

What research shows about effective science instruction and connections to practice

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National Science Foundation
WHERE DISCOVERIES BEGIN

The Challenge

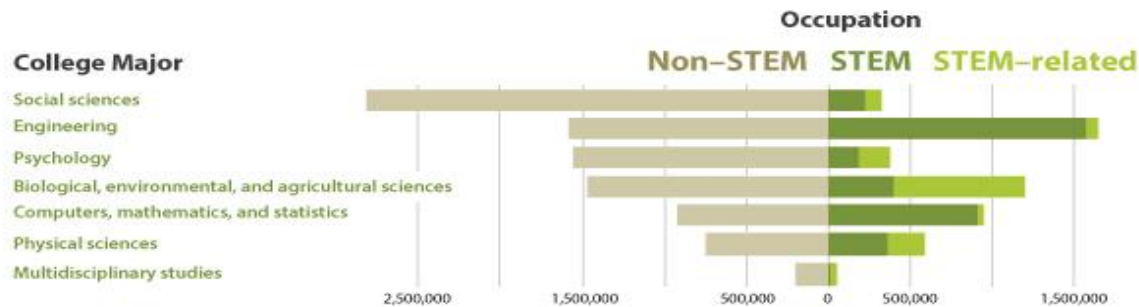
STEM



Science, Technology, Engineering, and Mathematics (STEM)

Degree vs. Employment:

Some science and engineering graduates go into STEM fields, many don't



Source: U.S. Census Bureau, 2011 American Community Survey

United States
Census
Bureau

U.S. Department of Commerce
Economics and Statistics Administration
U.S. CENSUS BUREAU

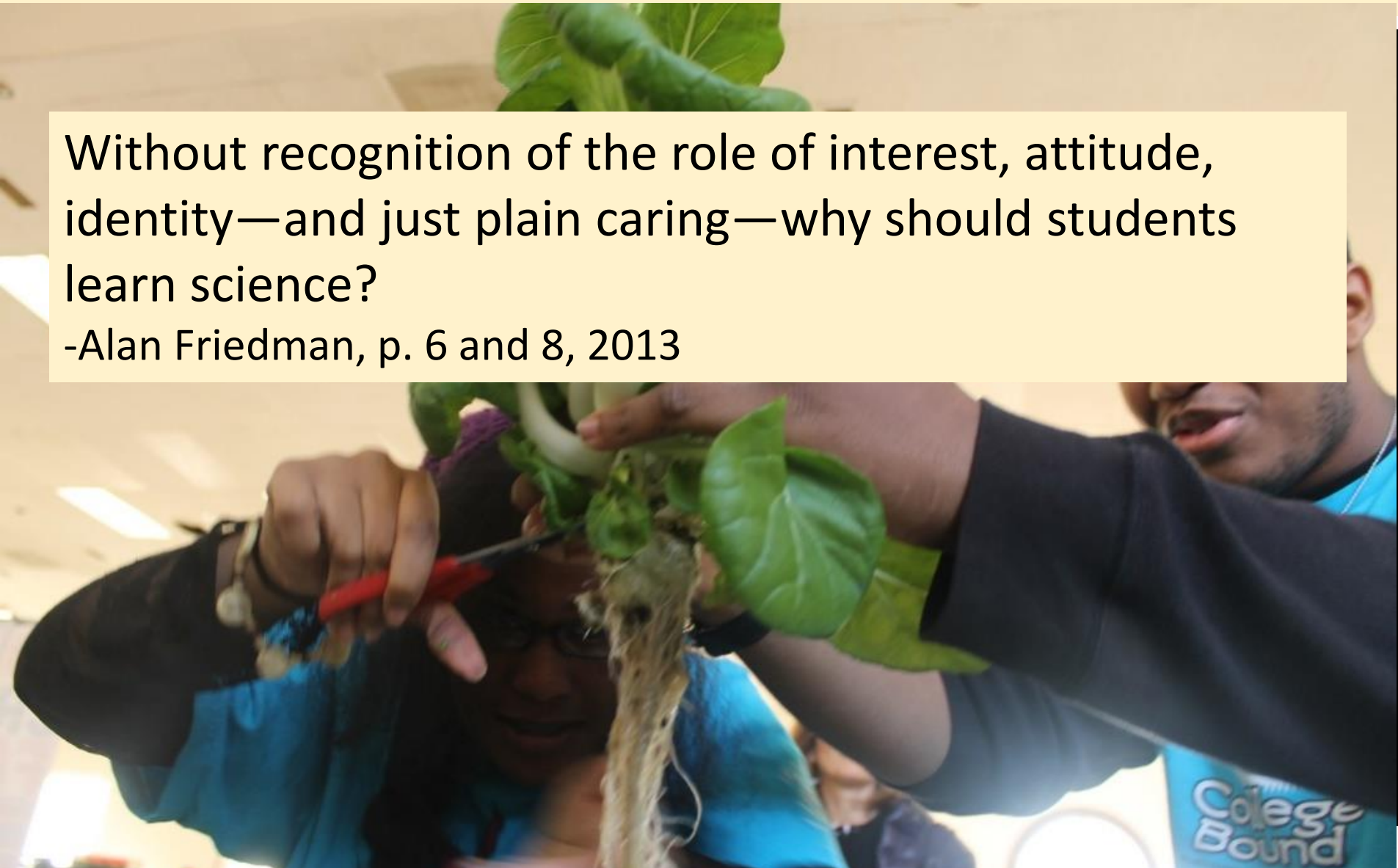
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Obtain a
degree
within
50% time

