



What have we learned from a systematic review of literature on Hispanic transfer students in engineering?

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Abstract

This paper describes preliminary results of a literature search. The purpose of our study is to synthesize all of the relevant prior work regarding Hispanic students matriculating through two-year to four-year institutions and completing engineering bachelor's degrees. The approach we are using to identify and synthesize the articles is systematic review methodology. Systematic review is a set of methodologies to identify relevant primary studies (e.g., journal articles, technical reports, conference papers) from multiple sources and synthesize results from these studies. The inclusion criteria we have defined for the articles we will synthesize are: (1) provides a clear definition of how student success was defined, e.g., transfer, retention, graduation, intent to complete degree; (2) presents empirical evidence of at least one individual or contextual factor that contributes to success of students at two-year institutions or who have transferred from a two-year to a four-year institution in the United States; (3) presents results or comparison of Hispanic students, Hispanic-serving institutions, or STEM students; and (4) published as a report, article, conference paper, or dissertation in English.

This study emphasizes Hispanic transfer students in engineering for several reasons. Firstly, representation of Hispanics in engineering careers is well below their significant and growing proportion of the U.S. population. Secondly, although substantial research has identified cultural and socioeconomic challenges that Hispanic students are facing, there is a dearth of large scale and/or quantitative work focusing on Hispanic students in engineering disciplines. Lastly, few (if any) systematic studies of effective interventions for Hispanic transfer engineering students exist.

The intent of our study is to identify articles that have addressed Hispanic transfer students and synthesize results from the collected set. At present, we are still identifying articles that would support our study. This paper describes early results from the literature search to provide an overview of that has been found.

Introduction

To prepare more than one million additional science, technology, engineering and mathematics (STEM) professionals for the U.S. workforce over the next decade, more emphasis must be placed on improving pathways for all students [1], particularly ethnic and racial minorities who have been historically underserved by higher education [2]. Prior work has shown that various underrepresented racial/ethnic student populations in STEM need to be studied separately and specifically, because these groups differ in higher education access and vertical transfer patterns [3]. We have focused this project on Hispanic STEM transfer students for multiple reasons. Firstly, representation of Hispanics in STEM careers is well below their significant and growing proportion of the U.S. population. Secondly, although substantial research has identified cultural and socioeconomic challenges facing Hispanic students in higher education, much less is known about Hispanic STEM students, and virtually no large scale studies have specifically studied Hispanic STEM transfer students. Thirdly, few systematic studies of effective interventions for Hispanic STEM transfer students exist. Programs such as summer bridge programs, mentoring,

tutoring, learning communities, and other activities are fairly common at the undergraduate level in STEM fields, and many of these programs have historically been funded by NSF STEP and S-STEM programs. Few systematic studies of interventions have been conducted, however. Local assessment data, typically published in conference papers and reports, support the efficacy of these interventions; however, no systematic reviews of the considerable literature have been found. To significantly and positively impact representation of Hispanic scientists and engineers, we need a comprehensive synthesis to (a) develop patterns of successes and failures of Hispanic STEM transfer students and (b) identify factors related to effectiveness of interventions to promote transfer, retention and graduation of Hispanic STEM undergraduates. Given the urgency to improve transfer of Hispanic students to four-year engineering programs, the likelihood of large-scale programs to improve the success of minority students in STEM, and the lack of comprehensive syntheses, the need for such syntheses is imminent and important. Therefore, we propose to develop a comprehensive framework for promoting success of Hispanic STEM transfer students by applying established systematic review methods [4] to existing primary studies in several areas. Results of the synthesis will be extensively shared with multiple stakeholders in the success of Hispanic STEM transfer students. The research question guiding this systematic review is:

What student and contextual characteristics and interventions have prior studies identified as supporting successful transfer and STEM bachelor's degree completion of Hispanic students who matriculate at two-year institutions?

Research Methodology: Systematic Review

Our proposed approach will provide a comprehensive review of existing primary studies through systematic review methodology, specifically a qualitative synthesis of quantitative, qualitative and mixed methods primary studies. Systematic review is a set of methodologies to identify relevant primary studies (e.g., journal articles, technical reports, conference papers) from multiple sources and synthesize results from these studies. We are following established guidelines for conducting a systematic review [4, 5].

