Metro Early College High School: An Inclusive STEM School

Building Critical Opportunity Structures for Students in STEM

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Abstract

• STEM education reform in the US is increasingly tied to a push to increase student achievement and socioeconomic, gender, and racial equity in STEM.
• These initiatives have led to an increased number of inclusive STEM-focused high schools (ISHs), which may serve as testing grounds for innovative pedagogical approaches to STEM education (NRC, 2011; PCAST, 2010).
• This paper presents a case study of Metro Early College High School (Metro), an ISH in Columbus, Ohio.
• Metro engages its students with a rigorous STEM-focused and early-college curriculum. Additionally, with its connections to STEM networks and industry partners, Metro provides new opportunity structures supporting student success in STEM fields in high school, college, and beyond.

The OSPrI Study

Aim of Study

• To identify the critical components of exemplar ISHSs and an initial common theory of action for these schools

Theoretical Framework: Opportunity Structures

• Concept of opportunity structures was introduced as an alternative to theories of career development that positioned student choice as the primary factor (Roberts, 1968)
• Argued that the physical and social access and affordances encountered by students influenced their choices about jobs, more than any notions of career options that were out of reach
• OSPrI adapts this concept to consider the full range of deliberate or inherent supports that exemplar ISHSs employ to help students from groups underrepresented in STEM move into rewarding STEM college majors, jobs, and careers

Research Questions

1. Is there evidence of each of the candidate critical components in the design of Metro?
2. How are the critical components implemented at Metro? Do other components emerge from the data collected on-site?
3. What are the contextual affordances and constraints that influence Metro's design, implementation, and outcomes?
4. How do Metro's student STEM outcomes compare with those of the school district and state?

Candidate Critical Components of 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. Supports for Underrepresented Students

Methodology and Design

Instrumental case study approach (Stake, 2006), providing a means for thorough school-level analysis that is also open-ended, allowing for emerging evidence and interpretation
• 6-person team conducted 4-day site visit in March 2013
• Data collected through surveys, interviews, focus groups, classroom observations, and artifact analysis
• Participants included administrators, teachers, students, parents, representatives from external partners, counselors

Metro Early College High School: Overview

Context

• Opened in 2006; had first graduating class in 2010
• Product of partnership with Ohio State University (OSU) and Battelle Memorial Institute
• Member of the Early College High School Initiative
• Model school for the Ohio STEM Learning Network
• Leading participant in the STEM network

Student Enrollment

• Students from Central Ohio region (5 counties, 25 districts) eligible to attend
• Applying students selected via random lottery, with no selective criteria based on achievement
• 90% of students were drawn from Franklin County, and Metro's demographics align with the county

2012-13 Demographics of Metro and Franklin County (%)

<table>
<thead>
<tr>
<th>Student Group</th>
<th>Metro</th>
<th>Franklin County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>26.3</td>
<td>26.8</td>
</tr>
<tr>
<td>White</td>
<td>54.3</td>
<td>57.8</td>
</tr>
<tr>
<td>Multiracial</td>
<td>9.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Hispanic</td>
<td>12.4</td>
<td>15.6</td>
</tr>
<tr>
<td>Asian</td>
<td>5.0</td>
<td>4.1</td>
</tr>
<tr>
<td>Other/White Hispanic</td>
<td>3.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Student Outcomes

• Metro selected as exemplar due to reputation as a successful school and its consistent record of positive student outcomes
• On state-mandated Ohio Graduation Tests (OGT), required for high school diplomas, Metro's outcomes were substantially higher than the district, county, and state for all subjects

Spring 2013 OGT Results for Metro, District, County, and State (Percent of 12th graders at or above Proficient)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Metro</th>
<th>District</th>
<th>County</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>96%</td>
<td>85%</td>
<td>87%</td>
<td>77%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>96%</td>
<td>85%</td>
<td>89%</td>
<td>79%</td>
</tr>
<tr>
<td>Reading</td>
<td>96%</td>
<td>86%</td>
<td>89%</td>
<td>79%</td>
</tr>
<tr>
<td>Writing</td>
<td>78%</td>
<td>79%</td>
<td>71%</td>
<td>63%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>96%</td>
<td>93%</td>
<td>93%</td>
<td>88%</td>
</tr>
</tbody>
</table>

