# Beyond intelligence: The role of noncognitive factors in student success and student thriving

**Dr. John Chen, California Polytechnic State University, San Luis Obispo**
**Jocelyn Paula Gee**
**Dr. Brian P. Self, California Polytechnic State University, San Luis Obispo**
**Nicholas Seah**
**Melissa Nicole Melton, California Polytechnic State University, San Luis Obispo**

It is well established that noncognitive factors – psychological traits, behaviors, affects and beliefs – have a significant impact on academic performance of students from elementary grades to college undergraduates. Examples of noncognitive factors include, for example, mindset, self-control, belongingness, anxiety, and study behaviors, to name a few. Previous research typically isolates a single noncognitive trait, or at most a small number of them, and study its impact on student performance. Here we present findings from the SUCCESS (Studying Underlying Characteristics of Computing and Engineering Students Success) project, in which we study a large collection of noncognitive factors and how they work in concert to support student success and thriving.

Beginning in 2016, we created the SUCCESS survey to measure a wide range of noncognitive factors that have established research evidence for their association with student success. Through exploratory and confirmatory analyses, we reduced the initial collection of factors down to 28 factors measured through a 35-min. survey instrument with evidence of reliability and validity. The constructs encompassing the 28 factors include: The Big5 personality traits, grit, engineering identity, mindset, mindfulness, meaning and purpose, belongingness, gratitude, future time perspectives of motivation, test anxiety, time and study environment, perceptions of faculty caring, self-control and student life stresses. The confirmatory factor analysis also established that these measures can account for 26% of the variance in student grades as measured by the grade point average (GPA), while standardized test scores (i.e., SAT or ACT) can explain only 10% of the variance.

Our first challenge was deciding how to use this collection of factors to characterize each student, and we took the approach of cluster analysis. Clustering revealed the emergence of four student groups, each characterized by a distinct and defining set of noncognitive factors. Our analysis found that cluster membership is strongly associated with academic performance as measured by GPA and this association persists over time.

Since most noncognitive factors are known to be malleable, we next explored how these noncognitive factors develop as students progress through their college experience, which involves both curricular and extracurricular activities, as well as other personal experiences. Among the 388 survey respondents from 2018, when they were all first-year mechanical engineering undergraduates, 48 took the survey for three consecutive years, allowing us a view of how noncognitive factors evolve. Five of the 28 factors changed significantly over time. These were: stress due to changes, reactions to stress, belongingness, engineering identity (interest), and motivation by expectancy. All five factors changed in the direction that prior research found to be negatively associated with academic success and, interestingly, all changed between the first and second years of college. We emphasize that all students in this sample are "succeeding" academically. This collection of findings points to the need for timely, directed initiatives to support students' needs beyond curricular content, and also speaks to the role that the university should take to help students go beyond success and toward thriving.