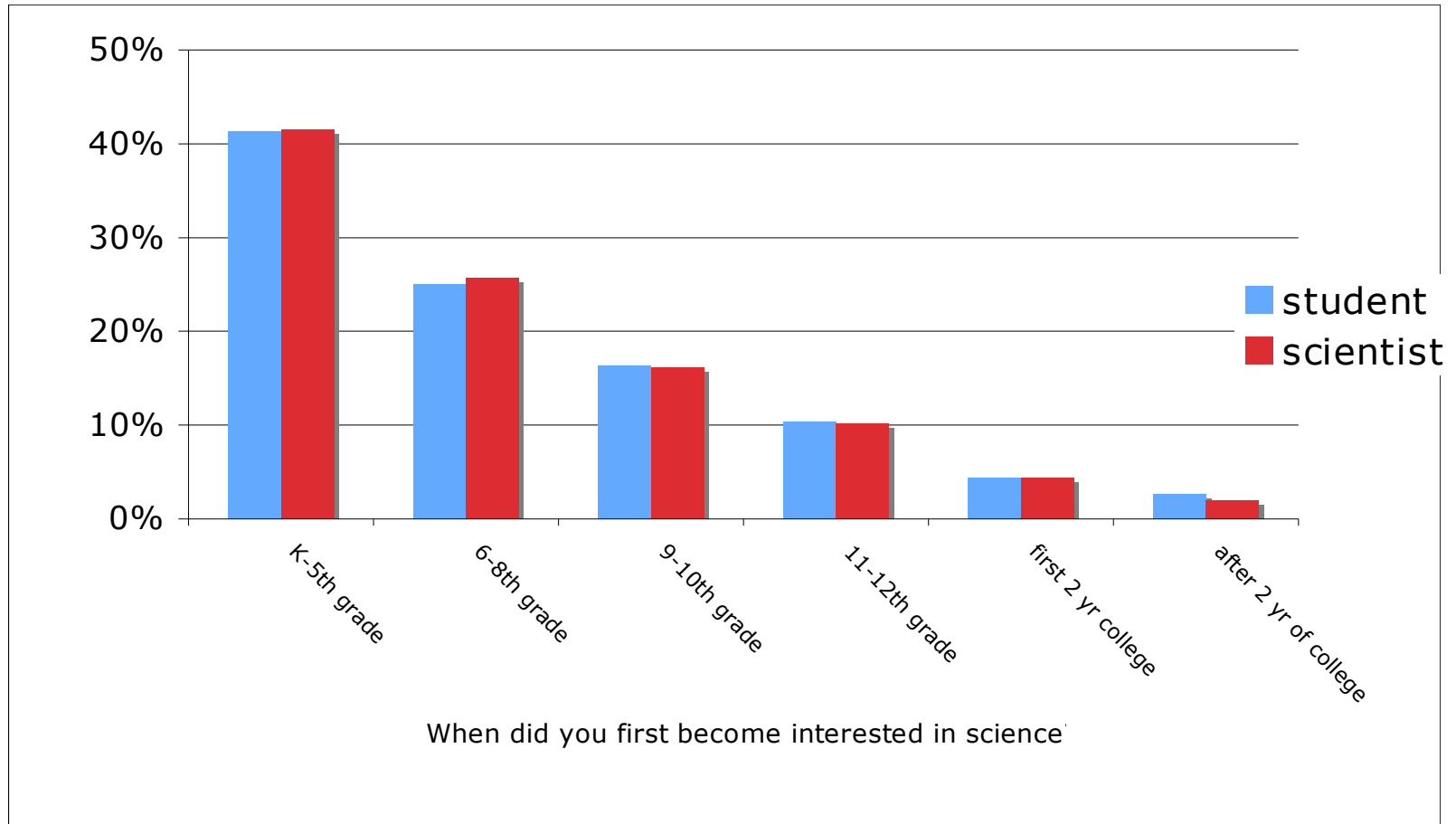
So what gets youth (people) excited about science?

