

Advanced Career STEM Pathways: A Learning Experience for Students and Teachers

By Gene Bottoms, Senior Vice President, Southern Regional Education Board

What goes on in the Advanced Career (AC) classroom? A lot of math; intense researching and reading; and most importantly, learning — the type of learning that remains in the forefront of students' minds as they apply it to practical, purposeful projects. This learning is relevant to educational pursuits as well as good paying, productive careers that meet the demands of the workforce in students' states and communities.

The Southern Regional Education Board (SREB), in partnership with eight states, created the AC pathway programs of study — eight pathways of four courses each — to prepare students for the modern workforce. At SREB's annual High Schools That Work Staff Development Conference in Louisville, Kentucky, I led a panel discussion on "Advanced Career STEM Pathways: AC Teachers' Perspectives," featuring three teachers who lead AC's STEM- and project-based learning curricula in their schools. The panel members were:



Kimberly Cortines,
AC Aerospace Engineering
teacher, **Oak Hill High
School,** Oak Hill, West Virginia
(Fayette County Schools)



Kevin Hoover, AC Informatics
teacher, **Carroll County
Area Technology Center,**
Carrollton, Kentucky (Kentucky
Community and College
Technical College System)



Sara Smith, AC Clean Energy
Technology teacher, **Goose
Creek High School,** Goose
Creek, South Carolina (Berkeley
County School District)

Q&A

Here is part of that discussion.

What makes the AC curricula so different from other courses?

Cortines: It's hands-on and relevant to the real world. There is much higher engagement from the students. Once you get them started, they are self-directed.

Smith: It promotes student engagement. They are invested in their learning, because they have to do more without me telling them answers. I like the research dimension. There's a product at the end. It's not a test. There is definite investment in the learning, or students won't be able to complete the project.

Hoover: I like the concept of 21st-century workforce skills. So many different issues come up, and students have to solve the problems. In other business classes, there is lecture, examples and then student practice. The teacher was always the resource. Now, I ask questions so they can find the answer. They own the learning, the process and the outcome.

AC offers fully developed pathway programs, with a four-course sequence in each pathway. What is the advantage of this for the teacher?

Smith: The lessons are complete. I can focus on assisting my students to do their best, read a website and pick out the important information, or determine if an internet reference is valuable. I teach them how to proofread. I focus on things they need to learn when they go to college and enter the workforce.

AC pathways are aligned with college-ready and career-ready standards. Do you find that these projects draw from the high school's core literacy and mathematics standards?

Cortines: They hit all four main content areas: science, math, literacy and technology. I'm a math teacher — the strategy for reading complex technical materials is already done for me, so I don't have to figure out the best way to approach that.

Hoover: My students have had algebra, geometry and all this math, but they never really had the experience of applying it to real-world problems. When they come in and do projects that use math, they already know it. If not, it's a good introduction, because they will use it in the future for another project

How does project-based learning change your role as a teacher?

Smith: I'm not actively lecturing them every day. They are teaching themselves; they are learning together. It takes me from the front of the classroom, and puts students at the center of learning.

Cortines: Students love school if they can do project-based learning. They don't like to sit and listen to a rambling 30-minute lecture. They have the tools to get the information they need to complete the assignment. Students are smart and resourceful. When they are doing something in which they are interested, they get it done.

Hoover: It's different for both the teacher and the student. Students have to work together. There are few places where teamwork is not important. Project-based learning carries forward from project to project. I'm more of a facilitator, pointing students in the right direction. Some teachers struggle with this, because they want to be the expert in the room. You can't be the expert on everything. You have to rely on students to solve problems.

What does it mean to provide students with a blended learning experience?

Cortines: They are doing hands-on learning, researching, listening to lectures and participating in group work — parts of which they are individually accountable. They get a taste of everything they may encounter in college or on a job site. That's important. If kids are just in a classroom to give information back to a teacher on a test, or listen to a lecture and memorize — that's not getting it.

