

Inclusive STEM High Schools: Promise for New School Communities and Democratizing STEM

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Opportunity Structures for Preparation & Inspiration (OSPrI): A Cross-case Analysis of Inclusive STEM-focused High schools

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What is STEM education?



A Good Definition of STEM Education

“...an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy” (Tsupros, Kohler, & Hallinen, 2009).

- ▶ Attracting the attention of political leaders, business and industry, philanthropy and NGOs.
- ▶ STEM literacy for all.

What is an Inclusive STEM-Focused School?



Inclusive STEM-focused High Schools

ISHSs:

- ▶ Self-identify as STEM schools.
- ▶ Are schools of choice with specific missions to increase participation of groups under-represented in STEM.
- ▶ Have “open” admissions, lottery, few requirements.
- ▶ Provide high quality STEM learning experiences for students, with support systems for success.
- ▶ Link local economies, communities, and colleges/universities: community involvement in conception and delivery.

OSPrI: Importance of Study

This study is important because:

- ▶ Encouraged by President Obama and the White House.
- ▶ ISHSs are included in several state plans (OH, NC, TX, WA, and TN).
- ▶ But, the ability of ISHSs to prepare new learners ready for college STEM majors and careers not been well documented.
- ▶ There is no umbrella philosophy or organizational structure for ISHSs.
- ▶ But a companion ISTEM study (Means et al.) is in progress that explores the impact of ISHSs in NC.

Opportunity Structure Model

- ▶ Proposed by Kenneth Roberts (1968)
- ▶ Theories of career development that held that hard work and good choices determined job choices and success.
- ▶ Roberts' research: Geographic and social proximity determines access to different types of employment.
- ▶ AHA! STEM schools intentionally build opportunity structures and expand students' possibilities for jobs and careers as they contribute to the quality of STEM learning. This is win/win for students.
- ▶ This is why they are exciting.

ISHSs Build Opportunity Structures, Purposefully

The choice is not “school OR work”; rather it is “school and work” – mentors and projects build social capital.

- ▶ Develop students’ cognitive assets, especially in STEM.
- ▶ Develop non-cognitive factors, enhancing 21st century skills.
- ▶ Enhance students’ contacts and experiences to produce (more) social capital.

Research Questions

- ▶ Is there a core set of critical components implemented in well-established, promising ISHSs? Do other critical components emerge?
- ▶ Is there a model that captures the critical components?

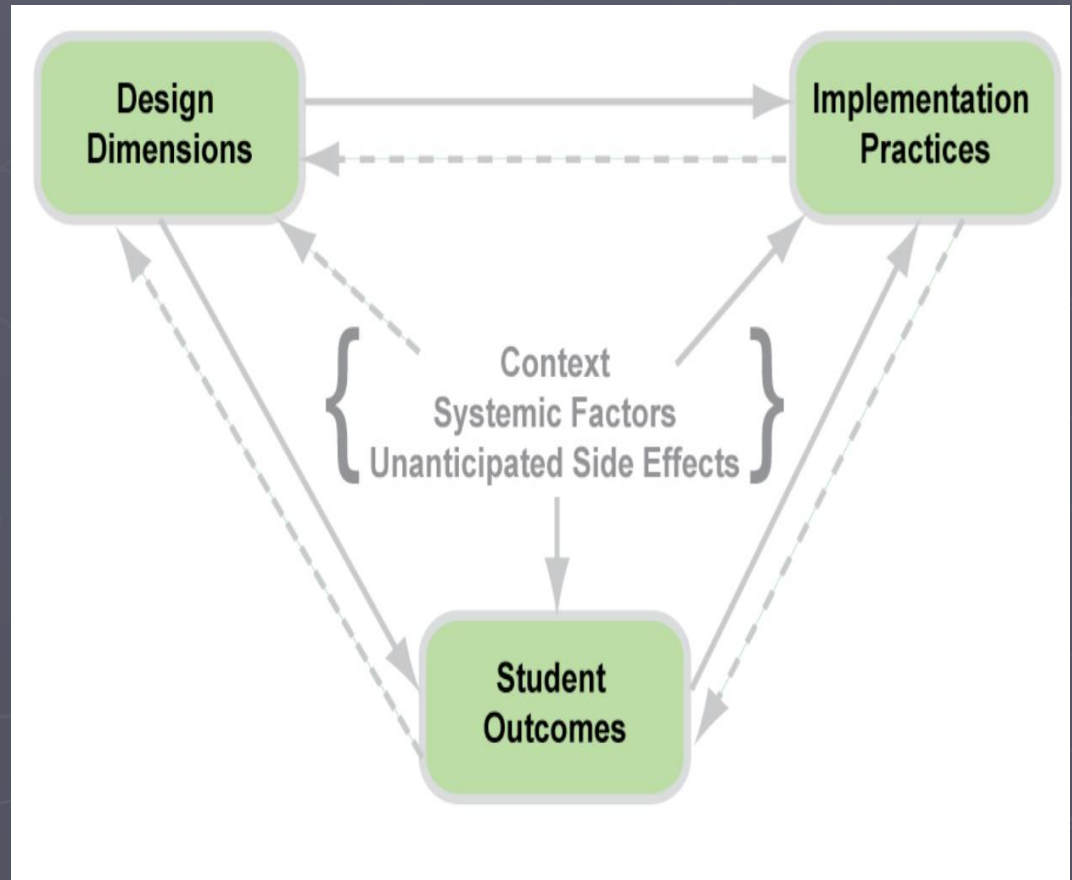
(A model would contribute to understanding the feasibility of scale-up and sustainability.)