Without recognition of the role of interest, attitude, identity—and just plain caring—why should students learn science?

-Alan Friedman, p. 6 and 8, 2013

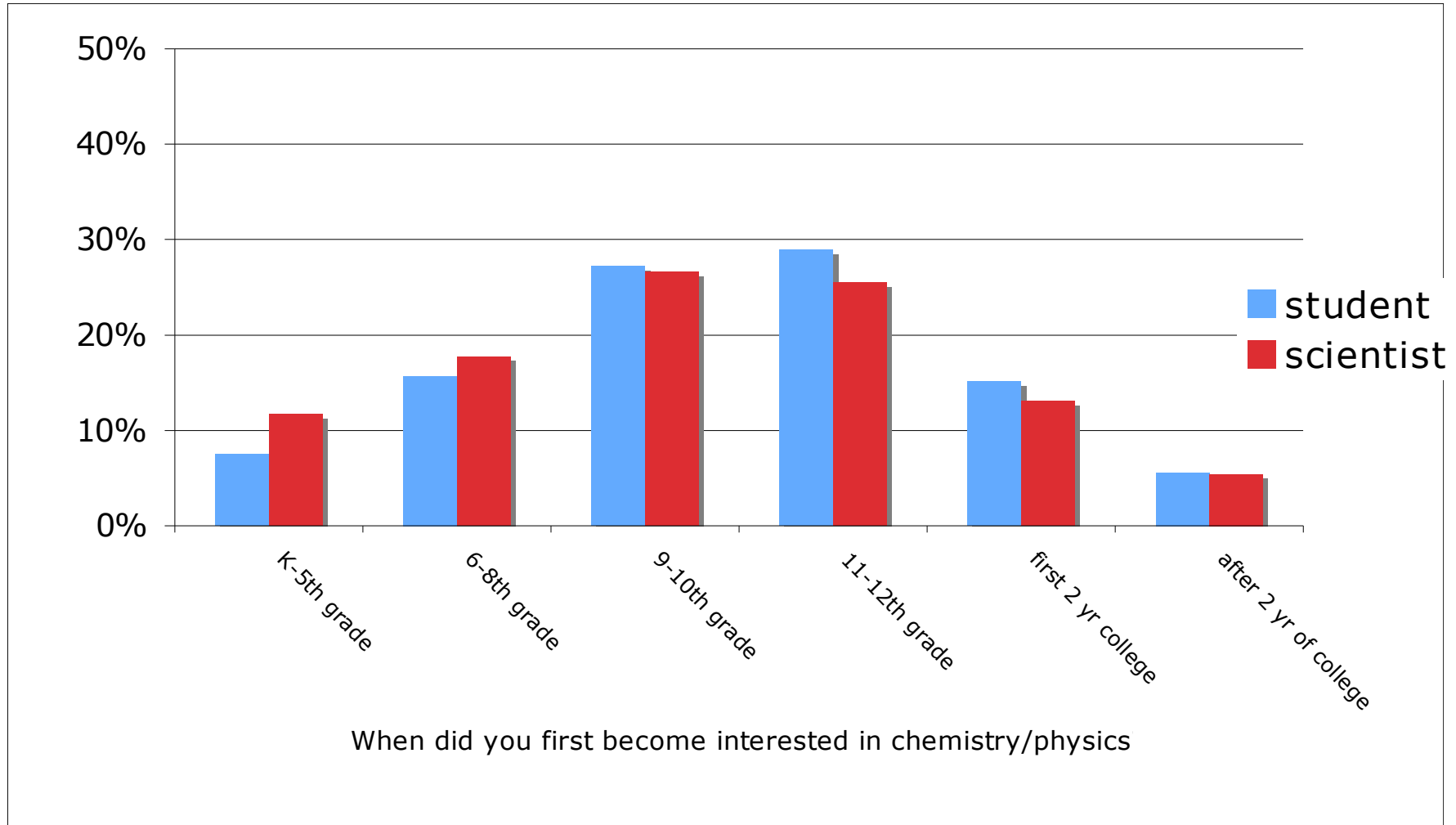


When do scientists and graduate students say they first became interested “science”?



National Educational Longitudinal Data

When do scientists and graduate students say they first became interested “Chemistry/Physics”?



What constructs matter for STEM

- **Non-cognitive factors** are as important, if not more, than academic indicators – resilience, persistence, and motivation (Farrington, et al., 2013)
- **STEM self-efficacious** individuals persist longer to complete a task, particularly in the face of obstacles and adversity (Pajares, 2005; Zimmerman, 2000)
 - Higher self-efficacy individuals find “hard” tasks as challenges rather than threats or barriers
- Science **interest** is a predictor for studying STEM and when coupled with **math efficacy** significant predictor (Tai, 2006, 2012)
