

## Promising Practice in Action: *Integrating Science Content Across CTE Programs*

Caribou Regional Technology Center<sup>1</sup>  
Caribou, ME  
Lynn R. McNeal, Director

- **Location:** Independent building adjoining Caribou High School
- **Student population:** 360
- **Sending schools/districts:** 6
- ▶ **Program focus:** Partnership with Caribou High School to integrate science into six CTE Program Areas—industrial construction, large equipment maintenance and operations, commercial driving licensure, automotive repair, auto-body (collision), and welding. Students get one science credit for chemistry upon completion of each two-year program, thus fulfilling the requirement.

### Getting Started

Alan Dearborn began as a science teacher “on loan” to the Caribou Regional Technology Center during the 2002–03 school year. The Caribou High School science department quickly recognized the need for a third year of science to ensure all students met the Maine Learning Results, but also recognized that it would be impossible for CTE students to fit in their schedules. Academic achievement was a concern, but so was student access to CTE programs. A plan, supported by the high school principal, Dave Ouellete, and the CTE director, Lynn McNeal, was devised to integrate academic science content into CTE program area classrooms. Dearborn would be relieved from teaching high school courses for two periods a day to go and work with CTE teachers and teach science content that related to the CTE program area. The assessments for high school students and CTE students were the same Level II assessments.

CTE teachers responded positively—they did not see this as a loss but as a way to enrich their programs through relevant science content. Science was integrated into six two-year CTE program areas: industrial construction, large equipment maintenance and operations, commercial driving licensure, automotive repair, auto-body (collision), and welding. By participating in those programs for two years and by having Dearborn provide science-related instruction for one period per week, one year of students’ three-year science requirement was waived. Four years into the process, Dearborn is still working on new lessons to add to the 87 lessons already developed. A sequence of lessons is keyed to teach and/or reinforce physical science concepts. Dearborn tracks the lessons that were taught in each class each year to document the chemistry concepts that were addressed. Several lessons are the same content-wise across programs but the application piece differs. For example, demonstrating an understanding of energy in chemical bonds might be explained through a study of adhesion/cohesion/bonding and glues and/or through an examination of the combustion of vapor. All lessons developed to date are plotted on a lessons/standards grid so the content of the academic integration can be easily checked.

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<sup>1</sup> This mini-case study is based on conversations with CTE and high school staff, CTE students, review of documents, and data collected during an onsite visit in June 2006.

## What It Looks Like in Action

Science lessons began with high interest activities that give Dearborn immediate credibility with the students. He then connected the activity to the science behind it and worked with the students to apply the concepts directly to what they were working on in the shop. For example, he exploded dust with the auto-body class and did vapor explosions, discussing why bonds harden and paint dries. Dearborn planned the curriculum so he can “hit the same topic in different ways over the course of the year.” In the large engine class, for example, he worked with air–fuel ratios during several sessions in a variety of different ways. Dearborn had the same planning period as the CTE teachers—8<sup>th</sup> period—so he could meet with the instructor, review upcoming terminology, discuss what was happening in the shop, and plan to connect the lesson as much as possible to the “lab situation” the shop provided.

## Keys to Success

The director and the CTE teachers agreed that Dearborn has great rapport with the five instructors, possesses a lot of knowledge, relates with the students, works well with the teachers, and is very flexible. Informal interviews with some of the CTE instructors generated the following comments:

*Electricity, that was a good one. I think this year we really did it well—we actually wired up the playhouse and talked about current and electricity. It makes sense when it is relevant.*

*He’s a real hands-on kind of guy—that’s what it takes to make it happen. He takes the science and does a real good job of relating the science end of it. The kids end up using a lot of the terminology.*

*I think he is very well received—you know, he is like Bill Nye the Science Guy—he makes it real and he definitely keeps their attention. If I had had the science when I was in the program, a lot of the stuff I found out over time would have been learned right here—stuff I had to learn by reading the trade magazines. I think this gives students a concrete base to work from.*

## What Students Said

Students seemed to agree. One auto-body student said that the science “relates a lot of the time” to the trade area. That same student gave an example: “He’s teaching us a lot about bases and acids and I learned that overcharged batteries can explode. We have to know that kind of electrical stuff when we are working on interiors so that’s helpful.”

*I like it much more than [another science class] I had to take. He talks about things that relate like pigment and paint. One time he had four vials—town water, a base, an acid, and salt water—and asked us to predict which would take the fastest to rust a piece of metal. It was the town water—acid rain eats up the metal—within a week it rusted all the way through. I couldn’t believe it.*

*I liked the lesson on the electrical stuff. We took wires and three lights and did serial hookups and saw different ways to hook them up. So that was good—we could learn what to do with the electrical under the dash after a crash—it really relates to what we do.*

## **Use of Data**

The CTE center uses CTBS and TerraNova test data to determine where students are in terms of academic skills. All students are expected to score at least 85% on the basic competency test. Tutoring services are provided in response to students' needs.

## **Other Academic and Literacy Supports in Place**

All students at Caribou High School read and journal for 45 minutes during their English period on Thursdays—something that the CTE director said has made a positive impact on the school's culture. According to McNeal, there is “a culture of high expectations in place.” There has been a collaborative staff development team made up of high school and CTE teachers and administrators dating back to the mid-1980s.

## **Evidence of Student Learning**

Hard evidence of student learning is more difficult with the assessment program on “pause.” Initially, Dearborn developed and tested Level II assessments with academic and vocational students. For example, on an assessment for acids and bases, Dearborn indicated 80% of the CTE students met the standard. “But the instruction was different—over here, I could tie it to auto-body, etc.” He noted that 85–90% of the CTE students were able to build a 3D model of characteristics of the periodic table and answer questions about it. The third assessment on conservation of matter also had a high student success rate. There was a shared sense among administration, teachers, and students that learning science this way is a good approach. Some students asked to take their science through the CTE center instead of taking another academic science class.

## **Next Steps**

- Develop a way to track evidence of learning of science concepts and of success given that the assessment system is currently paused. Add science items to CTE tests in the six program areas.
- Keep developing lessons that are increasingly keyed to what CTE instructors need.
- Work on articulation of science concepts addressed during the junior versus the senior year.
- Think about how to increase the literacy development piece of the science lessons—this would help improve learning and assessment. Use of quick writes, coding when reading, note taking graphic organizers, vocabulary strategies, and anticipation/reaction guides may fit well.
- Work on sending school reciprocity, agreements, and credits.
- Make sure all CTE program areas have at least two different trade journals; enough for a class set. Use these to reinforce or augment the science lessons.

*For more information, contact Lynn McNeal, Director, or Alan Dearborn, Caribou High School Science Teacher.*