• Metro also substantially outperformed both the state and the nation in the ACT Subject Tests, across all subject areas

2013 Average ACT Scores for Metro, State, and Nation

<table>
<thead>
<tr>
<th>Subject</th>
<th>Metro</th>
<th>State</th>
<th>Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>28</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Mathematics</td>
<td>28</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>Reading</td>
<td>24</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Writing</td>
<td>21</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>Composite</td>
<td>24</td>
<td>22</td>
<td>21</td>
</tr>
</tbody>
</table>

Key Components and Innovations

• All critical components were actively observed at Metro, but our analysis suggested that the joint work of five critical components was especially salient in characterizing the educational program at Metro:
  • **STEM-Focused Curriculum**: Metro required students not only to complete more advanced college prep STEM coursework than Ohio, but also to do so on an accelerated schedule, typically in 2 ½ years.
  • **Reform Instructional Strategies**: The focus of Metro’s instruction was to foster both a rigorous mastery of the subject-matter content and to develop critical habits of mind for all of their students.
  • **Real-World STEM Partnerships**: Metro established close partnerships with local and national STEM industry leaders, which enhanced both the learning opportunities for the students and PD opportunities for the teachers.
  • **Early College-Level Coursework**: The average Metro student completed 5-6 OSU courses, and Metro covered all associated costs for their students. OSU and Metro provided a dedicated college advisor for these students, and they developed key college-readiness skills.
  • **Supports for Underrepresented Students**: Students were immersed in a structured and supportive environment, with dedicated teachers, advisors, and counselors. The early-college work allowed students to move into more complex work as they were ready to tackle them, whether through advanced courses at OSU or greater responsibilities at their STEM-related internships.

Two facets of Metro’s educational program extended beyond the traditional “four walls” of classroom practices and were particularly insightful in defining the nature of Metro’s strengths and distinguishing it from other schools:

1. **Learning Centers**: Metro created themed educational programs called Learning Centers (e.g., Energy, Environment, and Engineering; Human Body Systems; Biomedical Engineering; Design) to help ease the transition from high school to early college coursework for students. These incorporation a combination of high school and college courses, interdisciplinary connections with humanities courses, and experiential learning with local businesses and educational partners in the community.
2. **STEM Learning Networks**: Metro was a leader in both statewide and national STEM learning networks, including the Ohio STEM Learning Network and STEMx. Their involvement in these networks greatly enhanced the amount and types of resources, educational innovations, and best practices to which the school, teachers, and students were exposed and had access.

A long-term student outcome and indicator of Metro’s success is the college enrollment and persistence rates for their students. As shown in the table below, their rates substantially surpassed national averages, both overall and for 4- and 2-year institutions.

College Enrollment and Persistence Rates for Metro and Nation, Classes of 2010-2011

<table>
<thead>
<tr>
<th>Indicator Class of 2010</th>
<th>Class of 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>Nation</td>
</tr>
<tr>
<td>Total Enrolled in College at Any Time During the First Year after High School</td>
<td>91.0</td>
</tr>
<tr>
<td>Total Enrolled in 4-Year College</td>
<td>79.7</td>
</tr>
<tr>
<td>Total Enrolled in 2-Year College</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Conclusions

• Through their challenging STEM and early-college curriculum, Metro’s students graduate from high school better prepared for successful STEM college-level work on their own and with up to two years of college credits earned.
• Such opportunity structures are not likely feasible at the classroom level alone, and Metro cohesively aligns its innovative STEM curriculum, instructional practices, an early-college school structure, real-world STEM partnerships, and extensive student supports to provide unique opportunity structures and social capital for their students.
• This alignment appears to provide a far more ambitious and extensive platform for innovation than can be found at most schools in the United States. Consequently, the STEM focus, educational reach, and learning opportunities that Metro structures, develop, and provides for their students extend far beyond the four walls of the school.

References


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