

# ISSUE BRIEF

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## TRENDS IN EDUCATION RESEARCH

### Infusing Academics into Career and Technical Education

by Joshua Haimson, James R. Stone, III, and Donna Pearson

*Mathematica's Academically Focused Career and Technical Education project, sponsored by the U.S. Department of Education, helped curriculum developers infuse more math into two career and technical education (CTE) curricula and enhance their teacher professional development plans. In addition, the project assessed the feasibility of conducting a rigorous evaluation of these kinds of curricula. This brief reviews lessons from the project, focusing on challenges faced by those seeking to incorporate more academics into CTE curricula.*

#### Enhancing the Curricula

Policymakers and educators have focused on enhancing the academic content of career and technical classes since the late 1980s. Federal education initiatives, including the Tech Prep program launched in the 1980s, the School-to-Work program in the 1990s, and the recent vocational education accountability provisions of the Carl D. Perkins Act reauthorizations, have pursued this objective. One strategy has been to expand opportunities for students to apply academic skills in career-focused classes, with the goal of reinforcing and clarifying the value of these skills.

Schools encounter at least two challenges in using CTE to reinforce students' academic skills. First, the availability of high quality, comprehensive curricula that integrate CTE and academic content is limited to a few occupational areas. Teachers who want to deliver an integrated academic and CTE class must develop new materials or collect and adapt existing materials. Second, even in areas with high quality, integrated curricula, professional development opportunities for learning how to use these materials are limited or costly.

As part of its study, Mathematica helped identify two CTE developers to modify two curricula—the Automotive Youth Educational System (AYES) and the Ford

## BACKGROUND ON CURRICULA

Automotive Youth Educational Systems is a partnership of auto manufacturers, dealers, and high schools that encourage youth to consider careers in retail auto service and prepare them for entry-level positions.

The Ford Partnership for Advanced Studies is an interdisciplinary high school program, developed by Ford Motor Company Fund in collaboration with Education Development Center, that focuses on business, economics, engineering, and technology.

Partnership for Advanced Studies (Ford PAS) (see box). Both are considered “replacement” curricula, which can take the place of an entire auto technology or business curriculum. This approach has potential to expand the use of integrated CTE and academic instruction without requiring teachers to develop new materials.

To enhance the math content of the AYES and Ford PAS curricula, developers retained subject matter experts to expand math content, as well as CTE experts in auto repair and business to suggest changes. Mathematica worked with the developers to organize focus groups of teachers to review the modified curriculum, pilot test lessons in CTE classrooms, and assess drafts of revised student and teacher guides.

The study suggests the following lessons for others attempting to enhance the academic content of CTE curricula in the future.

**Substantial time and effort are required.** Incorporating academic learning into CTE curricula can be time-consuming, even for experienced developers. Developers and expert reviewers identified the need to substantially modify the occupation-specific content of the CTE curricula to provide a clearer rationale and context for math problems. These changes went well beyond the original plans. In addition, refining materials and securing feedback from teachers required more time and effort than anticipated.

**A broad range of experience in math, CTE, and curriculum development is valuable.** Many types of skills and experience proved useful, including background

in curriculum development as well as mathematics and CTE-related expertise. Both developer teams in the study relied on math subject matter experts to draft most curriculum changes. In addition, CTE experts played a critical role in identifying opportunities to incorporate more math by helping the subject matter experts understand the CTE context and terminology. They also helped clarify the relevance or implications of math problems. Both teams used curriculum consultants to help improve organization, flow, and readability of student and teacher materials.

#### **Securing feedback from CTE teachers is helpful.**

CTE teachers provided useful feedback at two key points. First, focus groups offered helpful comments on early curriculum drafts. These groups confirmed the value of the math covered in the lessons, suggested modifying some math terminology to make it consistent with CTE content, and noted the importance of adding activities that engaged students.

Second, the curricula were pilot tested in two CTE classrooms with instructors providing feedback after delivering the integrated lessons. They suggested ways to (1) demonstrate the importance of the math application to motivate students, and (2) refine professional development plans to enhance teachers' math content knowledge. Because of unexpected shifts in classroom schedules and the need to cover material other than the enhanced curriculum, teachers took longer to implement the refined modules and were not able to teach all of them. It is advisable to allocate extra time for pilot testing, recognizing that teachers will not be able to implement all lessons as quickly as desired.

**Planning for professional development should start early.** Effective professional development can mean the difference between a curriculum that sits on the shelf and one that teachers implement. For math-enhanced CTE curriculum, professional development is important because most teachers need to refresh their math skills and master new content. Some in the focus groups were unfamiliar with the math or unsure how to teach it. Even those comfortable with math may need help to learn strategies for teaching integrated material effectively.

One developer demonstrated the value of beginning professional development early. The developer sponsored a workshop in which facilitators showed CTE teachers how to teach the math, using drafts of the revised curricula. Teachers provided feedback

on additions to the teacher guide as well as professional development activities that would be helpful. Through this effort, the developer learned what types of teacher support are helpful and how much time is needed for workshops focused on math content.

Both developers are offering workshops to help CTE teachers learn how to implement the math-enhanced curriculum. It is not clear how many teachers will choose to participate. The workshops are free, but teachers pay for their own time and travel or secure funding from their districts to cover these costs.

## **Looking Forward**

An objective of this project was to determine if curriculum developers, with assistance, could help achieve the goals of the Perkins Act by producing viable, integrated CTE curricula with the potential to improve students' math skills. Although these curricula have not been formally tested, the project demonstrated the feasibility of supporting developers' efforts to infuse academic content into CTE curricula. The project also highlighted the substantial time, effort, and expertise needed for some curriculum integration efforts.

In the end, several policy-relevant questions remain. First, while both curricula are disseminated nationally, it remains unclear how many teachers will take advantage of them. Both developers are offering workshops to help teachers deliver the integrated curricula. States could facilitate these efforts by encouraging districts to use integrated curricula and supporting professional development. Second, policymakers need to determine whether and how much these new curricula improve students' math skills relative to either the existing curricula or other curricula available. Finally, policymakers and educators should consider whether and how they can facilitate the development of integrated CTE curricula, given the time and resources required. Public subsidies may be helpful in fostering development and assessment and encouraging the professional development required to use the new curricula. The federal government, state consortia, and foundations could each play a role in these efforts.

For more information on this project, contact senior researcher Joshua Haimson at (609) 275-2208, [jhaimson@mathematica-mpr.com](mailto:jhaimson@mathematica-mpr.com). James R. Stone, III, is director and Donna Pearson is deputy director of the National Research Center for Career & Technical Education. Mathematica® is a registered trademark of Mathematica Policy Research, Inc.

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