 - Early Interest in Science is very important, but continuing to promote interest in high school is also very important
- Career **awareness** and **belief** (hope) that one can obtain a STEM career predictor (Carter et al., 2010).
- **Opportunity** for Engaging, Relevant Content that is connected to their lives and community (NAP, 2012)

What we try to do: Build STEM around issues that matter to students

- An important tenet of social justice education is that students become “empowered” when provided with opportunities to engage *in learning that aims to rectify social injustices* (Chubbuck & Zembylas, 2008; Nieto & Bode, 2008)
 - Low income communities breathe different quality of air and have different levels of access to healthy food
- Coupling scientific investigations with social action projects may provide spaces for students to *experience academic empowerment alongside political empowerment* (Dimick, 2012).



What we do...

- SHOW VIDEO HERE

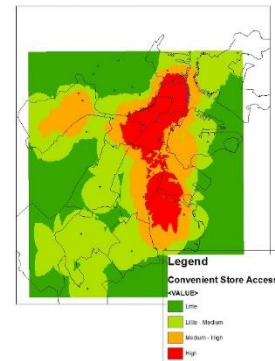
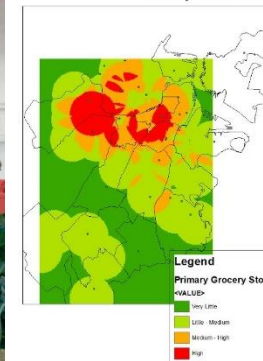
http://www.nsf.gov/news/special_reports/science_nation/hydroponicsed.jsp

