JEFFCO PUBLIC SCHOOLS

Building Bright Futures

Success Spotlight

COLORADO Department of Education

STORIES OF PROMISING PRACTICE

Problem-Based Learning: How Jeffco Public Schools is Revolutionizing Career and Technical Education

JEFFCO PUBLIC SCHOOLS *has honed its approach to preparing students for an array of postsecondary options; problem-based learning has become a focus in middle schools and career and technical education (CTE) at high schools.*

Grant Euler, Jeffco's STEM (science, technology, engineering, mathematics) coordinator, refers to himself as "an evangelist for this work." Euler has helped oversee a move away from the view that CTE is for "those other kids" not headed for college, and toward a realization that technology-focused education benefits everyone, and leads to highly marketable skills.

"CTE used to be viewed as exclusively the building trades, woodshop, auto-body work, welding," Euler said. "Today it's all about video editing, graphic design. It's all tech-focused. Businesses tell me they have plenty of people who know how to run a lathe, but today people need to know how to program it as well."

Jeffco Public Schools is the second-largest school district in Colorado; with an enrollment of 86,708 students spread over 800 square miles spanning the Denver metro area and close-in mountain communities. Schools in Jeffco range from inner-ring suburban, with high numbers of low-income students of color, to affluent suburban schools, to semi-rural schools in small mountain towns. Students of color comprise one-third of the Jeffco student body, and 30 percent of Jeffco students are eligible for subsidized school lunches, a proxy for poverty.

Although the two campuses of Warren Tech comprise Jeffco's estimable flagship CTE school, the district has moved in recent years to instill technology-focused CTE classes in schools throughout the district. In middle schools, Jeffco encourages using problem/project-based learning (PBL) as a way to engage students in thinking about possible career pathways.

> "We offer CTE pathways, classes and project based learning experiences everywhere. This program is not a school specific program. We've figured out how to make this work anywhere and in many different ways."
>
> *Grant Euler, STEM Coordinator*
> *Jeffco Public Schools*

One middle school and one high school have stood out for their innovative and trailblazing approaches to problem-based learning and CTE, respectively. This case study will focus on work being done on problem-based learning at Bell Middle School in Golden and career and technical education innovations in career academies at Green Mountain High School in Lakewood.

These two schools provide models for what Jeffco officials would like to see happening in all district schools in coming years.

"The idea here isn't that we are preparing students to go out into the world and contribute," Euler said. "They can contribute right now, not some day in the future. Our goal is to transform schools into a partner producing goods and services for the larger community."

Bell Middle School Objective

Bell Middle School wasn't exactly struggling five years ago, "but the life was trickling out of it a little bit," Susan Arntson, Bell's STEM director, recalled recently.

That began to change when a group of Bell Middle School parents visited the school to offer some pointed suggestions about the school's curriculum. "We have a lot of parents who work in STEM fields, and this group's message was they wanted us to increase the rigor" of Bell's STEM-focused classes, said Arntson, who was a teacher at the time.

What ultimately resulted from that meeting was the iSTEM (innovation STEM) program, a rigorous STEM pathway at Bell that uses what the school calls "problem-based learning" to engage students.

Strategy

Getting iSTEM to where it is today was a gradual process. After that meeting with the parent group, Arntson and five STEM colleagues went to city officials in Golden and told them of their ambitions to transform the school. The city responded with a $20,000 start-up grant, which they used for professional development. Some went to an Air Force STEM boot camp. Others attended a STEM conference on the east coast.

They also studied the Buck Institute's guiding principles on project-based learning (the more common name for what Jeffco has dubbed problem-based learning), because they quickly came to believe that effective STEM education had to be rich and deep.

When iSTEM launched only about 60 students signed up for the unknown, untested pathway. But it has gained steadily in popularity (see results section below).

Euler, the self-described district "evangelist" for STEM, CTE and project-based learning, said a project must fit three requirements. First, it has to follow the Jeffco curriculum. The curriculum is so rich that "no one has time not to" follow it, he said.

