Chapter 3
Engineering Study Abroad:
High Impact Strategy for Increasing Access

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ABSTRACT

Successful engineers must be technically savvy, self-confident as well as culturally competent. Cultural competence is the ability to tolerate ambiguity and empathize with the socio-cultural nuances of different people groups. This calls for a diverse engineering workforce especially in today's increasingly global economy. In the United States, Minorities and Females constitute only 4% and 15% of the engineering workforce respectively. Research shows that women and students of color, dropout due to feelings of not belonging coupled with low self-efficacy. To change the profession's diversity portfolio requires a plethora of high impact approaches. Common among successful retention strategies is the provision of structured opportunities for all students to develop self-directing competencies in both the cognitive and affective learning domains. This chapter demonstrates that the study abroad experience engenders, facilitates and fosters these very aptitudes as well as cultural literacy, and advocates for its inclusion in discussions on increasing under-represented participations in engineering.

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INTRODUCTION

Engineering is fundamentally about design, an iterative process at the nexus of art and science, creativity and competing criteria, and ambiguity and application. Successful engineers are of course technically savvy, but must be self-confident as well as culturally competent. In today's increasingly global economy, there is therefore an urgent need for a diverse engineering workforce. These mandates are codified in ABET's Student Outcome 3(h) "*the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context*" and Student Outcome 3(i) "*a recognition of the need for, and an ability to engage in lifelong learning*". Educating engineers, therefore, involves preparing culturally literate individuals as well as providing increased access to members of under-represented, under-served and minority (UUM) groups. According to the American Society for Engineering Education's (ASEE), *Going the Distance* report, 53.6% Hispanics, 61.4% Native Americans, 61.7% African Americans and 49% Female students who enter engineering programs do not graduate in this major (ASEE, 2012). This translates to an engineering workforce that comprise of about 6% Hispanics, 0.3% Native American, 4% African Americans and 15% females according to the latest National Science Foundation's report (NSF, 2015). Many strategies are currently being employed to reduce this disparity. These efforts include first-year seminars, internships, learning communities, and capstone projects (ASEE, 2012; Freeman, Sharon, & Duvon, 2008).

Study abroad, however, has not been seriously considered as a high impact retention activity. The research shows that UUMs struggle in mathematics and science intensive programs such as engineering, not simply because of academic under-preparation *per se*, but more importantly, due to feelings of not belonging and lack of confidence in their ability to learn coupled with low self-efficacy and self-direction (Felder & Brent, 2005; Gray & Lundy, 2016; Matthews, 2012). In fact, the common theme among successful high impact retention strategies is that they provide access to structured opportunities for all students, including UUMs, to develop self-directing competencies in both the cognitive and affective learning domains (Brainard & Carlin, 1998; Chubin, May, & Babco, 2005). Therefore, facilitating skill sets that are *sine qua non* both to successfully learn and complete engineering degree programs. Studying abroad inherently impact students' personal and academic development (Yang, Webster, & Prosser, 2011). Study abroad exercises students' cognitive analysis ability (students are able to deal with ambiguity in new, ill-defined situations by formulating models and seeing relationships), affective organizational skills (students are able to balance their responsibilities and formulate a cohesive and systematic approach to learning) as well as self-efficacy, which is a proximal predictor of proficiency in both these domains (Milstein, 2005).