BOOK REVIEW


Reviewed by Laura Stiles-Clarke, PhD candidate, St. Francis Xavier University.

Government reports and journal articles dating back decades have warned that society's need for technological expertise is increasing, and that science, technology, engineering, and mathematics (STEM) education must be a priority from early childhood through the doctoral level in order to feed the proverbial “pipeline” into these fields (National Science Foundation, 1994; Tobias, 1990). More recently, concerns have arisen about the pervasive lack of women and minorities in many STEM fields, with engineering having a larger problem in this area than related fields such as medicine and bioscience (Archer et al., 2017; Burke & Mattis, 2007). Much of the literature focuses on undergraduate education as the primary venue in which more young people from more diverse backgrounds can be recruited into STEM fields and encouraged to persist until graduation and eventually into the workforce (National Research Council, 2013; Seymour & Hewitt, 1997).

Jacqueline Fleming and Irving Pressley McPhail (2019) both have long publication records and deep experience regarding what universities and community colleges can do to improve student persistence rates, with a particular focus on Black students and engineering programs. Their 2019 book, Success Factors for Minorities in Engineering, is currently available in hardback or e-book format, and is an excellent resource that includes the results of their own major study of student experiences in engineering across America, along with a thorough overview of the available literature. It should be included as a reference in any current science education library, as it thoroughly investigates all of the known concerns about the experiences of minority students in engineering programs.

The large, three-phase study the authors conducted is highly detailed, seeming to leave no stone unturned. They began with a nationwide request for quantitative data from the 31 colleges that are members of the National Action Council for Minorities in Engineering (NACME), and they were able to use the data from 26 of these colleges about student test scores, performance, and retention to graduation. Collecting information about student test scores allowed the authors to take an important step in
their analysis: comparing students of similar abilities across institutions. As this normalization of their data sometimes made a difference to their results, the authors are scrupulous about stating when this was and was not significant.

During the first phase, and throughout the study, the authors were able to disaggregate a great deal of data by ethnicity. For example, they were careful to delineate exactly what is meant by the term “minority”: those of African-American, Hispanic, and Native American heritage. The particular interest in these students arises from the fact that they are underrepresented in the engineering community. Specifically, the proportion of engineering students, faculty, and professionals from these groups is significantly lower than their proportion in the American public. Students of Asian, Middle Eastern, and East Indian descent were considered part of the “majority” or “non-minority” group because their numbers in engineering are commensurate with their prevalence in the general population. Similarly, Fleming and McPhail (2019) discuss the paucity of women in engineering, regardless of ethnicity, while focusing primarily on the intersection of race and gender in engineering in one of the book’s chapters. The detail included in this study regarding the different experience of each segment of the population is highly valuable for researchers and other interested parties.

The second phase of the study involved focus groups conducted on 11 of the 26 campuses from phase 1, exploring the perspectives of 176 students. The authors acknowledge that the participants do not form a representative sample of minority engineering students, which is unfortunate but unavoidable given that the students were recruited through the Minority Engineering Program (MEP) office on each campus, where only those who participate in the MEPs have access to participate in the study. Conversely, due attention was paid to the difficulty of hearing quieter and dissenting students’ voices in focus groups by requesting that each focus group participant also complete a mini-survey, the results of which were then analyzed in detail. Despite the authors’ devotion to untangling the differences between various types of students, some of the results of the focus group work were inconclusive. However, the focus group and mini-survey results were used to design, administer, and analyze a larger survey in phase 3 of the study.

This larger survey was distributed to all 26 participating campuses and was completed by 632 minority (mainly African American and Hispanic) students and 513 non-minority (White, Asian, and Middle Eastern) students. Unfortunately, the small numbers of mixed-race and Native American students who participated were not sufficient to calculate results for these groups. The results were thoroughly analyzed using analysis of variance (ANOVA), regression, and factor analysis methods, comparing by gender, ethnicity, and the intersection of both. The authors continue to show their fastidiousness by acknowledging that the study produced many results that were not significant, and that a few results seem inexplicable given their current knowledge.

Each chapter of this book presents its own set of conclusions based on the data explored during the corresponding phase of the study. Overall, several similar themes continued to appear. The most important and interesting conclusion in my opinion is that internships, research positions, and problem-based courses are the most beneficial of
all experiences for students in terms of correlation with persistence to graduation. Specifically, these “hands-on” engineering experiences are valuable for all students, but are disproportionately available to non-minority students. Work focused on increasing the availability of such opportunities to minority students seems like an important next step. Other factors that the authors show to contribute to minority student success in engineering are academic adjustment to college life (as separate from social adjustment), and participation in other MEP opportunities, such as networking, group work, and tutoring. This book also reconfirms previous work showing that for Black students, attending a Historically Black College or University (HBCU) is an important pathway to success, regardless of any of the other factors under investigation.

*Success Factors for Minorities in Engineering* is filled with detailed analyses of student opinions and experiences from a large number of individuals on a wide variety of campuses. I applaud the authors for their dedication to understanding the differences in experience between women and men in engineering programs, and between minority and non-minority students. The significant results in this study merit the attention of the STEM education community. Where the authors were not able to make conclusions, the important work of unpacking the similarities and differences of student experiences and what works best for different people must continue. Because education is a complex, human pursuit, a complimentary qualitative approach will benefit the field, especially for those individuals in the smallest of the underrepresented groups.

**REFERENCES**


**BIOGRAPHICAL NOTE:**

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Laura Stiles-Clarke is a Ph.D. candidate working on a dissertation in physics education at St. Francis Xavier University. She teaches physics part-time at Saint Mary’s University and has published in both science education and medical education.

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