The Effect of Student Engagement on Student Achievement in STEM: Implications for Public Policy for High School STEM Education

IMPORTANCE & BACKGROUND

Given the demands of a global, technology-based society, facilitating students into the STEM (science, technology, engineering, mathematics) pipeline (majoring in STEM-related fields and choosing STEM-related careers) has become a goal of the United States. Consequently, STEM schools have been created nationwide. In Ohio alone, there are over 10 STEM schools and STEM training centers. These schools are funded via public funds and philanthropic sources. Many public school districts have also developed STEM programs (such as Project Lead The Way – PLTW) that mirror the practices of STEM schools. Such programs infuse inquiry learning and project-based learning (PBL) in their courses.

The Ohio STEM Learning Network (OSLN) was created in 2008 with the goal of developing STEM literacy and disseminating information throughout the entire state. The network consists of various STEM hubs, hosts, platform schools, and STEM programs across Ohio. There are seven regional STEM hubs in Ohio, most of which are tied to at least one area STEM school and one area STEM training center. Training centers provide STEM best practice professional development for in-service teachers. While many of the STEM schools focus only on middle and high school students, there are initiatives that also include K-6 students, such as that in Reynoldsburg, Ohio. Research and teacher experiences tell us that while student engagement in school diminishes over time, effective teachers are able to engage students in a variety of ways. When students are engaged, they put forth more effort, take initiative, and display curiosity.

The purpose of this study is to examine student engagement across the contexts of STEM schools, traditional public schools with STEM programs, and traditional public schools without STEM programs. The intent of this study is to inform policy makers and K12 stakeholders of the differences between the 4 subgroups of students from these 3 schools: 1) STEM students, 2) students who attend a school with a STEM program, but who do not participate in the program, 3) students who attend a school with a STEM program, and who do participate in the program, and 4) students who attend a traditional school without a STEM program.

RESEARCH DESIGN

The High School Survey of Student Engagement (HSSSE) model, focusing on cognitive engagement, was adopted as this study's framework. Within this framework, students’ focus on and completion of academic work reflects cognitive engagement (Yazzie-Mintz, 2010). Participants include 9-12 grade students, representing two Ohio regions, who have completed the HSSSE. For each region, School A is a traditional high school with an optional STEM program; School B is a STEM school; School C is a traditional high school without a STEM program. Participants’ grade point average, state graduation test scores, ACT, and SAT scores are used to measure achievement. Focus group sessions, at each site and each grade level, provide data on students’ views of their engagement and how their respective schools/classes facilitate engagement.
From the information gathered, this project aims to determine:

- If the relationship between engagement and achievement differs across subsamples
- If differences in school engagement and achievement exist across subsamples
- How much unique variance three engagement dimensions contribute to achievement
- If teachers of students across the subsamples differ in their pedagogical practices
- Why students self-select STEM program or STEM school enrollment

DATA

All data collection is complete. All 32 focus group sessions have been transcribed, coded, and analyzed at the school level. Additionally, data from the walkthrough observation protocols have been collected and analyzed. Quantitative data from the HSSSE and achievement data are in the process of being analyzed.

PRELIMINARY FINDINGS

Preliminary findings from the focus group data indicate that students who are in the STEM strand feel engaged in their STEM program (e.g., PLTW) courses. They reveal that they are able to be very creative in how they work on their projects and that they see connections between their STEM program courses (e.g., engineering) and courses such as math and science. Data from one region indicate that key factors influencing student engagement in both STEM schools as well as those in STEM programs include: strong student-teacher rapport, teachers with ‘personality’, and long-term projects that require various tools (hands-on and computer). Furthermore, participants in both the STEM school and STEM programs noted that they put forth effort (reflecting engagement) because the expectations are challenging and they are not merely completing "busy work.”

Data from the walkthrough observation protocol indicate that students in both STEM field classrooms (e.g., math, science, engineering) and Non-STEM field classrooms (e.g., English, social studies, art) at the STEM school were significantly more likely to engage in listening to peers compared to their counterparts in the traditional school. Furthermore, in region 1, students in both the STEM school and STEM program school were significantly more likely to express interest and enthusiasm compared to students in the traditional school. In region 2, the STEM school students were significantly more likely to express interest and enthusiasm compared to students in both the STEM program school and the traditional school. The only significant differences in collaborating with a teacher was noted in region 2, with students in the STEM school collaborating significantly more than their counterparts in the STEM program school. Overall, students in both area STEM schools (for both the STEM field and Non-STEM field groups) were significantly more likely than students in the STEM program school and the traditional school to be engaged in collaboration with peers during the observations.

REFERENCES


Suggested Citation