



## **STEAM Ahead Program Evaluation Report 2017**

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STEAM Ahead is a collaborative, community-based educational program with a curriculum focused on science, technology, engineering, the arts, and mathematics (STEAM). STEAM Ahead was implemented in Manchester High School West in September 2014. This report summarizes the results of a mixed-methods program evaluation of STEAM Ahead that was conducted in the high school toward the end of the 2015-2016 academic school year. This study utilized secondary academic records (n=505), self-report surveys (n=44), and in-depth interviews (n=12) to compare students in the STEAM Ahead program with students in the traditional learning environment and examine STEAM Ahead's impact on a number of student outcomes. Outcomes examined in this report include students' academic performance, engagement in school, and perceptions of college and career readiness. All secondary academic data were de-identified and only students whose parents provided consent and who agreed to participate completed the survey and/or interview portion of this research.

Students self-select into STEAM Ahead, leading to potential self-selection bias. There may be inherent differences between students who opt to participate in STEAM Ahead and those who do not. For example, students who decide to participate in STEAM Ahead may have higher grade point averages at the start of their high school careers than students who elect to remain in the traditional learning environment. Without baseline data at the start of students' participation in the program, eliminating bias related to self-selection was not possible and, as such, that is a limitation of the present research. However, examining two comparable groups within the same high school allows for valuable comparisons to be made on the effectiveness of the program, despite this potential self-selection bias.

### **Manchester High School West**

During the 2015-2016 academic school year, Manchester High School West had 278 freshmen students and 213 sophomore students enrolled in the school. Demographically, Manchester High School West is comparable to the two larger high schools in the district but with a more diverse and lower-income student population than the state as a whole. Fifty-nine percent of the Manchester High School West student population qualifies for free or reduced lunch, which is comparable to the district average of 56.8 percent but well above the state average of 28.3 percent. Additionally, 6.7 percent of the student population has limited English proficiency, which is slightly less than the district average of 9.6 percent but significantly higher than the state average of 2 percent. Sixty-three percent of students are white, 18.1 percent are Hispanic, 9.1 percent are black, and 6 percent are Asian or Pacific Islander, which makes Manchester High School West comparable with the other schools in the district but much more diverse than the student population in the state as a whole (New Hampshire Department of Education 2016).

Manchester High School West's overall academic profile makes it an excellent candidate for the implementation of a program aimed at improving student outcomes, such as STEAM Ahead. Its dropout rate during the 2015-2016 academic school year was almost 5 percent, which is higher than the district average of 3.6 percent and the state average of 1.1 percent (New Hampshire Department of Education 2016). Twenty percent of male students and 37.4 percent of female students at Manchester High School West plan to attend a four year college, while the state average is more than twice that for male students (42.7 percent) and significantly higher for female students (56.6 percent) (New Hampshire Department of Education 2016).

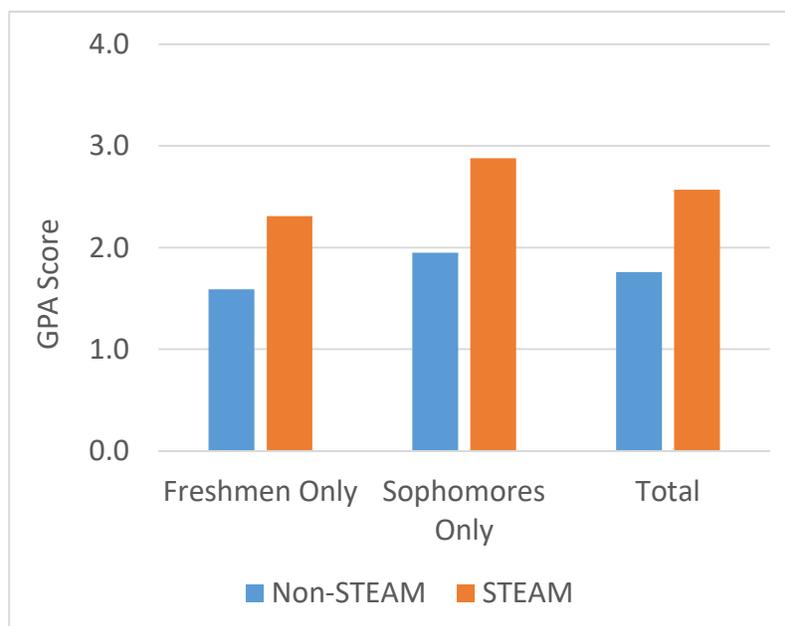
Not only do the demographic characteristics and post-graduation plans of Manchester High School West students make it an ideal school in which to implement and assess an educational program such as STEAM Ahead, but its test results do as well. While the majority of Manchester High School West's student achievement levels fell into the 'partially proficient,' 'proficient,' or 'proficient with distinction' categories for reading and writing during the 2013-2014 academic school year (the last year all subject level test results were available), 55 percent of students were 'substantially below proficient' in mathematics and 40 percent were 'substantially below proficient' in science. Both of these percentages put Manchester High