Second, projects must be cross-curricular. "How do you incorporate music and art, or math and social studies?" The exact combinations aren't as important as making sure the combinations exist in a meaningful way, he said.

Finally, a meaningful project has to include "something going on outside the classroom. It can't be paper-and-pencil only." Authentic experiences in the real world add depth and also create early linkages to CTE.

Where a given school is located determines the kind of real-world experiences a student might gain, Euler said. So, for example, a school in southern Jeffco might have a relationship with the United Launch Alliance, while a school in Golden or Wheat Ridge might forge a relationship with local city government.

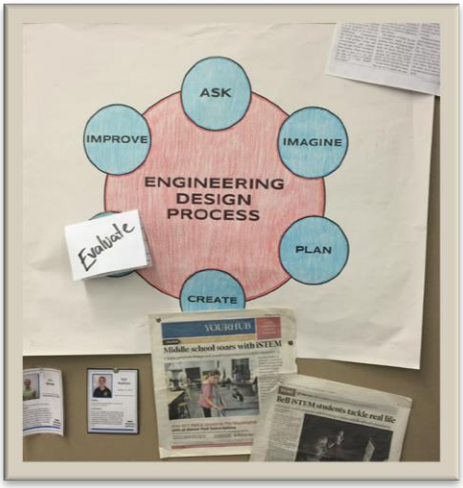
On a sunny May morning, Kelsen and Ella two Bell sixth-grade girls, showed visitors their project, which fit all three requirements. Using MIT Media Lab's Scratch Studio simulation software, the girls built a piñon juniper woodland ecosystem simulation. Under one simulation, animations showed how floods, fires, droughts, and other natural occurrences can be healthy and beneficial for an ecosystem. A second simulation showed how those same natural events can devastate an unhealthy ecosystem.

Kelsen and Ella exuded enthusiasm for the project, talking over each other as they explained how they built the simulation and what it taught them about the impact humans have on natural systems.

Euler explained why Jeffco prefers to call this style of learning problem-based rather than project-based. “Problem goes deeper: what is the problem you’re trying to solve?” he said. “A project was always the dessert. Problem-based learning makes PBL the main course.”

Over time, the Bell staff’s thinking on how to implement problem-based learning evolved, centered on what Arntson referred to as the four Cs: critical thinking, collaboration, communication, and creativity.

Although some teachers initially worried that the new focus on PBL would be an add-on, detracting from their focus on teaching to standards, Euler and Arntson stressed that projects support the standards work.



“They are tied together philosophically,” Euler said. “We are teaching to standards – always, always, always.”

Posters throughout the school remind students of the necessary steps to implement a meaningful project: Ask. Imagine. Plan. Create. Evaluate. Improve. And that’s what students and teachers alike do in offerings ranging from hydroponics to a class where students learn how to build phone and computer apps.

Results

Today, half of the school’s 800 students choose iSTEM for their middle school education. iSTEM has become so popular that students from outside the Bell attendance area seek admittance. “We could easily bring in another 50 kids,” Arntson said, if the school could hold them.

To get an idea of why iSTEM is so popular, consider a recent experiment conducted by engineering teacher Jesse Swift and his class. They decided to launch a weather balloon filled with 28 experiments, and equipped with a global positioning system (GPS) so they could track its progress and an avalanche beacon to help them find it once it came down.

“What I really like about this is that it’s a project that lets students experience something without worrying about whether an answer is right or wrong,” Swift said in a student-made video about the project. “Instead, it’s what is the best decision” about what to try next?

The class went out to the eastern plains town of Deer Trail to launch the balloon on April 8. To get it off the ground they had to remove some of the experiments and the GPS to lighten the load.

The balloon came down the next day in a farmer's field in Tryon, Nebraska, 300 miles northeast of Denver. Initially, Swift was going to drive out and retrieve it himself, but when students got word, parents joined in and caravanned the kids to aid in the retrieval.

In recent years, the school has worked to ensure that there is gender and racial balance in iSTEM. It has been a challenge, Arntson said, to recruit students of color into iSTEM. But a concerted effort has brought the numbers up, though challenges remain.

