Bath Regional Vocational Center and Morse High

Education Success Story

Autodesk® Design Academy
AutoCAD®
Autodesk® VIZ
Autodesk® Inventor™ Professional

The act of re-creating their observations in the lab using professional tools helps students to get a better grasp on the scientific method, as well as the abstract concepts they've heard in lectures.

—John Maskarinetz,
Chemistry Instructor
Morse High School
Bath, Maine

Shaping the future.

Bath Regional Vocational Center and Morse High School students move to the head of the class with Autodesk 3D software.

Project Summary

Located in the southern mid-coast region of Maine, the city of Bath is home to just over 9,250 people and has a rich, centuries-long heritage of ship-buiding. Despite its small size, Bath is also home to the state's largest private employer, Bath Iron Works Corporation.

Although the local industry demands math and science skills, Morse High School (MHS), with almost 900 students, was challenged to demonstrate student proficiency in these and other subjects to comply with state learning standards. The area's vocational school, Bath Regional Vocational Center (BRVC), shares MHS campus facilities and was experiencing declining enrollment. To address their respective issues, the two schools' science and technology instructors have teamed up to build programs that integrate project-based instruction. This collaboration provides students with the opportunity to apply their math and science skills to real-world problems, focus on teamwork, and experience multiple learning styles—while fulfilling graduation requirements.

The Challenge

The Maine learning results (MLRs) are state standards for public education. They mandate that to graduate, students must be proficient in a variety of subjects and skills, including complex thinking and problem solving. In 2004, the state legislature ordered a review of these standards with the expectation that schools would implement programs starting in 2006–2007. MHS administrators realized that the school would need to add classes and raise requirements for graduation in order to comply with MLRs, but MHS did not have the budget, space, or personnel to quickly and successfully implement a major reorganization of its curricula.

The Maine Department of Education was urging vocational schools to improve academic rigor, at the same time that BRVC faced declining enrollment. The MLRs had an indirect but significant effect on BRVC, as well: Rising academic requirements would leave students from area high schools (MHS, Boothbay Regional High School, Wiscasset High School, and Lincoln Academy) without time in their schedules to attend half-day vocational classes.

Autodesk®

The Solution

Despite their different charters, the academic and vocational schools shared not only facilities, but also the issue of raising student achievement. The time seemed right for these institutions to collaborate on a solution, and Cindy Harris, a computer-aided design (CAD) instructor at BRVC, saw an opportunity to integrate her programs with the MHS science department and make better use of the technology she was teaching, as well as provide students with a clear, hands-on approach to learning.

Harris anticipated that students in MHS classes ranging from the freshman science survey course to chemistry could take advantage of CAD technology instruction in BRVC for hands-on exploration of core science concepts that could lead to a stronger understanding and proficiency in required subjects.

Several science teachers at MHS met with Harris and shared her views. Chemistry teacher John Maskarinetz, physics teacher Evan Cyr, and freshman science teacher Eric Varney saw the perfect opportunity to help their students make sense of science. Through the BRVC curriculum and exercises, MHS high-school students would be able to learn and master concepts required by the MLRs and align vocational skills-building with academic rigor.

At the same time, students would be exposed to technology they would be likely to encounter as professional drafters, engineers, and product designers. Having worked in professional engineering and science industries, Harris, Maskarinetz, Cyr, and Varney understood the value of teaching real-world skills in the classroom. More important, they understood just how these skills would serve their students in the real world.

A Chain Reaction of Recognition and Understanding

The three MHS science teachers worked with Harris to develop lessons based on her classes. Harris teaches architecture, engineering, and animation, as well as a year-long drafting course that prepares students to enter the workforce or continue on to a two- or four-year program. Her instruction integrates the software applications included in the Autodesk® Design Academy academic solution, which maps to national standards and is designed specifically to support science, technology, engineering, and mathematics (STEM) education with a project-based approach to design basics, pre-architecture, pre-civil engineering, pre-mechanical engineering, geometry, and substantial design courses.

> The catapult exercise gave them a feel for what professional designers and engineers do and the tools that professionals use, and that gives so much more meaning and purpose to their studies.
>
> —Evan Cyr
> Physics Instructor
> Morse High School

The instructors piloted two projects in the 2005–2006 school year to test their integrated approach. Students in Maskarinetz's chemistry classes and Harris's animation classes took part in a cross-discipline exercise from the Autodesk Design Academy solution. Cyr's physics classes developed industry-standard plans for building catapults.

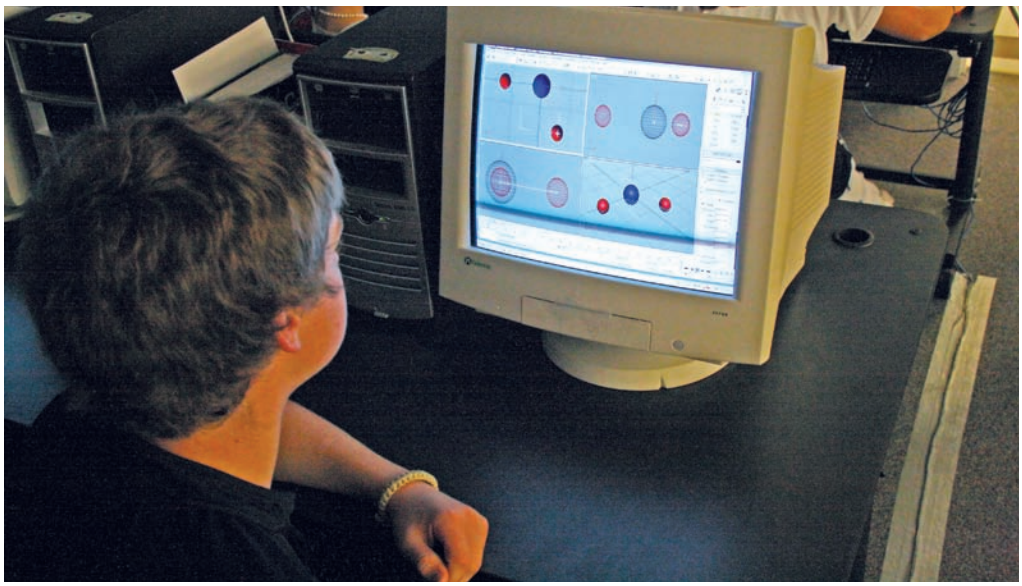
Maskarinetz and Harris's students began work by producing a chemical reaction in his chemistry lab. They learned about the components of the reaction and how they interact. Once they understood the elements and process, students went to Harris's computer lab to create graphical representations of each stage in the chain of events, using Autodesk® VIZ software. Then they animated the series to show how each of the elements divided and recombined over the course of the reaction.