Structure and Nature of our Work

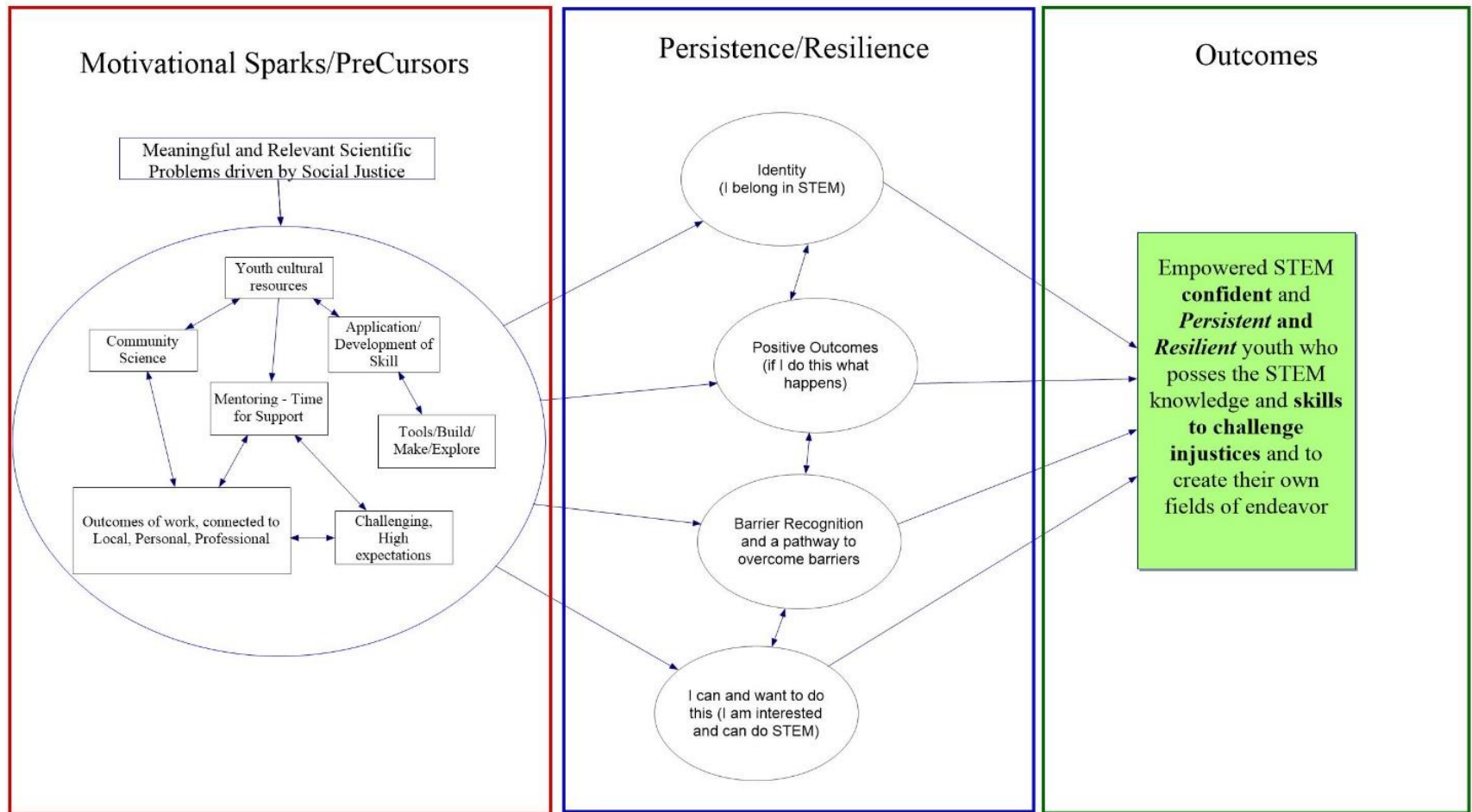
- Youth design and build hydroponics systems... sell produce
- Build air quality sensors and analysis realtime data using geospatial tools
- Social/environmental justice analysis of why work is needed and how and why connected to their community and their lives
- Alternative Energy exploration
- Internships with partner companies
- Prepare for post-secondary STEM work



