Case Study: Dighton-Rehoboth engineers initiative to align STEAM learning across grades PK–12

MASSACHUSETTS DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION

Executive Summary

- The Dighton-Rehoboth leadership team determined that their students were underperforming on the Science and Technology/Engineering MCAS, compared to students in similar districts.
- The team decided to focus on aligning learning experiences in science, technology, engineering, arts, and mathematics (STEAM) courses for all grades.
- Leadership invested in four major areas: (1) early elementary literacy curriculum that introduced science concepts, (2) a new curriculum and materials for middle school science teachers that included experiential learning methods, (3) a high school biology curriculum that aligned with MA standards, and (4) computer science and engineering pathways for grades 9–12.
- To pay for these initiatives, Dighton-Rehoboth used grant funds, reallocated resources from other professional development initiatives and operational savings, and employed assets from separately awarded grants.
- At the end of 2018-19, the Dighton-Rehoboth team saw positive trends in MCAS scores, course enrollment, and teacher feedback on the implementation of standards.

FAST FACTS

Dighton-Rehoboth Public Schools

SY 2016-17

Schools **5**

Teachers **237**

Students **2,883**

Econ. Disadv. **13.7%**

District Leadership

Anthony Azar, Superintendent
Kerri Anne Quinlan-Zhou, Assistant Superintendent for Curriculum, Instruction and Professional Development
Catherine Antonellis, Business Administrator
Jeremy Guay, CTE Director
Karen Rose, STEAM Specialist & Biology Teacher

Case Study Authors

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Resource Reallocation to District Priorities Grant Program

A competitive two-year program supporting school districts to make substantial changes in resource allocation and direct more resources toward evidence-based improvement strategies. This grant program also encourages districts to use the new suite of Resource Allocation and District Action Reports (RADAR) tools to analyze how they use resources.

RADAR

Overview of Grant

This case study is one of nine in a series showcasing the work of recipients of a 2017 DESE two-year grant for reallocating resources to align with district priorities. The case study explains how the participants used state data tools such as RADAR and DART to identify an area of need, determined an evidence-based investment, shifted resources in their existing budget to make the investment, and then evaluated the cost and impact of the investment.

Planning: Dighton-Rehoboth focuses its efforts on improving STEAM practices

Leaders from Dighton-Rehoboth Regional School District (DRRSD), a district of just under 3,000 students, reviewed RADAR data and DART comparisons during 2016-17 and found that their students scored lower on the Science and Technology/Engineering (STE) MCAS than similar districts. In response, leadership explored ways to improve instruction and outcomes in science, technology, and engineering for students in all grades, through a set of district-wide STEAM (Science, Technology, Engineering, Arts, and Math) initiatives.

The district had ambitious goals for improving STEAM outcomes. These goals included creating a vertically-aligned curriculum, updating standards and instructional models for high school biology, and creating computer science and engineering career pathways for grades 9–12. To support the start-up costs associated with bringing these plans to fruition, the Dighton-Rehoboth team applied for the Resource Reallocation to District Priorities grant.

Upon receiving the grant, the Dighton-Rehoboth team collaborated with District Management Group (DMGroup) and DESE to develop a plan to target investments and reallocate resources for STEAM and then track the impact.

The team set out a plan that began with their PK–4 elementary schools. In these grades, district leadership realized that not all teachers and school leaders were comfortable teaching science. To incorporate science concepts where teachers were more confident, the district's assistant superintendent worked with their STEAM and literacy leads to select curriculum resources to integrate science in their literacy lessons. They also incorporated experiential learning lessons from the Wade Institute for Science Education (formerly known as the Museum Institute for Teaching Science) into the curriculum.

Exhibit 1 | Dighton-Rehoboth Enrollment

Exhibit 1.a Total district enrollment (students)

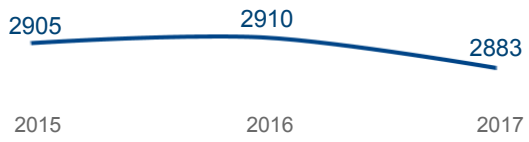
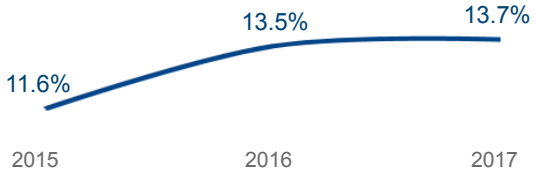


Exhibit 1.b Economically disadvantaged students (% of total enrollment)

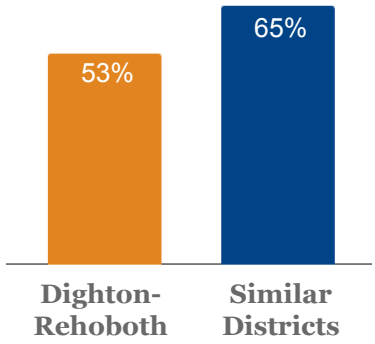


At the middle school (grades 5–8), Dighton-Rehoboth implemented new science standards and coaching strategies. All grade 5-8 science teachers gathered for nearly five full days of mapping new standards, learning experiential pedagogical approaches, and developing "tasks" (multiple aligned and connected lessons on a given topic).