"It was impressive to watch the kids get so much out of the exercise," says Maskarinetz. "The act of re-creating their observations in the lab using professional tools helps students to get a better grasp on the scientific method, as well as the abstract concepts they've heard in lectures."

Meanwhile, Cyr's physics classes were asked to design a catapult that met specific criteria and restrictions. Once the students had studied concepts such as mass, force, acceleration, and distance, they were grouped into teams to design and build a catapult. After they designed their catapults, the students tested physical prototypes. These physical trials showed teams the strengths and limitations of their designs so that they could go back to their computers and revise their designs to improve the catapults' performance. With some basic instruction in AutoCAD® software from Harris, they developed industry-standard orthographic projections (top, front, and side views) of their designs.

According to Cyr, his students found using professional tools inspiring. "The catapult exercise gave them a feel for what professional designers and engineers do and the tools that professionals use, and that gives so much more meaning and purpose to their studies."

Cyr also observes that the class gave students a different kind of teamwork experience. "So often, one or two students will do more of the work or speak on behalf of the team. But since there were intellectual and physical, classroom and lab aspects to the project, there were more opportunities for everyone to contribute and participate."



Expanding Exposure to Real-World Opportunities

In the 2006–2007 school year, MHS and BRVC instructors repeated the chemical reaction and catapult lessons, and added an integrated project with freshman science students. Working with Eric Varney, Harris developed an animation exercise to illustrate a molecular model, using the solar system lesson module from the Autodesk Design Academy as a foundation. After basic instruction from Harris, each student was given an element from the Periodic Table to model. Then she taught students how to use software effects and functions to animate their models and show the molecules' electrons rotating around the protons and neutrons.

Building on the success of these classes, Harris and Maskarinetz worked together to develop an Introduction to Engineering class. Taught by Harris, the course exposes students to career opportunities in engineering, including a wide range of disciplines, teamwork, project and plan development, and what to expect in engineering school and an engineering career.

The MHS and BRVC instructors who initiated the integrated, project-based instruction are committed to continuing and expanding the range of classes offered. They're doing so with the full support of BRVC director Mert Dearnley. New topics under consideration include a lesson unit on "green" houses for Varney's Advanced Placement environmental science class; an engineering project that would incorporate Introduction to Engineering, chemistry, and physics classes; and a DNA strand animation exercise for biology classes.

Students say they really enjoy the curriculum and project-based learning style

—Cindy Harris
CAD Instructor
Bath Regional Vocational Center
Bath, Maine

The Result

According to the four instructors, MHS and BRVC integrated classes open their students' eyes to applications for STEM learning and provide an exciting preview of the kind of work or study that they might pursue and the tools they might use after graduation.

"Project-based classes provide a way for our students to meet state requirements to graduate, in a way that's really fulfilling for them as individuals," says Harris. "You can see them light up with the possibilities for the future when they start solving real problems with professional tools."

One chemistry student discovered the technology classes through participation in the first-year pilot program. As a result, she signed up for Harris's Introduction to Engineering class and will study engineering at Wentworth Institute of Technology this fall. Students who meet basic college entrance requirements can receive up to nine college credits at the end of the school year. Harris says many students cite the programs on their college applications to show their strength in science and technology.

Harris says that students who plan to enter the workforce after graduation develop a better sense of career direction. Their training on industry-leading technology products gives them high standing and even preferred consideration when they apply for positions at Bath Iron Works.

"Students say they really enjoy the curriculum and project-based learning style," says Harris. The proof is in the numbers: Enrollment in Harris's classes has increased by 500 percent—and that's given a real boost to MHS and BVRC's progress toward compliance with MLR standards.

To learn more about Autodesk's academic solutions and programs, including Autodesk Design Academy, visit **www.autodesk.com/education.**

To download free* student versions of Autodesk 3D products, including Autodesk® Inventor™ Professional and Autodesk VIZ software and sample curricula, join the Autodesk Online Community at **www.autodesk.com/edcommunity.**

To learn more about Morse High School and Bath Regional Vocational Center, visit **www.bathpublicschools.com.**

> Project-based classes provide a way for our students to meet state requirements to graduate, in a way that's really fulfilling for them as individuals. You can see them light up with the possibilities for the future when they start solving real problems with professional tools.
>
> —Cindy Harris
> CAD Instructor
> Bath Regional Vocational Center
> Bath, Maine

*Free products are subject to the terms and conditions of the end-user license agreement that accompanies download of the software. The software is for personal use for education purposes and is not intended for classroom or lab use.

Autodesk®