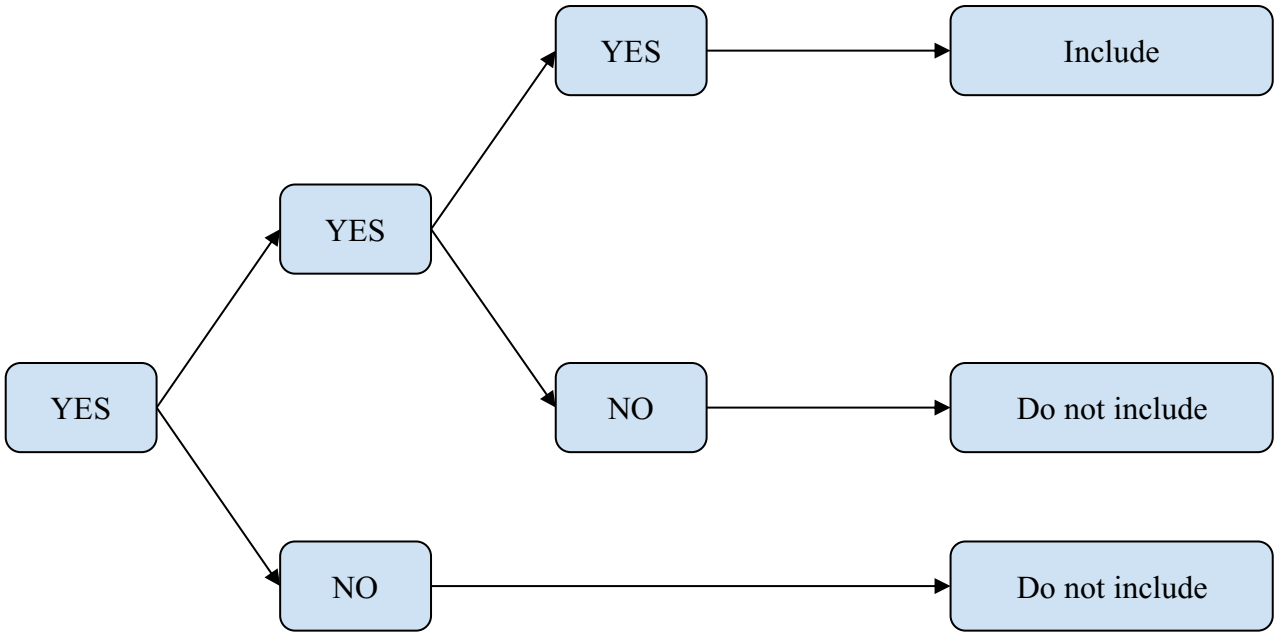
1) Was the article written in English?
2) Was the research setting in a US context?
3) Was the article published within the past 25 years?

Figure 1 outlines whether an article was selected based on the yes or no criteria questions. For an article to continue to be included in the study, it must first have had a “yes” answer to the round one eligibility criteria questions. If the article receives a no answer for any of the three round one eligibility criteria screening questions, it was not included in the SLR. If the article met these three criteria, it was screened to determine if it met a second round of criteria. These criteria were as follows:

1) Is the article about a co-curricular program?
2) Or is the article about student involvement with a Greek organization?
3) Or is the article about student involvement in an identity-based organization?
4) Is the article about minority or Underrepresented Minority (URM) students?
5) Is the article about engineering college students?

For this second round, the article needed to meet at least one of the three questions about program involvement: Greek life, identity-based or co-curricular activity. If the article met one of these criteria, it moved on to the next review. If the article did not meet at least one of these three criteria, it was excluded from the SLR. As an article advanced to the last part of the screening process, it needed to meet the minority or URM criteria and the engineering college student criteria. If it met both criteria, the article was successfully included in the study. In total, 23 out of 442 articles (5%) met all eligibility criteria and were included in the systematic mapping. Only articles that met both sets of inclusion criteria were included in this study.

Figure 1: Flowchart for Inclusion Criteria



1) Was the article written in English?
2) Was the research setting in a US context?
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2) Or is the article about involvement with a Greek organization?
3) Or is the article about involvement in an identity-based organization?
4) Is the article about minority or Underrepresented Minority (URM) students?
5) Is the article about college students in engineering?

Figure 2 contains a flowchart which outlines how articles were retained and removed throughout the screening process. First, 442 articles resulted from the database search as potential articles to be included in this study. A librarian with expertise in engineering education helped the research team to determine the search terms; she also generated the search strings and conducted the actual search for articles in the library databases as shown in Table 1. The flowchart moves on to show articles were removed if they were duplicate articles or if the articles did not meet the three eligibility criteria in round one of the screening, as listed above. The remaining 395 articles were screened in the second round and were required to meet one of the first three criteria in round two and both criteria 4 and 5 in order to be included. At this juncture, articles were determined to either be included or not included in this study.