School West well below the average district and state achievement levels for both mathematics and science (New Hampshire Department of Education 2016). With ratings in science and mathematics comprehension falling below the district and state achievement levels, Manchester High School West is an excellent choice for the implementation of a program that focuses on the STEAM fields.

### Academic Performance

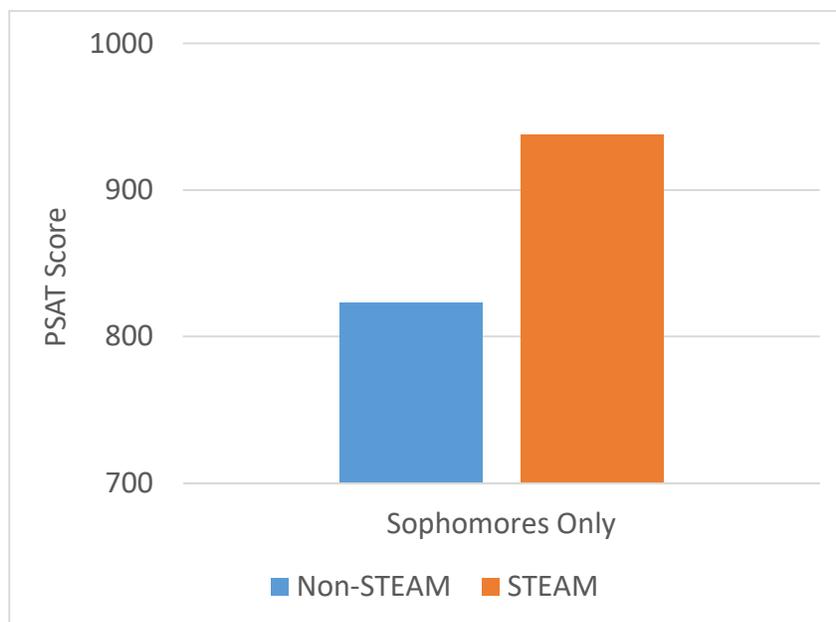
To examine how participation in STEAM Ahead impacted students' academic performance, the grade point averages (GPA scores) and preliminary scholastic aptitude test scores (PSAT scores) for students participating in STEAM Ahead and students in the traditional learning environment were compared using secondary academic records. The results suggest a significant difference in mean GPA scores for students participating in STEAM Ahead and students in the traditional learning environment, with the STEAM Ahead students having a higher mean GPA for both the freshmen and sophomore cohorts (see Figure 1). Out of a 4.0 scale, freshmen students in the traditional learning environment had a mean GPA score of 1.76, while freshmen students participating in STEAM Ahead had a mean GPA score of 2.57. Similarly, sophomore students in the traditional learning environment had a mean GPA score of 1.59 while sophomore students participating in STEAM Ahead had a mean GPA score of 2.31.

**Figure 1. Academic Performance: GPA Scores**



The second measure used to examine students' academic performance was sophomore students' PSAT scores. PSAT scores were available only for sophomore students who opted to complete the exam (n=141). The results indicate a significant difference in mean PSAT scores between students participating in STEAM Ahead and students in the traditional learning environment. The mean PSAT score for students participating in STEAM Ahead was 115 points higher than students in the traditional learning environment (out of 1520 possible points) (see Figure 2).

