Mindsets and the Learning Environment:
A Big Biodata Approach to Mindsets, Learning Environments, and College Success
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RESEARCH SNAPSHOT | SUMMER 2018

While earning a college degree is becoming a requirement for more and more jobs, only about 40 percent of first-time, full-time U.S. college students graduate with a bachelor's degree on time.[1] Traditional research on college completion has highlighted many factors, chief among them socioeconomic status and high school academic preparation, as key predictors of college success, but less is known about how psychological factors relate to college graduation rates.

How might exploring mindsets and other psychological factors help us to understand what contributes to students' likelihood of graduating from college and how are these relationships influenced by environmental contexts?

STUDY DESIGN

This project, led by Sidney D'Mello, used data from the combined Common Application / National Student Clearinghouse dataset (Common App-NSC), a 6-year longitudinal dataset containing college applications from a national sample of nearly 280,000 U.S. students who enrolled in college in 2009. This dataset includes information on dozens of factors, including students' environments, experiences, and achievements, including family information (e.g., parents' educational level), academic information (e.g., grades and standardized tests scores), and extracurricular activities and work experiences (e.g., number of activities in Grade 12). The team used a machine learning approach that leveraged these data to predict college graduation.

NOVEL MEASUREMENT APPROACHES

Oftentimes, students' mindsets are measured using survey scales or performance tasks. Although these approaches to mindset measurement are useful, they have limitations.[2] In order to investigate whether underlying psychological factors are reflected in reported participation in extracurricular activities and work experience, the research team examined a convenience sample of 1,700 high school seniors who completed both the Common App-NSC and self-report survey measures of extracurricular participation, grit, growth mindset, and self-control.

KEY FINDINGS

- On average, students who sustained participation (for two or more years) in multiple extracurricular activities reported higher levels of grit, self-control, and growth mindset relative to their peers

- Associations between sustained participation in extracurricular activities and college graduation are complex. For most students, moderate levels of sustained participation (3-4 activities), rather than low or high levels, may be most strongly linked to on-time college graduation

- A machine learning model accurately predicted college graduation rates for 73% of students using only data from students' applications in high school

RESEARCH TEAM

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Areas of Expertise: Computer Science, Data Science, Psychology, Human Development, Education

SAMPLE

This study used the Common Application-National Student Clearinghouse (NSC) dataset, a 6-year longitudinal dataset containing college applications and graduation outcomes for 278,201 students who completed a college application during the 2008-2009 academic year. The researchers computed biographical data (biodata) based features from the following sections of college applications: Personal Information, Family, Academics, Standardized Tests, Extracurricular Activities, Work Experience, and Honors.

In a separate sample of 1,700 high school seniors from five high schools in and around two large Northeastern U.S. cities, students completed self-report survey measures of extracurricular participation, grit, growth mindset, and self-control.

MINDSET
SCHOLARS
NETWORK

The Mindset Scholars Network is a group of leading social scientists dedicated to improving student outcomes and expanding educational opportunity by advancing our scientific understanding of students' mindsets about learning and school.

The research team used a machine learning method with the larger Common App-NSC data set to explore whether they could predict students' likelihood of graduating from college from data derived from their application; in particular, they were interested in understanding whether information on high school extracurriculars and work experience, which might reflect psychological factors, is useful for predicting college graduation beyond sociodemographics and academics. This was done by using half the sample (~150,000 college applications from 2009) to build a machine-learned model that predicted whether a student graduated from college in four years. The model was then used to generate 4-year graduation predictions for the second half of the college applicants. If the model is accurate and generalizable, its predictions about which of this second group of students were successful in college should match those students' actual graduation rates.

Key Findings

Sustained participation in extracurricular activities was correlated with grit, self-control, and growth mindset

In their test with the sample of 1,700 students, the researchers examined students who participated in between zero and three activities. They found that the number of extracurricular activities in which students reported sustained participation (i.e., two or more years) was positively correlated with grit. Sustained participation in these activities was correlated to a lesser but still significant extent with self-control and growth mindset.

The association between participation in extracurricular activities in high school and college graduation is complex

For most students in the larger Common App-NSC data set, participating in a greater number of activities, up to approximately four activities, was linked to higher odds of 4-year college graduation than was participation in fewer activities. Among some students, participating in more than four activities decreased the odds of on-time graduation. This negative effect was found among students who participated in their activities for multiple years.

The association between participation in extracurricular activities and 6-year college graduation was more straightforward. Participating in a greater number of activities predicted higher odds of graduation within six years. This positive effect was more pronounced among students who reported sustained participation in extracurricular activities.

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As expected, sociodemographic characteristics and academic achievement were highly predictive factors. Importantly, the researchers found that extracurricular activities and work experiences significantly added to the model's accuracy. This suggests that predicting college success requires not just consideration of traditional factors, such as socioeconomic status and academic achievement, but also of behaviors that reflect students' learning mindsets.

Insights & Future Directions

The door has been opened for innovating on the use of rich college application data. The research team is already working on different ways to use the college application data. One area is to explore causal links between the various cognitive and noncognitive factors that predict college success. Additionally, the team is using natural language processing to automatically code the qualitative data in students' 150-word responses describing a significant extracurricular activity or work experience. The idea is that these open-ended responses will provide a deeper understanding of students' learning mindsets and motivation so as to more precisely understand the psychological mechanisms that contribute to college success.

The researchers have also begun to investigate how factors about individuals (student race/ethnicity, student English language learner status, parents' education, and parents' marital status) and school environments (Title I eligibility and racial/ethnic composition) may lead to differences in relationships between extracurricular activities and college graduation rates among sociodemographic groups and different school contexts.

The final step for the research team is to use these data to derive actionable insights geared towards helping every student succeed in college. For example, the team's work on the link between extracurricular engagement and college success has uncovered complex interactions between the number of activities and years per activity. These findings will be used to inform recommendations for appropriate levels of extracurricular engagement that are related to college success. Ideally, continued study will allow the researchers to use the methodological and theoretical advances to mindset science to provide recommendations on how mindsets relate to college success and steps that schools can take to support students as they continue to and through college.

References

1. NCES 2016. Digest of education statistics 2016. *Digest of Education Statistics*. U.S. Department of Education, National Center for Education Statistics.

2. Duckworth, A. L. & Yeager D. S. (2015). Measurement matters: Assessing personal qualities other than cognitive ability for educational purposes. *Educational Researcher, 44 (4)*, 237-251.

About the Mindsets & the Learning Environment Initiative