Results from a Preliminary Literature Search

An initial literature search of the ERIC database was conducted using the following search string:

(DE "Hispanic American Students" OR DE "Hispanic Americans" OR AB(hispanic* or latin*)) AND ((DE "Two Year College Students" OR DE "Two Year Colleges") OR AB("two year" or community or technical or vocational or junior) near/1 college*))

ERIC was chosen as the first database to search, because it was thought to provide the largest number of articles on education. The search yielded 1207 citations. As work on the project continues, we will use other search strings and expand the search to other databases. Some of the papers will be duplicates of the citations found in the initial search, but many others will be new citations. Given the extensive list of citations that have been found with this initial search it is helpful to summarize what has been found thus far.

Table 1 shows that the most common citations were reports, which include reports on community colleges at the state and district levels as well as reports from individual institutions. Journal articles were the second most common type of citation, followed by entire books and dissertations and a small number of conference papers.

Table 1. Types of Citations found in the ERIC Database Search

Type	Number	Percentage
Report	849	70.34%
Journal Article	228	18.89%
Book	85	7.04%
Dissertation	39	3.23%
Conference	6	0.50%
Total	1207	100.00%

Over 70% of the citations found in the initial literature search were reports. One hundred thirty of the 849 reports were state level reports on the community college system in the state. California, given its large system of community college, provides the largest percentage of state reports. California is followed by Florida, Illinois, and Washington. Together, these four states provided over 75% of the state reports. Although there are exceptions, state reports tend to focus on student enrollment demographics (e.g., gender, race/ethnicity, age, part-time/full-time, credit/non-credit), enrollment projections, and financial issues.

Table 2. Reports by State

State	Number	Percentage
California	43	33.58%
Florida	29	22.31%
Illinois	17	13.08%
Washington	11	8.46%
Connecticut	8	6.15%
North Carolina	3	2.31%
Oklahoma	3	2.31%
Colorado	3	2.31%
Arizona	3	2.31%
New Jersey	2	1.54%
Nevada	2	1.54%
Texas	1	0.77%
Massachusetts	1	0.77%
New York	1	0.77%
Total	130	100.00%

Single institution reports provide another large segment of the reports with 217. Table 3 shows the most frequent institutions. Miami-Dade Community College contributed the most single institution reports.

Table 3. Most Frequent Institutional Reports

Institution	Number
Miami-Dade Community College	71
College of the Canyons	14
City College of San Francisco	11
Piedmont Virginia Community College	9
Westchester Community College	8
Houston Community College	8
Northern Virginia Community College	7
Los Angeles City College	7
Community College of Philadelphia	5
St. Petersburg Junior College	5
Hudson County Community College	5
Cabrillo College	4
Prince George's Community College	4
San Antonio College	4
Austin Community College	4

Analyzing the articles by year published can provide some indication of the importance of the issue. As shown in Figure 1, there was very little published before 1977. After 1977, the number of articles published on Hispanic students at two-year institutions increased until 1991. During the 1990s, the number of articles decreased until a significant spike in 2000-2002. From 1997-2014, larger numbers of articles annually published tend to be at the beginning of decades, perhaps as reports on the past decade are published.