"Some kids from impacted environments have outside demands that make it hard for them to keep up," Arntson said. Some have parents who work multiple jobs, so they have to head home as soon as the school day ends to care for younger siblings. This keeps them out of the rich after-school offerings that augment the curriculum.

The gender balance has improved as well over time. Today about 40 percent of iSTEM students are female. Arntson proudly points out that iSTEM has a higher proportion of female students than does the nearby Colorado School of Mines.

The success of iSTEM has also lit a fire under the traditional pathway at Bell. "iSTEM was so rigorous that it was making the traditional side look not as good, so they have upped their game," Arntson said. It's now common to see PBL and collaboration among teachers from different departments in traditional classes.

> "They combine the PBL with the CTE learning. We're starting to see businesses and community members really look at school differently and reach out to us with meaningful internships."
>
> *Grant Euler, STEM Coordinator*
> *Jeffco Public Schools*

Green Mountain High School Objective

Green Mountain High School has been a fixture in the suburban city of Lakewood for 43 years. Nestled against the foothills of the Rockies, it enjoyed a solid reputation as a strong, comprehensive high school for most of its history.

But eight years ago, "we were in the middle of a dark time here," said current principal and Green Mountain alumna Colleen Owens, who was a teacher at the school then. "The culture was not good. There was animosity between teachers and the administration." Students read the tea leaves and fled the school in droves, knocking its population down from 1,600 a decade ago to a low of 1,089 five years later.

District leaders took a close look and decided something needed to change, and they were willing to dedicate funds to make that happen.

Strategy

Thus were born the Academies at Green Mountain High School. Under the new structure, now in its eighth year, students can enroll in one of four academies, each of which offers either three or four pathways to pursue. Students can complete multiple pathways, move between academies, or choose a traditional course of study entirely outside the academies.

The academy structure grew out of the work of a committee of 125 teachers, community members, and students formed during that "dark time."

"It was very organic, and not at all top-down," Owens said. "We came up with a common vision, and we went for it."

The committee studied a number of school models, and became enamored with the academy model. There were hundreds of such schools on the east and west coasts, Owens said, but few if any in Colorado.

Committee members concluded that academies would engage students by allowing them to layer a course of study that especially interested them on top of the classes required for high school graduation in Colorado.

They decided on four academies: arts, humanities, and performing arts; business and global studies; health and human services; and STEM. Each academy would provide strong links to the outside world by providing career and technical education opportunities in all pathways – internships, job shadowing, and opportunities to be mentored by a professional in a student's field of interest.

Each academy would also offer a rich assortment of Advanced Placement (AP), honors, and concurrent enrollment courses.

"Traditionally, CTE has been very separate," Euler said. "Schools like Green Mountain are making connections that didn't exist before."

The academies launched in 2009 with only the freshman class given the option to enroll. This year, the fourth class of seniors to go through four years of the academy structure received their diplomas.

Results

Owens, who has been principal of Green Mountain for five years, was recently named the 2016 Colorado principal of the year for her role in making the school a jewel in the Jeffco crown.

Almost immediately after the academies formed, the enrollment slide halted and then reversed. Green Mountain is still far from its enrollment high-water mark, but this year 1,150 students attend the school.

A federal Perkins grant has enabled Green Mountain to hire a full-time academy coordinator, a position the school clearly needs. The slickly produced academies course and pathways guide is 36 pages packed with enticing course offerings.

Here's a small sampling of the options available to Green Mountain students:

- In arts, humanities, and performing arts, video production, broadcasting, 3D solid modeling drama stagecraft, public speaking, journalism, school senate, chamber orchestra, concert band, painting, digital photography, and architectural design.
- In business and global studies, Green Mountain gear and printing (a full-scale business that produces all of the schools t-shirts, hats, banners, and other gear), banking, and finance, international business marketing, world language, AP psychology, business law, sociology.
- In health and human services (the most popular academy because of multiple opportunities at nearby St. Anthony's hospital), anatomy, AP psychology, biology, and chemistry, forensics, statistics, fitness and conditioning, and a multitude of internships.
- In STEM, intro to agriculture (including a popular Future Farmers of America chapter), animal science, landscape and turf management, greenhouse management and floriculture, veterinary science, principles of engineering, robotics engineering, AP computer science principles, and internships.