Candidate Critical Components: Creating Opportunities in ISHSs

1. STEM-focused curriculum
2. Reform instructional strategies & Project-based learning
3. Integrated, innovative technology use
4. Blended formal/informal learning beyond the typical school day, week, or year
5. Real-world STEM partnerships
6. Early college-level coursework
7. Well-prepared STEM teaching staff
8. Inclusive STEM mission
9. Administrative structure
10. Special supports for under-represented students

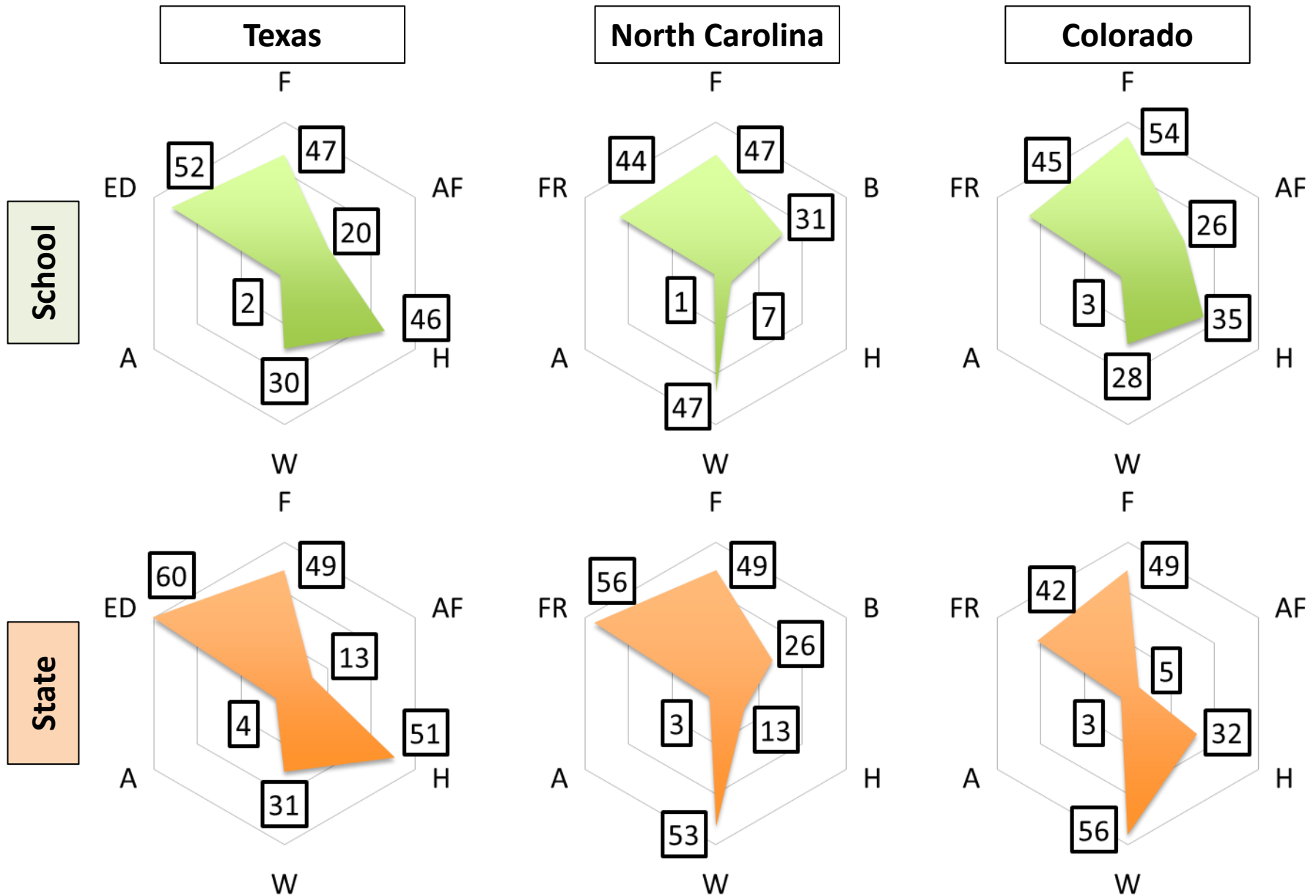
How are the 10 Critical Components designed into and implemented in each STEM School?