**Figure 2. Academic Performance: PSAT Scores**



During the in-depth interviews, students participating in STEAM Ahead were asked to describe how their involvement in the program has impacted their performance in school. All of the students participating in STEAM Ahead described having an overall positive experience in the program and improvements in their academic performance. The following quotes highlight some of the responses offered by students:

*“I like the hands-on part. It’s something I can, you know, do. It’s a more relaxed atmosphere than just sitting there and taking notes.”*

*“[STEAM Ahead] is absolutely a plus... Just sitting down doesn’t work. Since I am working on something and I can just see it and how it all works, it’s absolutely an improvement. It’s way better. My general learning experience is better.”*

*“I think my grades have definitely improved. And the projects, I feel are easier because I don’t do good on standard tests. Because I get nervous for them.”*

*“[STEAM Ahead] has made my life, in school, much better.”*

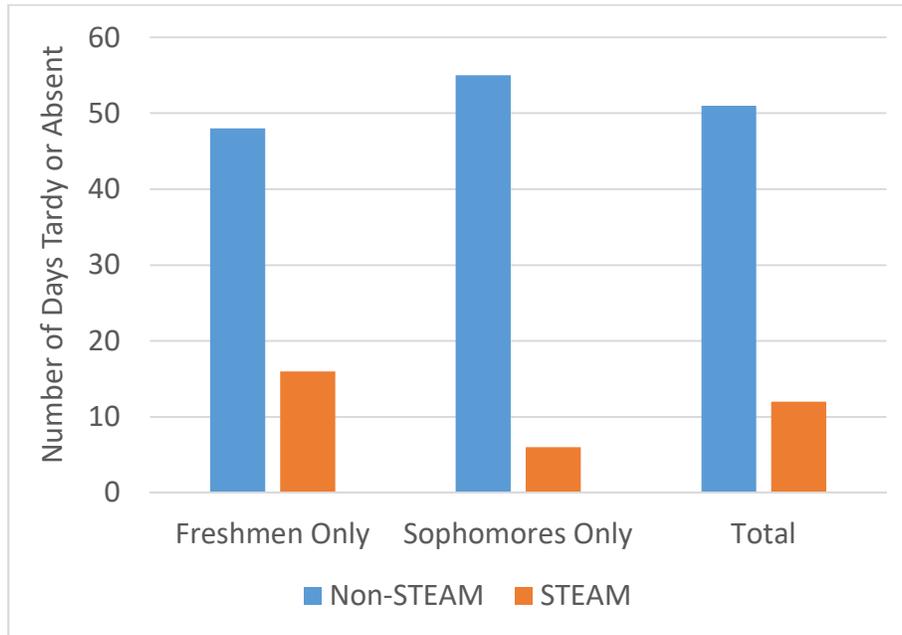
*“I like the freedom... to find the way that works for you instead of having to go to a mold to fit in. You can just do what you feel is comfortable. And find it in your own way.”*

### **Engagement in School**

Two measures of engagement in school were examined using the secondary academic records: the number of days tardy or absent and the number of days suspended. Data for the number of days absent alone were unavailable, as instances of tardiness and each half day of absenteeism were both recorded as one occurrence of a “half day absent,” even if that instance involved a student being just a few minutes late for first period or if a student had an excused absence. For the purposes of data analysis, the number of “half days absent” was recalculated to the number of full days when a student was tardy or absent. Students with perfect attendance had 175 days in attendance.