Table 1: Databases and search string used to locate articles

Database Name	Search String	Note
Education Source (EBSCO host interface)	((AB STEM OR SU STEM OR TI STEM) OR (AB engineer* OR SU engineer* OR TI engineer*) OR (AB "enigneering identity" OR SU "engineering identity" OR TI "engineering identity")) AND	Advanced search Subject, Title or Abstract
	((AB student* OR SU student* OR TI student*) OR (AB undergraduate* OR SU undergraduate* OR TI undergraduate*) OR (AB college OR SU college OR TI college) OR (AB university OR SU university OR TI university) OR (AB education OR SU education OR TI education)) AND	Advanced search Subject, Title or Abstract
	((AB Black OR SU Black OR TI Black) OR (AB "african american" OR SU "african american" OR TI "african american") OR (AB minorit* OR SU minorit* OR TI minorit*) OR (AB underrepresent* OR SU underrepresent* OR TI underrepresent*)) AND	Advanced search Subject or Title
	((AB "greek letter" OR SU "greek letter" OR TI "greek letter") OR (AB fraternit* OR SU fraternit* OR TI fraternit*) OR (AB sororit* OR SU sororit* OR TI sororit*) or (AB (professional W1 (organization or society))) OR (SU (professional W1 (organization or society))) OR (TI (professional W1 (organization or society))) OR (AB association OR SU association OR TI association) OR (AB society OR SU society OR TI society)) AND	Advanced search Subject, Title or Abstract
	((AB "academic achievement" OR SU "academic achievement OR TI "academic achievement") OR (AB belonging OR SU belonging OR TI belonging) OR (AB community OR SU community OR TI community) OR (AB persistence OR SU persistence OR TI persistence) OR (AB graduation OR SU graduation OR TI graduation) OR (AB discrimination OR SU discrimination OR TI discrimination) OR (AB prejudic* OR SU prejudic* OR TI prejudic*) OR (AB success OR SU success OR TI success) OR (AB experience OR SU experience OR TI experience)	Advanced search Subject, Title or Abstract
ProQuest Disserations & Theses Global	((AB STEM OR SU STEM OR TI STEM) OR (AB engineer* OR SU engineer* OR TI engineer*) OR (AB "enigneering identity" OR SU "engineering identity" OR TI "engineering identity")) AND	Advanced search Subject, Title or Abstract
	((AB student* OR SU student* OR TI student*) OR (AB undergraduate* OR SU undergraduate* OR TI undergraduate*) OR (AB college OR SU college OR TI college) OR (AB university OR SU university OR TI university) OR (AB education OR SU education OR TI education)) AND	Advanced search Subject, Title or Abstract
	((AB Black OR SU Black OR TI Black) OR (AB "african american" OR SU "african american" OR TI "african american") OR (AB minorit* OR SU minorit* OR TI minorit*) OR (AB underrepresent* OR SU underrepresent* OR TI underrepresent*))	Advanced search Subject, Title or Abstract

	AND	
	((AB “greek letter” OR SU “greek letter” OR TI “greek letter”) OR (AB fraternit* OR SU fraternit* OR TI fraternit*) OR (AB sororit* OR SU sororit* OR TI sororit*) or (AB (professional PRE/1 (association or society))) OR (SU (professional PRE/1 (association or society))) OR (TI (professional PRE/1 (association or society)))) OR (AB (professional PRE/1 (organization))) OR (SU (professional PRE/1 (organization))) OR (TI (professional PRE/1 (organization)))	Advanced search Subject, Title or Abstract
	AND	
	((AB “academic achievement” OR SU “academic achievement OR TI “academic achievement”) OR (AB belonging OR SU belonging OR TI belonging) OR (AB community OR SU community OR TI community) OR (AB persistence OR SU persistence OR TI persistence) OR (AB graduation OR SU graduation OR TI graduation) OR (AB discrimination OR SU discrimination OR TI discrimination) OR (AB prejudic* OR SU prejudic* OR TI prejudic*) OR (AB success OR SU success OR TI success) OR (AB experience OR SU experience OR TI experience)	Advanced search Subject, Title or Abstract
Compendex (Ei Village interface)	STEM or engineer* or “enigneering identity”	Quick search Subject/Title/Abstract
	AND	
	Student* or undergraduate* or college or university or education	Quick search Subject/Title/Abstract
	AND	
	Black or “african american” or minorit* or underrepresent*	Quick search in controlled term or Title
	AND	
	“greek letter” or fraternit* or sororit* or professional ONEAR organization or profesional ONEAR society or association or society	Quick search Subject/Title/Abstract
	AND	
	“academic achievement” or belonging or community or persistence or graduation or discrimination or prejudic* or success or experience	Quick search Subject/Title/Abstract