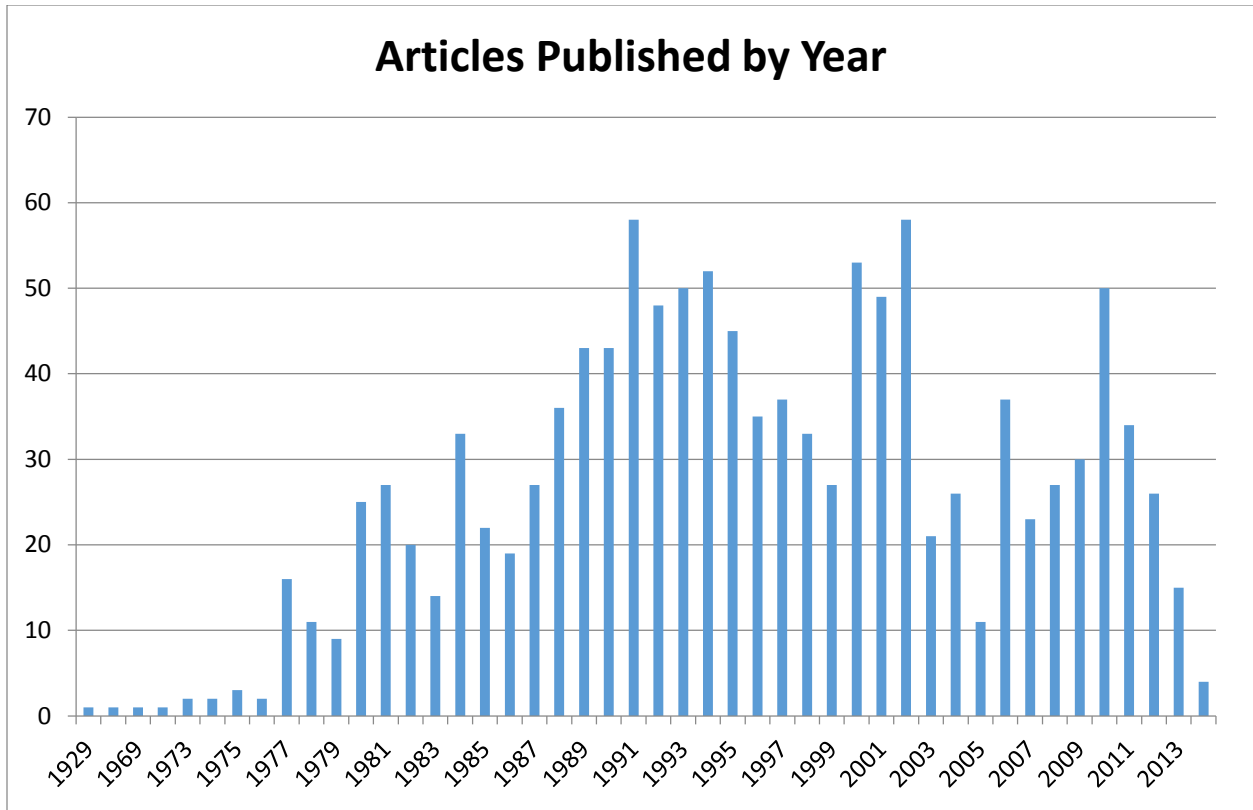


Figure 1. Articles Published Each Year

Discussion

We are at one of the earliest phases of this systematic review. Since we are not yet focusing on engineering-specific publications, this literature is relatively new to us and may be new to other ASEE members. Our search of just one database yielded over 1000 citations. However, many of these, particularly the oldest ones, did not meet our inclusion criteria. The inclusion criteria we have defined are: (1) provides a clear definition of how student success was defined, e.g., transfer, retention, graduation, intent to complete degree; (2) presents empirical evidence of at least one individual or contextual factor that contributes to success of students at two-year institutions or who have transferred from a two-year to a four-year institution in the United States; (3) presents results or comparison of Hispanic students, Hispanic-serving institutions, or STEM students; and (4) published as a report, article, conference paper, or dissertation in English. We found many state and institution-level reports that focused on student characteristics, including graduation or transfer rates. However, most of these did not describe specific interventions or factors in detail, and if they did, there was no empirical evidence to support arguments of efficacy. Nonetheless, we have identified a number of citations that will be examined more closely in later phases of the project which we anticipate will yield important insights about factors that contribute to the success of Hispanic STEM transfer students.

Conclusions

Our paper has presented preliminary results from a search of the ERIC database for articles on factors influencing the success of Hispanic students who start at two-year institutions and transfer to four-year institutions. In addition, our project intends to study interventions that have been implemented to improve the success of students in transferring as well as results from these interventions. Our paper has attempted to characterize the literature base that is available to support the study. Further, as a part of the study, *we are actively seeking nominations* of prior studies and ongoing projects from the community that would be appropriate to include in the synthesis.

While the intent of our particular systematic review is to study Hispanic engineering students who completed their four-year engineering degree after transferring from a two-year institution, the methodology described in this paper [6] can be used for multiple other purposes.

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