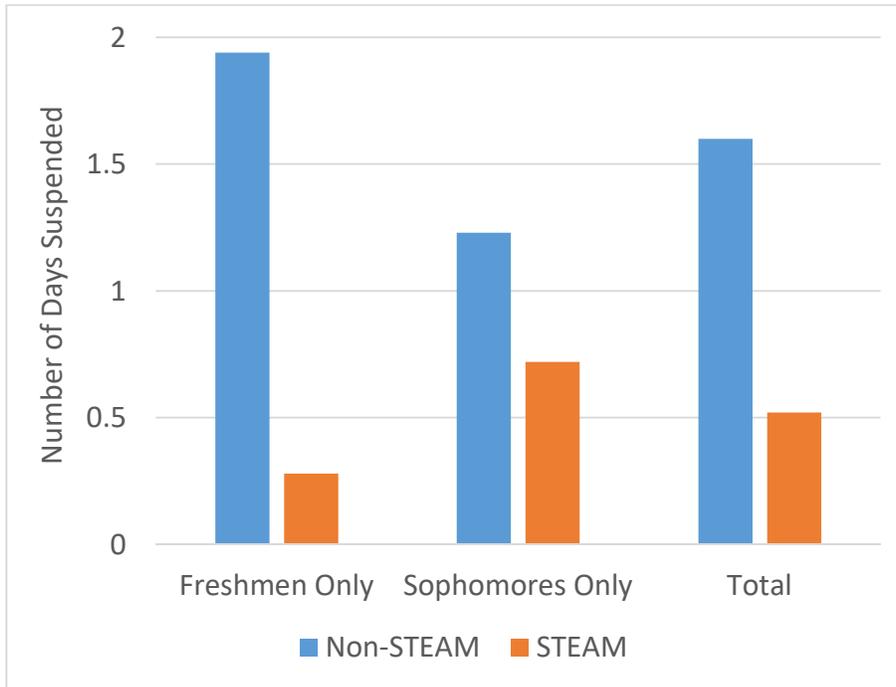
The results indicate the difference in means for the number of days tardy or absent between students participating in STEAM Ahead and students in the traditional learning environment was significant. Students participating in STEAM Ahead had a lower mean number of days tardy or absent when compared with students in the traditional learning environment (see Figure 3). On average, students in the traditional learning environment were tardy or absent forty days more during the 2015-2016 academic school year than students participating in STEAM Ahead. The differences in means for each grade level were also significant. Freshmen students in the traditional learning environment were, on average, tardy or absent thirty more days during the academic year than freshmen students participating in STEAM Ahead. The difference in means was even greater for the sophomore only group, as sophomore students in the traditional learning environment were, on average, tardy or absent fifty more days during the academic year than sophomore students participating in STEAM Ahead. These results suggest that STEAM Ahead students tend to have significantly fewer days tardy or absent from school than the students in the traditional learning environment.

**Figure 3. Engagement in School: Number of Days Tardy or Absent**



The second measure of engagement in school examined the number of days suspended. The results indicate the difference in means for the number of days suspended between students participating in STEAM Ahead and students in the traditional learning environment is significant. The students in the traditional learning environment received, on average, one more day of suspension in the 2015-2016 academic school year than students participating in STEAM Ahead. The significance between the two groups remained when each grade level was examined (see Figure 4).

**Figure 4. Engagement in School: Number of Days Suspended**



During the interviews, students were asked to describe how their involvement in STEAM Ahead has impacted their engagement in school. Many students described feeling more engaged with school, their teachers, and their peers, as well as feeling more motivated to attend school.

The following responses were provided by students participating in STEAM Ahead:

*“I think STEAM is more fun than a regular learning classroom because we get to interact better with the teachers because there are smaller classrooms. There’s more one on one time with the teachers and we do presentations and it’s better to do presentations instead of a test because us talking about it shows that we really know the information... You have to be comfortable with talking to people. Someone isn’t going to hand you a test in the middle of your day while you’re at work and ask you to do it. They’re going to have a conversation with you.”*

*“[STEAM Ahead] is kind of like its own little community in a way. But at the same time, it’s still part of this big West community that we have going on... You know you can go to these people if you have problems with really anything. Just school, work, or whatever. You can go to these people and be like, this is what’s going on and thanks for listening, while at the same time, they can give you some real good advice for the future. [Teachers and students] both work together to try to help make things better for you personally. Because each teacher, if you really need it, they will help you out.”*

