Executive Summary

ROOTS of STEM:

Research on North Carolina Women and Underrepresented Minorities in Science, Technology, Engineering, and Mathematics Across the UNC System

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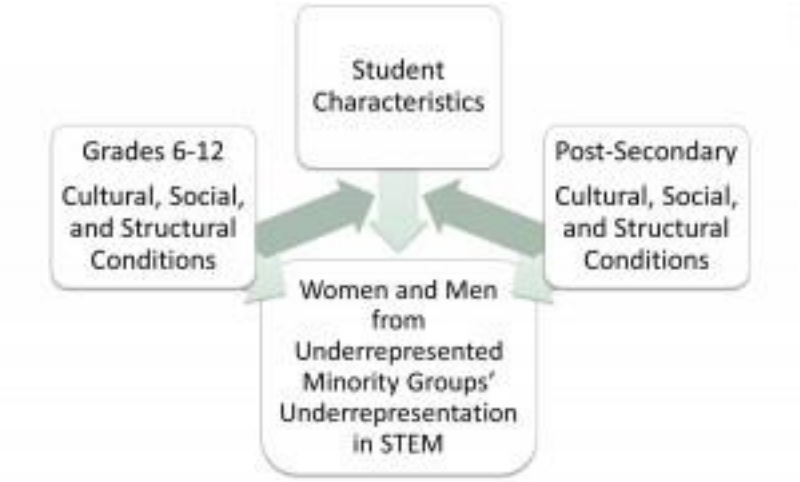
Copies of research papers summarized in this document are available by request from the authors. Address all inquiries to RoslynMickelson@uncc.edu

The ROOTS of STEM Project is a multi-method study that investigates the individual, family, and institutional factors that influence women's and underrepresented minorities' decisions to pursue college science, technology, engineering, or mathematics majors at any of the 16 campuses in the University of North Carolina system. This project is particularly focused on identifying the roots of the underrepresentation of women and disadvantaged minority groups in STEM majors. The model below captures the interactive dynamics that our project investigates.



The study includes quantitative and qualitative data designed to test this conceptual framework where underrepresentation of women and men in STEM fields is accounted for by student characteristics interacting with their experiences in secondary and post-secondary schools.

We conducted this research in two phases. The first phase started in 2010. We created a large longitudinal dataset (named the NC Roots of STEM 8-16) in cooperation with the UNC General Administration, NC Department of Public Instruction, the College Board, and Duke University's North Carolina Educational Research Data Center. This dataset follows members of North Carolina's entire 2004 public high school graduating class who enrolled at any campus in the UNC system in the fall of 2004. We have data for each person from middle school to high school and into their public university years. In 2013 we began the second phase. We interviewed 317 seniors across the 16 campuses of the UNC-system in order to better understand students' experiences with math and science in middle and high school and in college.

Our study has generated important insights regarding the pathways that students take toward majoring in STEM fields before and after they matriculate directly to UNC campuses. In this Executive Summary we highlight only a few key findings. They are categorized into three sections: The role of high school faculty in student persistence toward STEM degrees, high school experiences and their effect on STEM outcomes, and issues related to underrepresented populations in STEM fields. Below is a brief overview of these findings. Each finding is followed by policy implications.

The role of high school faculty in student persistence of STEM degrees

- The proportion of female math and science teachers at a particular high school has a powerful effect on female students' likelihood of declaring and graduating with a STEM degree and effects are largest for female students with the highest math skills. But the proportion of female math and science teachers has no impact on male students' STEM outcomes. Policy implications include:
  - Hiring greater numbers of women for math and science faculty positions in secondary school.
- Because the enjoyment of math and science is an important condition for Latino/a students' pursuit of STEM majors, teachers play a very influential in the process. Latino/a students are

more likely to major in STEM during college if they were educated in high schools where they studied with teachers who worked in collaborative professional communities, and in schools where teachers had a high level of satisfaction with their jobs. Policy implications include:

- Implementing culturally responsive teacher professional development programs that better equip teachers to support and inspire Latino/a students.
- Cultivating opportunities for teachers to participate in collaborative professional communities in their workplaces.
- Ensuring that highly qualified math and science teachers are assigned to classes that they enjoy teaching because their enjoyment can be contagious, particularly for Latino/a students.

High school experiences and their effects on College STEM Outcomes

- Exposure to racial segregation in high school at both the school and classroom level affects students' college freshman grade point averages, and has an especially negative relationship with the achievement of disadvantaged minority students. Policy implications include:
  - Recognizing that as long as racial segregation persists in public schools, we are likely to continue to see race gaps in college performance irrespective of the myriad programs and policies implemented to close these gaps.
  - Encouraging local pupil assignment plans that create diverse schools and discouraging practices that foster greater segregation by race and socioeconomic status.
- Taking physics, attending a school that offers a math and science focused program and stating an intention to major in STEM during high school are positively associated with students' choice of STEM as a college major. Taking physics is especially important for young women's likelihood of declaring a STEM major. Policy implications include:
  - Increasing opportunities to take physics during high school.
  - Increasing the number of math and science-focused programs at schools and the number of STEM-related co- and extracurricular experiences available to youth.
  - Cultivating high school cultures and academic climates that encourage young women to participate in these programs.

Underrepresented Minority Groups and Women in STEM Fields

- Gender differences in college academic performance in STEM compared to non-STEM subjects do not contribute to the gender gap in STEM major declaration. Policy implications include:
  - Looking beyond the easily measurable academic experiences that students have in their first year of college to explore where the roots of the inequality in choice of college major lie.
- Findings suggest ABC's and NCLB's focus on accountability through standardized testing as currently practiced undermines the learning and teaching process. For students from lower performing high schools, in particular, test preparation often narrows curricula and distorts teaching practices, leaving these students less prepared for college STEM success. Policy implications include:
  - Reexamining high stakes testing as a strategy for school improvement because of its negative effects on teaching and learning, especially for students in low performing high schools.