For grades 9–10, Dighton-Rehoboth developed a new biology curriculum that aligned with updated DESE standards. Lessons prioritized discovery and experiential learning by incorporating virtual labs, technology-assisted activities, case studies, and teacher-selected readings. The district implemented this new curriculum in a pilot model: three teachers developed and used the new curriculum and standards while three teachers continued to teach the current ones.

Exhibit 2 | RADAR Analysis – Science MCAS

Percentage of students scoring proficient or above (2016-17)



Simultaneously, district leaders created computer science (CS) and robotics courses at the high school, with plans to ultimately develop comprehensive computer science and engineering career pathways.

Measuring: Dighton-Rehoboth team gathers data to measure the impact and cost of their STEAM initiatives

As a part of the grant process, Dighton-Rehoboth worked with DMGroup and DESE to define success measures for their investments, which required them to think through the desired outcomes and the specific metrics they could use to assess these outcomes. The team developed the following definitions of success:

- Student achievement increases ten or more points on the Biology MCAS in grades 9–10.
- Student achievement increases on the STE MCAS in grades 5 and 8.
- Teachers increase their comfort and knowledge of the STE standards in grades PK–8, as measured by a teacher survey.
- Enrollment in computer science courses increases 100% in 2018-19 versus the prior school year.

To evaluate their investments, Dighton-Rehoboth collected Biology and STE MCAS scores, high school course selection data, and a teacher survey on comfort and knowledge of science standards in grades PK–8.

Dighton-Rehoboth paid for portions of curriculum planning time and professional development with grant funds. Grant funds also covered the costs of providing class coverages for collaborative planning sessions. District leadership repurposed staff time to support instruction and curriculum development from STEM specialists and district administrators, and reassigned one of their elementary school's librarian positions to spend 50% of their time working as another STEM specialist. The remaining resources came from additional operational savings, other grant programs, and professional development funds from other initiatives.

Using a process from DMGroup, leaders first brainstormed all resources related to the investments, including staff time, administrator time, fees, stipends, consultants, materials, and operations. Costs included curricula and materials purchased, staff time developing lessons and curriculum, the hiring of a new computer science teacher and other STEAM-related activities across their schools.

Exhibit 3 **| Fully Loaded Per Pupil Cost**

Time Investments	
Category	**Amount**
Staff Time	$395,000
Administrator Time	$105,000
Cash Investments	
Category	**Amount**
Fees, Stipends, Consultants	$19,075
Materials	$27,651
Estimated Cost Per Student	
Students Impacted	**Amount**
2,582	$211

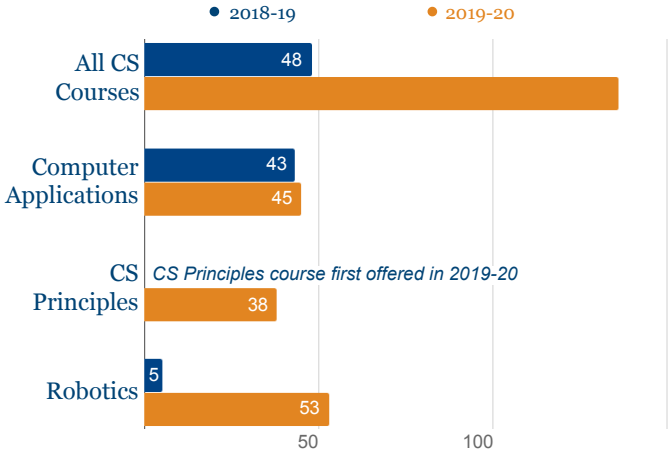
After cataloging all costs associated with the STEAM initiatives, the Dighton-Rehoboth team determined that the total cost was $547,000, which equated to a per pupil cost of about $200, given that these investments impacted all 2,514 PK–10 students and around 68 students from grades 11–12 who opted into the computer science courses. In addition to these expenses, DRRSD invested over $1,000,000 in their fiber and WiFi project, an effort that is directly related to the computer science initiatives at the high school.