*“[STEAM Ahead] keeps us wanting to come to school... I’d still come... but I wouldn’t want to. I’d have less of a drive to just go to school. It’s easier to wake up early if I have some cool project to do... I’m excited to learn.”*

*“I’ve probably done better [in STEAM Ahead]. I’ve definitely shown up more. Like, there aren’t days where I wake up and I don’t want to go to school. I think it’s because the teachers are trying to make learning interesting, rather than just, this is what we have to learn and we just go over it.”*

### **Perceptions of College and Career Readiness**

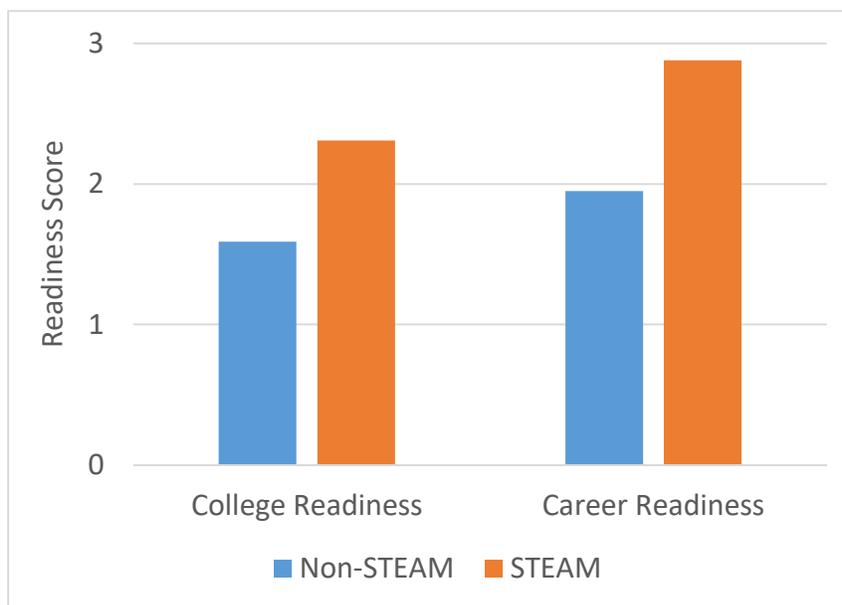
To examine students’ perceptions of college and career readiness, a survey was administered, using questions from the Common Measures College and Career Readiness Instrument from the National 4-H Council (4-H Common Measures 2015a). This instrument is a standardized assessment instrument used to evaluate the effectiveness of community programs aimed at improving youth outcomes, which for the purposes of the present research, focused on college and career readiness (Payne and McDonald 2012). The assessment asked students about outcomes related to school and college decision-making, career decision-making, and a number of teamwork and intrapersonal skills associated with success in college and the workforce. In total, forty-four students completed the survey portion of the present study, nineteen students participating in STEAM Ahead and twenty-five students in the traditional learning environment.

Of the students who participated in the survey, 73.7 percent of students participating in STEAM Ahead (n=14) indicated that they enjoyed coming to school, while 52 percent of students in the traditional learning environment (n=13) reported enjoying school. The majority of students indicated that they plan to attend college full-time after high school, with 80 percent of students in the traditional learning (n=20) and 89.4 percent of students participating in STEAM Ahead (n=17) reporting that they plan to attend college full-time. An additional four students in the traditional learning environment (16 percent) reported that they planned to attend college part-time, while one student participating in STEAM Ahead (5.2 percent) said the same. No student in either group reported that they did not plan to attend college, although one student in each group indicated that they were undecided.

One measure of college readiness and one measure of career readiness were examined to compare students participating in STEAM Ahead and students in the traditional learning environment based on their perceptions of college and career readiness. The results indicate the

difference in perceptions of both of the college and the career readiness measures between students participating in STEAM Ahead and students in the traditional learning environment were not significant (with a response range of 0 to 3, where 0 is a low perception of readiness and 3 is a high perception of readiness). When examining the differences for each grade level, a significant difference was found for each measure for the freshmen group but not for sophomore group. These results suggest that there is a difference in the perceptions of college and career readiness between students participating in STEAM Ahead and students in the traditional learning environment, but only for freshmen students (see Figure 5).