- ▶ Select 12 “well-established” STEM schools.
- ▶ Look for 10 “suspected” critical components, but capture other important elements and variations in context.
- ▶ Conduct cross-case analyses to define common model.



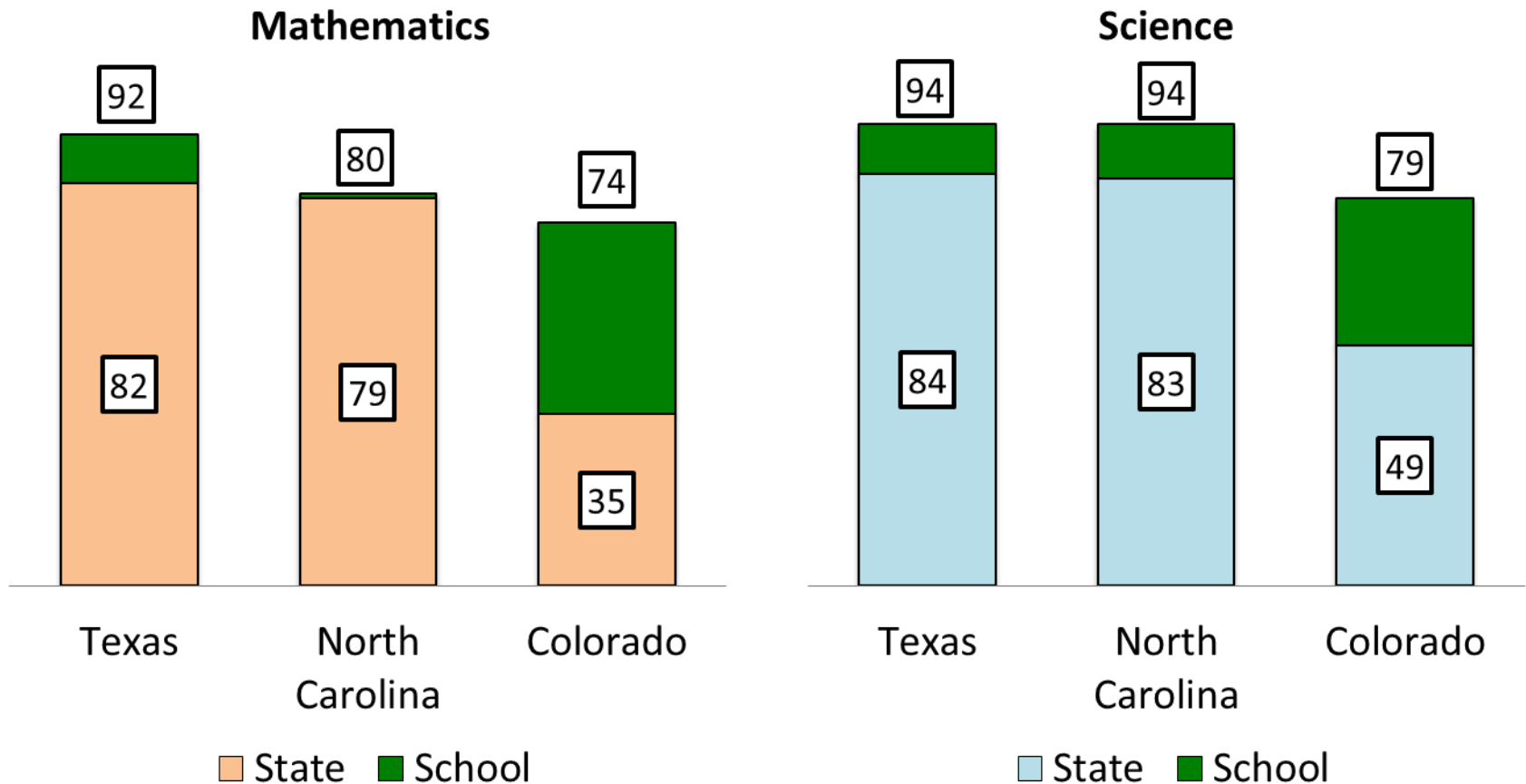
Highly Diverse: Demographics of 3 OSPri Study Schools