Figure 2: Flowchart for Systematic Mapping

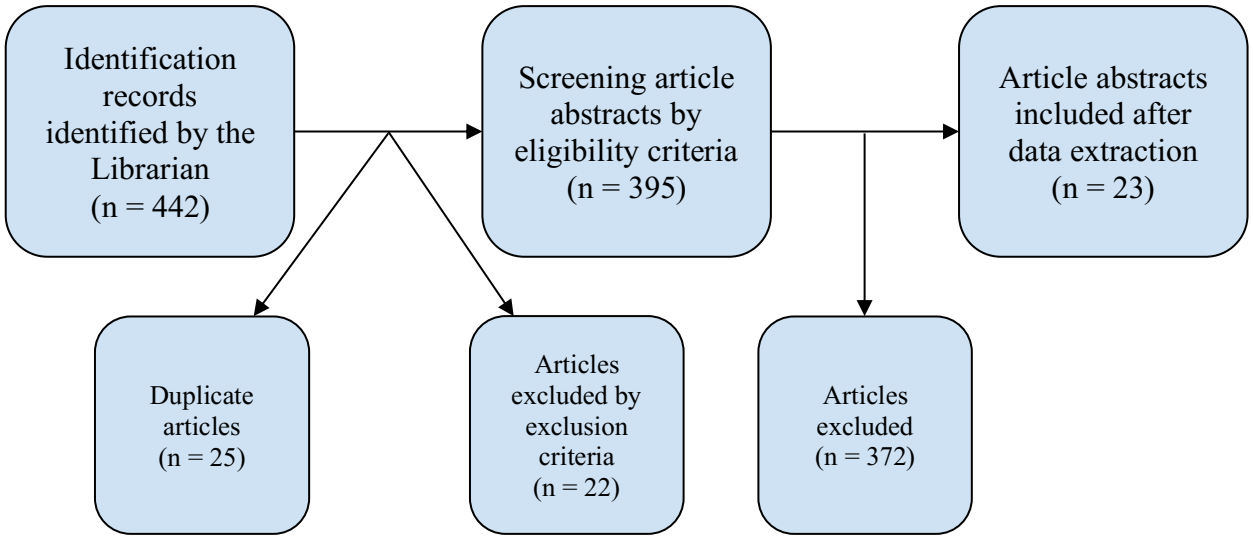

Table 2 summarizes the number of articles which met the required eligibility criteria for the second round of screening. It is also important to note that there are articles categorized into multiple criteria within the table. Each eligibility criteria is grouped with the criteria questions for the second round of coding. Only three articles met the Greek life organization involvement criterion, which corresponds to question two. Twenty-one articles met the identity-based criterion which corresponds to question three. These two criteria combined totaled 24 articles meeting the central criteria for this study. Using the broader criteria of whether the article was about involvement in a co-curricular program, 161 articles met this criterion.

Articles focusing on minorities and URM students totaled 334. This finding includes articles which focused on Black students. There were 89 articles where the Black student experience was central to the article. Both of these criteria corresponded with question four for the second round of screening. It was determined by the screeners that 283 articles pertained to engineering college students and 12 articles were specifically about the experiences of graduate students. There were 110 articles pertaining to pre-college students which were excluded from this study. These three criteria corresponded with question five.

Table 2: Articles by Criteria for Second Round of Screening

CRITERIA QUESTIONS	CRITERIA	TOTAL
1) Is the article about a co-curricular program?	CO-CURRICULAR	161
2) Is the article about student involvement with a Greek organization?	GREEK LIFE ORGANIZATION	3
3) Is the article about student involvement in an identity-based organization?	IDENTITY BASED PROFESSIONAL SOCIETY	21
4) Is the article about minority or Underrepresented Minority (URM) students?	BLACK STUDENTS' EXPERIENCE AS FOCI	89
	MINORITIES AND URM STUDENTS	334
5) Is the article about engineering college students?	ENGINEERING COLLEGE STUDENTS	283
	GRADUATE STUDENTS	12
	PRE-COLLEGE STUDENTS	110

Preliminary Synthesis of Key Findings

From the systematic mapping, 23 articles met the inclusion criteria. In order to conduct a synthesis of key findings, the articles were divided into two categories: evaluative studies and research studies. After dividing the papers, a preliminary synthesis was made for each group of papers.

For the evaluative studies, all but one of the articles focused on specific programs. The one that was not about a specific program was a report that highlighted the problem of African-Americans being underrepresented in STEM and discussed various programs that aimed to fix this problem. The articles that were about a specific program did talk about how students benefited from programs, however, a portion of these articles only reported the activities of the programs and failed to discuss any student outcomes. Student outcomes are important to include in these evaluative studies in order to assess if the programs are meeting the needs of the students. It is important to know how programs associated with broadening participation are helping underrepresented students in order to know if changes are needed. Additionally, these papers often failed to acknowledge any limitations that came with creating and evaluating their programs.

For the research studies, the articles were either identity-related organization focused, with some mentioning multiple organizations. Examples of these organizations include NSBE, BGOs, the Society of Professional Hispanic Engineers (SHPE), minority engineering programs and professional research organizations. From analyzing these studies, it is known how such organizations can help underrepresented students succeed in engineering and more specifically, the aspects of these organizations that help students succeed. Most of the critiques for this group of articles were associated with missing details that are essential to articles. One observation is that most of the studies used small sample sizes, which could be due to a lack of underrepresented students in engineering.

Next Steps

The next step of the systematic literature review is to synthesize the insights from the studies. This will be done using thematic synthesis in order to preserve the key elements of a systematic review while also addressing the effectiveness, appropriateness, and acceptability of each study [6]. The thematic synthesis will consist of three phases: 1) coding each line of text, 2) development of descriptive themes associated with the studies, and 3) generation of analytic themes that interpret the findings [7].

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