Mathematics, Engineering, Science Achievement (MESA) outreach programs are partnerships between K-12 schools and higher education in nine states. MESA efforts introduce integrated experiences in science, mathematics and engineering to K-12 students from groups that are traditionally underrepresented in the STEM disciplines. This exploratory study examined the influence of selected MESA activities on students’ self-efficacy, their perceptions of engineering, and their interest in engineering and other STEM fields. Field trips, guest lecturers, design competitions, hands-on activities and student career and academic advisement were of specific interest in this survey. The project also investigated the relationship between student engagement in MESA and academic performance. The results are applicable to a number of organizations with similar aims and provide information for increasing the number of engineers from underrepresented populations. This project provides insights on activities used in informal settings that can be employed in classroom practice and instructional materials to further engage students, especially students from underrepresented groups, in the study of STEM.

MESA sites in California, Maryland, Utah and Washington participated in the survey. In some cases, one of the investigators met with a group of MESA advisers during a regional planning meeting to describe the purpose of the study and potential outcomes. In other instances, a member of the local or regional MESA leadership team was briefed about the MESA study by one of the investigators and then this leader described the study to a group of MESA advisers (or MESA teachers) during a planning meeting and suggested that they contact one of the investigators if they were interested in participating in the study. Utah school districts had an additional IRB process that had to be approved by the district assessment coordinator before MESA schools could participate. MD, WA and CA did not require any additional IRB approvals.

A total of 184 respondents indicated that they were Hispanic or Latino/Latina (42.6%), 58 indicated that they were White (17.1%), 26 reported being Black or African-American (8.1%), 117 indicated that they were Asian (27.6%), 7 reported that they were American Indian or Alaska Native (1.6%), and 13 indicated that they were Native Hawaiian or Pacific Islander (3.0%). The frequency distributions of ethnicities, genders, and grade levels are reported in Table 2.

The large proportion of the respondents from underrepresented groups is noteworthy, though not surprising in view of MESA’s mission and goals. The distribution of ethnicities among the sample may be a function of the effectiveness of the MESA groups in attracting and serving a diverse clientele. Data recently released by the National Academy of Engineering (2014) on baccalaureate engineering graduates in the U.S. report that 8.1% were Hispanic Americans, 5.0% were African American, and 0.5% reported that they were Native American.
The Cronbach Alpha reliability estimates for each of the subscales were considered to be satisfactory: self-efficacy = 0.93; perceptions = 0.85; interest = 0.90; and outcomes = 0.96. The overall Cronbach Alpha for the survey instrument was 0.96. These well-developed subscales may be of value to other researchers.

The MESA respondents in this study appear to follow the general pattern of positive outcomes attributable to participation in structured extracurricular activities reported by Eccles, Barber, Stone, and Huna (2003) and by Feldman and Matjasko (2005). The MESA experiences of the respondents were perceived as making contributions to their sense of self-efficacy in engineering, their perceptions of engineering, and their interests in engineering.

The majority of the MESA respondents set high expectations for themselves in their plans for higher education and the career goals they reported setting for themselves. The MESA respondents expressed strong interest in college educations in science and engineering, and they appeared to be well-prepared for those opportunities.

Participation in MESA activities and MESA competitions competitive events has positive outcome in many dimensions explored in this study. Active involvement in these competitions and organized activities appears to contribute to the development of self-efficacy in engineering, to more accurate perceptions of engineering as a profession, as well as enhancing interest in engineering as a field of study and as a career.