(% Female, African-American/Black, Hispanic, White, AAsian,
Economically Disadvantaged/Free and Reduced Lunch Eligible)



“Exemplar” OSPri study schools in 3 states: Student Outcomes

Percent Proficient on State Assessments



Outcomes

- Colorado school: 100% of students admitted to college—most to 4-year colleges (60% of students are African American or Latino/a).
- Rural North Carolina school achieves higher college admissions rates than nearby schools, despite lack of resources.
- Texas school achieved 100% college admission rate in 2012 with 65% of graduates “first generation” to attend college”.



How do ISHSs accomplish this?



Cognitive Factors

- ▶ **More STEM coursework** during high school, or fast-tracking through high school to take college courses.
- ▶ **Instructional Practices** range from 100% project-based learning to traditional mastery learning aimed at college success.
- ▶ Dedicated, qualified STEM teaching staff **provide more instructional hours** in targeted and innovative ways.

Non-cognitive Factors~ 21st Century Skills

ISHSs create/develop:

- ▶ **Flattened hierarchies between students, teachers and knowledge** through project-based learning, ubiquitous technology use, and early college enrollment.
- ▶ **School data systems** involve both students and parents.
- ▶ **Character and values developed.** Students pride themselves on inclusive environment for all.

Opportunity Structures that Enhance Social Capital

- ▶ Mentoring systems, community-based STEM experiences; long-range contextualized challenge projects.
- ▶ College admissions honed. Students empowered to grow STEM identities through a succession of increasingly challenging, successful experiences in school and community.
- ▶ Horizons for education, careers and life expand.

Insights and Policy Implications



Insights

- ▶ **ISHSs are broadening the notion of school community in innovative ways, affecting cognitive and non-cognitive factors.**
- ▶ **ISHSs deliberately create opportunity structures** not typically available through families, neighborhoods, or community paths.
- ▶ **Families are involved.** This is not a deficit model but an opportunity model.
- ▶ If a student graduates, **she/he is going to college**, or already part way through college.
- ▶ ISHSs **democratize STEM** for students; the message to community is that under-represented students can do STEM with great success and are a valuable resource.

Policy Implications

- ▶ Inclusive STEM high schools are test beds for STEM innovations; innovative and flexible.
- ▶ While ISHSs are few, they are powerful examples of what regular students interested in STEM can do when opportunity structures are deliberately built into schools using expansive notions of school community.
- ▶ ISHSs can aid local economies AND reduce inequalities. These are not only twin goods, they are inter-dependent.

The End

Website:
<http://ospri.research.gwu.edu/about>



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