Evaluating: Dighton-Rehoboth team evaluates the impact of their STEAM investments

High school computer science course enrollment: From 2018-19 to 2019-20, Dighton-Rehoboth Regional High School saw a dramatic increase in enrollment in their three computer science courses: Computer Applications, Computer Science Principles (only offered in 2019-20), and Robotics. During 2018-19, Dighton-Rehoboth had 48 total students enrolled across the six sections of the two courses offered. During 2019-20, the school had 136 students enrolled across the six sections of the three courses offered, a 183% increase in enrollment. Additionally, sections were on average 60% fuller in 2019-20 than 2018-19. The most dramatic increase in enrollment was in the two sections of Robotics. During 2018-19, the high school had 5 students enrolled in Robotics; in 2019-20, 53 students enrolled, and sections were 91% fuller.

Exhibit 4 | Computer Science Enrollment

Students enrolled in computer science courses

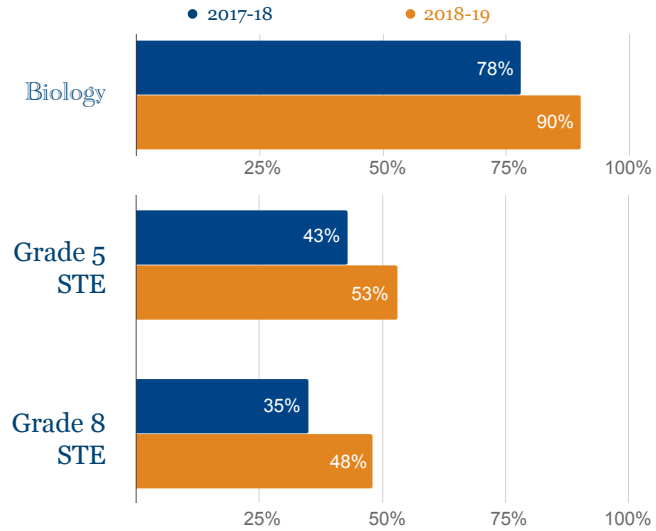


Biology MCAS: Dighton-Rehoboth reviewed MCAS data for high school students in grades 9–10 biology. Between 2017-18 and 2018-19, Dighton-Rehoboth Regional High School saw a 12 percentage point increase in students scoring proficient or higher on the MCAS test, from 78% to 90%. These results met the definition of success outlined by the team. Additionally, the Composite Performance Index (CPI) increased by 4.9 points, or 5% from 91.2 to 96.1, exceeding the target defined by the state.

MCAS, grades 5 and 8: MCAS scores for grades 5 and 8 STE also increased between 2017-18 and 2018-19. In 5th grade, the percent of students proficient or advanced grew by ten percentage points, from 43% in 2018-19 to 53% in 2019-20. Similarly, in 8th grade, the percent of students proficient or advanced on the STE MCAS grew by 13 percentage points, from 35%

Exhibit 5 | MCAS Scores (Bio & STE)

Percentage of students scoring proficient or higher



in 2018-19 to 48% in 2019-20. The growth in both of these grades met the goals set out by the district.

Teacher feedback: Finally, the Dighton-Rehoboth team surveyed teachers in grades PK–8 to gather feedback on the STE standards, STE professional development, and the incorporation of standards into their lessons. Of teachers surveyed, 56% reported that their knowledge of the new STE standards grew from the start of the year to the end of the year. These results show initial promise in the professional development, but the district will continue to put effort and focus working with teachers.

Looking ahead: Dighton-Rehoboth team improves and expands programs in 2019-20

Heading into 2019-20, Dighton-Rehoboth continues to analyze their 2018-19 data to identify how they can support teachers with the new science standards. Their work includes continuing to develop integrated lessons for PK–4 and tasks, or sets of lessons, for grades 5–8 with the support of technology and material integration into the classroom.

At the high school, the district is implementing the new standards for biology in grade 9 and is rolling up their pilot to all biology teachers next year. They continue growing their computer science coursework at the high school, adding Computer Science Principles in 2019-20, and plan to add Game and App design in 2020-21. Eventually, the district hopes to develop a full pathway program by adding Advanced Placement (AP) Computer Science, and expanding their robotics curriculum and engineering careers pathway.

Each investment made by Dighton-Rehoboth leadership required significant change in practice for classroom educators, and required the support of the district to implement. “Change is hard,” commented Dr. Kerri-Anne Quinlan-Zhou. “Flexibility is key, [and] we’re willing to change mid-course in order to get to the end goals.” The district will continue to provide sustained support and flexibility for teachers implementing these changes.

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