There are many more such courses in each of the four academies. Owens and her team have recruited more than 250 business partners from the community, many of which actively participate in the academy pathways.

Students have landed for-credit internships in places as varied as Lockheed Martin, 9News, National Renewable Energy Lab, and hair salons.

Each pathway offers four credits, out of 23 required to graduate. Owens said most students enrolled in academies complete at least four pathways, with some finishing as many as six. This year

70 percent of graduating seniors will complete one or more pathway. And this year, for the first time, all completed pathways will be documented on students' transcripts.

Earth Day provided a sterling example of how industry is partnering with the school to provide hands-on learning and internship opportunities for students. Several landscaping companies that belong to the Associated Landscape Contractors of Colorado trade association sent crews to the school to help re-landscape a large swath of land near a side door that had fallen into weedy disrepair.

In that single day, a dozen students worked side by side with landscape professionals pulling weeds, laying down mulch, planting trees and shrubs, installing a sprinkler system and generally beautifying the area. Becky Garber-Godi, the association's communications director, said companies donated $15,000 worth of materials to the project.

"We've all been very excited to work with the school," Garber-Godi said. "This fits our mission to build a landscape workforce, and the school's commitment to CTE."

The landscape contractors group is also working with the school to develop a landscaping pathway at Green Mountain. Courtney Mayo, who teaches agriculture education classes at the school, has participated in a training Garber-Godi's organization has provided that helps teach kids how to install a sprinkler system.

Green Mountain also offers students the opportunity to produce senior capstone projects. Four years ago, when capstones launched at the school, 16 seniors chose to participate. This year, more than 60 seniors are presenting capstone projects.

Owens' experience in bringing academies to Green Mountain has convinced her that "as a country, this is an area we really need to look at more deeply."

"Students would say that this education feels relevant to them, and gives tem a clearer sense of what to do next. Our students experience real engagement, not just in-classroom, but outside too."

"We figured out a way to make this work anywhere and in many different ways. We have so many different things going on in so many different schools, and that's really what is needed now for our students as they graduate into the world."

Grant Euler, STEM Coordinator
Jeffco Public Schools

How to Do It: Tips for Implementation of Problem-Based Learning

1. Objective

- How can problem/project-based learning (PBL) be added to existing curriculum to engage students on a deep level?
- How can industry partners add relevance to career and technical education (CTE)?

> "Truthfully so many businesses in Colorado right now are asking for those kinds of skills and certification for kids, and so we've tried to respond to that and really be thoughtful in how we offer it and grow our programs."
>
> *Grant Euler, STEM Coordinator*
> *Jeffco Public Schools*

2. Preparation

- Visit the Buck Institute's website for information on PBL.
- Read up on Bell Middle School's iStem program.
- Visit MIT Media Lab's Scratch Studio.
- Watch the video about Bell's weather balloon experiment.
- Visit Green Mountain High School's website to read about academies.
    I. Read about Green Mountain's senior capstone projects.

3. Implementation

- At a district level, make sure there is a senior official who is "an evangelist" for CTE and PBL. This person must have a passion for making these changes and must be able to instill this passion in others.
    I. This evangelist must lead the process of developing planning and implementation documents, so that administrators, principals and teachers understand how PBL and CTE will roll out gradually and systematically.
- At a classroom level, teachers need to be made to feel safe about a fundamental shift in teaching methodology, from a "sit and get" classroom to something much more interactive.
    I. Principals need training on how this changes the way in which teachers are evaluated.
    II. Teachers need to feel like "a warm blanket has been put around them," Jeffco's Grant Euler says, so they feel safe in stepping outside their comfort zone.
- Consider how to open your school to the business and non-profit communities to afford students rich opportunities to gain hands-on experience in a wide variety of possible career fields.

4. Assessment/reflection

- What worked?
- What did not work?
- How can it be adjusted?