Access to Full Service SuperMarkets
Compared to Convenient Stores

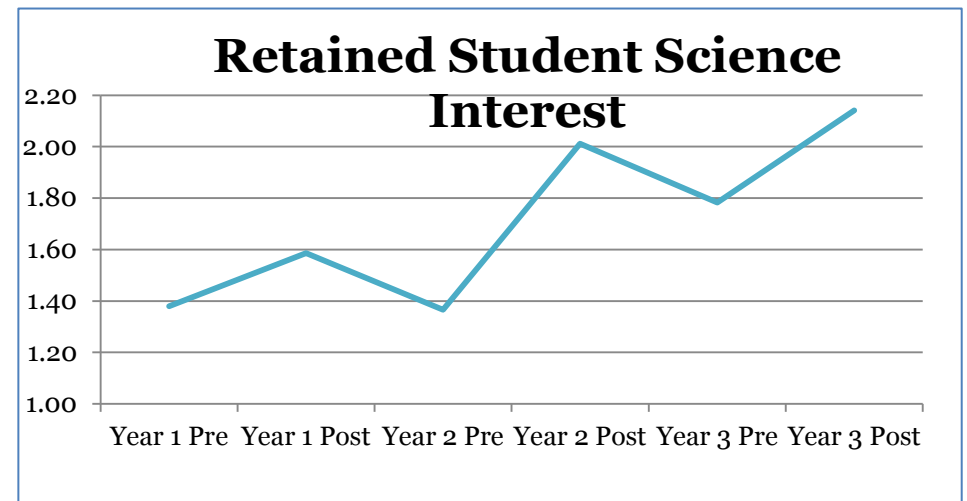
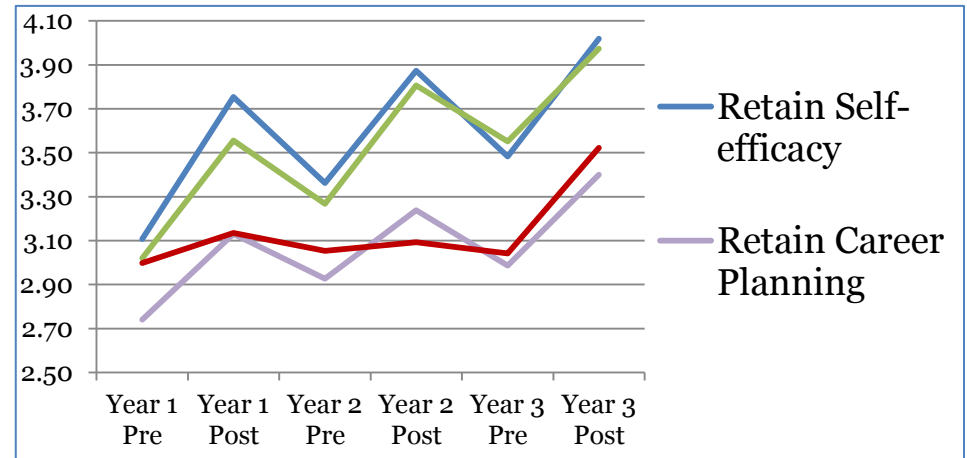


Pathway to STEM career complicated...



Takes time and lots of bumps along the way

- A residue effect that grows over time... in bits and starts
- Long time to develop the mindsets to study STEM
- It takes 2 years to re-spark interest
- It often takes 3 years to get students feeling like they can do “this” – STEM career
- More than just motivate and inspire
 - Resilience to persist in STEM and overcome barriers/challenges



$$(\hat{\beta}_{Time} = .15, t = 11.73, p = .98).$$

More than just motivation...need to build resilience

- More than just motivate and inspire
 - Resilience to persist in STEM and overcome barriers/challenges
- What I think was the most valuable experience of the program was the fact that I was forced out of being comfortable and that college science will be challenging and hard. Not hard in being able to do it..but hard in terms of knowing it but feeling like I can do it and be successful. It took a lot of work and many challenges to overcome during the years of college... facing that early was important....
 - Gates scholar – 2nd student year in college studying Mechanical Engineering...