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**How High-Achieving First-Generation STEM Students Persevere and Succeed in College:
A Mixed Methods Study**

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Abstract

Hispanic and Black students are disproportionately represented among first-generation students and significantly underrepresented in STEM degree programs and careers. This mixed methods convergent study examined high-achieving first-generation minority STEM students to identify the non-cognitive constructs, resources, and strategies that may help inform STEM student support programs targeting students from at-risk populations. The quantitative segment of this study examined whether grit, growth mindset, and self-regulation had a significant effect on GPA and time to degree completion. The qualitative component explored the experiences and resources that helped high-achieving first-generation STEM students persevere through challenges to complete their college degrees. The findings of this study indicated that grit and growth mindset had a significant effect on GPA but not time to degree completion. Self-regulation did not have a significant effect on either dependent variable. This study also revealed the various campus resources, relationships, and strategies that helped high-achieving first-generation STEM students persevere through challenges and complete their college degrees.

Aim

The purpose of this research is to examine the impact of grit, growth mindset, and self-regulation in high-achieving first-generation minority STEM students and to understand the experiences and resources that helped these students overcome challenges to degree completion.

Problem

Hispanic and Black students are disproportionately represented among first-generation students and significantly underrepresented in STEM degree programs and careers. First-generation student support programs abound, yet degree completion rates continue to be significantly lower for first-generation college students than their non-first-generation counterparts, especially for those pursuing STEM degrees. According to the most recent national data, only 24% of first-generation students obtain a four-year college degree after six years (NCES, 2018). Educational attainment for first-generation students pursuing STEM majors is even more dismal, with only 16% of first-generation students in STEM graduating in six years (NCES, 2018). This graduation rate is of increasing concern given that government agencies and policymakers continue to prioritize STEM education, emphasizing its role in job growth, global expansion, and sustainability. However, despite the STEM push, there continues to be an inadequate number of STEM graduates available and able to fill vacant STEM-related positions (Verdin & Godwin, 2015; U.S. Department of Labor, 2018).

Research Findings

Quantitative analysis revealed that grit and growth mindset had a significant positive effect on GPA but not time to degree completion. Conversely, self-regulation did not

significantly affect GPA or time to degree completion. Similarly, grit and mindset predicted the participant's GPAs but did not predict time to degree completion, whereas self-regulation did not predict GPA or time to degree completion for the first-generation STEM student participants. However, the interaction of all three constructs significantly predicted GPA and time to degree completion.

Qualitative interviews provided the context of how these non-cognitive traits manifested for high-achieving first-generation STEM students. Four themes emerged from their stories: (a) personal challenges while in college exacerbated academic challenges, (b) campus resources and supportive relationships with peers and mentors from similar backgrounds and experiences encouraged academic success, (c) a sense of purpose and personal interest in their respective STEM fields motivated students to persevere through academic challenges (aligned with grit), (d) when overcoming academic challenges effort matters more than intelligence (aligned with having a growth mindset).

Conclusion/Discussion

The findings and conclusions of this study support that high-achieving first-generation STEM students are gritty, have growth mindsets, and positively self-regulate to meet their personal and academic goals. Additionally, these students are active participants in their educational experience seeking assistance from supportive relationships and campus or external resources when necessary.

Five results emerged during the meta-analysis of the quantitative and qualitative findings: (a) high-achieving first-generation STEM students are gritty, (b) high-achieving first-generation STEM students exhibit growth mindsets, (c) self-regulation did not increase GPA but was critical in perseverance strategies, (d) none of the non-cognitive constructs helped first-generation STEM students graduate faster, and (e) access to campus resources and STEM support programs, research and internship opportunities, and peer and faculty mentors are significant to high-achieving first-generation STEM student success.

Research Implications

The findings and conclusions of this study indicate that the area of time to degree completion for first-generation STEM students warrants future research. The overall goal of higher education is not only academic performance but timely graduation. However, this study found that none of the non-cognitive constructs examined significantly affected how long it took first-generation STEM students to graduate. In addition, the sample size for the time to degree completion segment of this study was small. Therefore, future research may consider replicating this study with an increased sample size. Additionally, future research may want to consider the interaction effects of several non-cognitive constructs relative to degree completion since the interaction of grit, growth mindset, and self-regulation predicted degree completion where the individual constructs did not.

This study revealed that grit and growth mindset, while significant, only explained a small to moderate effect on academic performance. This finding suggests that other variables have a more substantial impact on academic achievement for first-generation STEM students than grit and growth mindset. Therefore, future research should continue to explore other variables that may positively impact academic success for this population.

Grit and growth mindset played a significant role in how first-generation STEM students persevered through challenges and approached setbacks while in college. There is a considerable amount of research about the role these non-cognitive constructs play in academic performance. However, a limited amount of extant research explores the roles that grit and growth mindset play in helping students from this population overcome challenges and persist in their college degree programs. The findings of this study suggest that future research exploring these non-cognitive constructs relative to how first-generation students approach setbacks is warranted.

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Author Biography

Dr. Sasha Ortiz has worked in higher education in various capacities for over 10 years, serving primarily at-risk and underserved minority student populations. Currently, she serves as the Campuses Director for the Pathways to Student STEM Success Program (PTS³) at CUNY Lehman College. Sasha has presented at several national conferences, including the most recent 34th Annual Conference for the Hispanic Association of Colleges and Universities (HACU). Her research interests entail exploring how positive psychological theories and concepts can influence retention and persistence strategies for first-generation minority STEM students. Sasha received her EdD in Educational Leadership and Management with a concentration in Learning Technologies from Drexel University. She earned her Bachelor of Arts in Psychology with a minor in Religious Studies from Swarthmore College and her Master of Science in Higher Education with a Global and International Education concentration, also from Drexel.