**Figure 5. Perceptions of College and Career Readiness: Freshmen Only**



During the in-depth interviews, students were asked to describe how their involvement in STEAM Ahead has prepared them to enter college and the workforce. Taken together, responses described improved skills that are valuable in both college and the workforce, including feeling better prepared for working as a team, stronger confidence in public speaking, and improved critical thinking skills. Students also reported feeling more knowledgeable in STEAM fields that interested them. Responses included statements such as:

*“With teams and stuff... working with other people ... You’re not always going to have the opportunity to do whatever you want. You’re going to have to do what somebody tells you to do... [In STEAM Ahead], I’m put into situations that I wouldn’t maybe put myself in. And I have to learn how to persevere.”*

*“I’m definitely more open. I used to be really shy. I’m more open with people and I’m comfortable with talking to people... The presentations and public speaking [helped] and I realized that everyone else is open, so I have nothing to be afraid of when I talk to people.”*

*“I think that I am more able to work through problems now than I was at the beginning of the year. So, I can look at a problem, dissect it, and see how to fix it, which is great. And it’s allowed me to think on my feet more effectively.”*

*“There are a lot of things that they have us do independently, in terms of learning. They’ll give us a paper and tell us to look on the internet to figure out what you’re going to do for this. And I think that’s definitely helped in terms of, if you get a job, there isn’t someone sitting there, telling you you have to do this this way or you have to write a paper with this exam format or something like that.”*

*“Now I think of things like differently. So if I was told do something, I would come up with different scenarios in my mind of how to do it. So maybe [STEAM Ahead] brought that out in me... to find a different way to do things. The easiest way or the most efficient way.”*

*“It has absolutely given me some insight on the industry in general.”*

### **Student Challenges to STEAM Ahead**

Students were also asked to describe any aspects of STEAM Ahead they thought could use improvement. Although the responses concerning students’ involvement in STEAM Ahead were overwhelmingly favorable, students described how their primary concern was that it was challenging to manage group work when their team members did not complete their share of the work. Two students described this difficulty in detail:

*“I want to say the group work because I generally don’t like to put anything in anybody else’s hands, just because in my experience, that never works out. On an engineering project, we had to make this robotic arm with hydraulics. And it was ok. It ended up ok. Initiating all of the different parts. But, my partner, the one day I was out, she did absolutely nothing. So, it feels like if I’m not there to manage absolutely everything, nothing gets done.”*

*“If you get to pick your own partners, I love [group work] so much because you know those are the people you work well with and everything goes smoothly. But this current project we’re doing, we didn’t get to pick the people that we are supposed to work with. And it’s excruciating. People do not work. They just sit there and you try, but you don’t want to seem bossy or whatever. But, you try to*

*say like, “Hey, can you do this?” or “Can you do this?” And they do nothing, so then you’re stressed out because you don’t want your grade to go down. So then you have to do all the catch up and hold them up and do all of the work. It’s just not fun.”*

Despite the challenge of group work, students also described how those challenges helped them learn how to deal with other people. One student discussed the benefit that the relatively small cohort sizes in STEAM Ahead has on group work:

*“We’re all stuck together. Everyone is in the same STEAM class for two years. We have fifty kids who are in it. So you start to know everyone’s strengths and weaknesses. So when you’re doing the projects, you’ll know what to do. So like this one kid is crazy good at drawing, so we’ll have him do the illustrations. You know which people can create models. All stuff like that. It’s nice.”*

## **Conclusion**

Overall, the results of the STEAM Ahead program evaluation were overwhelmingly positive. Students participating in STEAM Ahead had improved outcomes in terms of their academic performance and engagement in school when compared with students in the traditional learning environment. Limited support was found for stronger perceptions of college and career readiness for the students participating in STEAM Ahead when compared with students in the traditional learning environment. While students in STEAM Ahead did report some challenges with the program during the in-depth interviews, overall, they reported improvements in their academic performance, engagement in school, and improved skills that they believed were necessary for success in college and the workforce.

## **References**

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