Smith: The math is at a higher level than in their math classes, in the context of a real-world problem. That increases the value of that portion of each project. In clean energy, they have chemistry, physics and biology, all in one course, so they pull a lot from their science classes. The literacy part is the most challenging, because students are so used to reading fiction and novels in English class. There is not much nonfiction or technical reading. It's different to transition from writing a story or an essay to writing a technical paper with technical language in a set format.

What role do technology and software play in class?

Smith: We use the technology and software in every project. Students use National Instruments' myDAQ programs to collect data. The software and devices give them something they will see outside of high school, whether directly in a job or in college.

Cortines: We use the Computer Aided Design (CAD) program to do simulations. That is an excellent tool to supplement math in their regular classes. It teaches complex subject matter. These kids are actually building the solids and figuring out how to slice them out.

How does the written assessment at the end of each project help you determine your students' mastery?

Cortines: It tells me if I've emphasized the correct themes; what students have learned; what they did not learn; what I need to reteach or work into the next project. It also gives me an opportunity to suggest revisions to the curriculum.

Smith: The tests show me where kids struggle. I find items they should have gotten from the research component of the project. That tells me that I need to help them do research to learn what information is really important. They are used to being told what to learn. So, I have to get better and continue to teach them — with each project — how to read through the background materials and really focus on the important information.

Hoover: I know that they get it! I know if we need to spend more time on something. Did they learn the math and the literacy? That's a good barometer. They know what they need to learn up front. They struggle in the first few projects, but then they understand why it is important to do the research.

How does each project provide students a window into a career field?

Smith: In every project, there's the engineering piece. There's a big biology and biotech component in the bioreactor project, and a big chemistry component in the Course 1 biodiesel project. There are huge sections of data collections in all projects. My students are involved in career days at an elementary school, so they research jobs related to clean energy to introduce the young students to the career.

Cortines: They get to see what skills they are good at. They develop leadership skills. That gives them a place to start. Some of these kids have never been a leader. When their projects go well, the other kids appreciate that. It gets them thinking, "Maybe I'm good at this; I'm going to think about a career where I can use these skills."

Hoover: I have students who want to be software engineers say, "I knew I enjoyed technology, but I didn't know I'd enjoy it this much," or "I didn't know what I wanted to do with technology, but now I want to go in a certain direction." Others say, "I like technology, but this isn't for me."

How is the summer professional development different, and what are its strengths?

Cortines: You get the opportunity to do everything the students do. You experience failure, so you know how kids will feel; you get an idea of what to expect; you can watch how others handle it. The master teachers will only help you so much; they model how you should facilitate your class.

Smith: Clean energy is an interest of mine, so the summer class is two weeks of playing. Then there's the learning. You will have someone who knows nothing about a topic, and someone who knows everything about it. We look at student papers and talk about technical writing. The literacy coaches work through the skills that the kids need to be successful with literacy-based assignments. Teaching literacy is not our strongest skill. You see this as part of the curriculum.

Hoover: You are actually doing the work that the students have to do. I'll see problems beforehand so I can anticipate. It's also nice to show them an example of what I did. It helps the students because they see teachers as human; they are not perfect.

Have you brought in professionals in your community to collaborate on the course curriculum?

Hoover: Yes, at the end of every project, professionals from various fields give feedback. People who run their own businesses or people who have been hired to run businesses for others provide feedback too. It's one thing when a teacher tells students something, but it's another when they hear it from the people who work in a profession every day.

Do you have local two- or four-year colleges that have programs of studies which these curricula might fit into?

Hoover: We have an articulation agreement with Bluegrass Community and Technical College. Students get three credit hours for the first two AC courses and three credit hours for the third and fourth courses. When they are finished, they will have six college credit hours. They take a test at the end, but we hope to move toward a dual credit model.

The Eight Advanced Career Pathways:

Aerospace Engineering
Clean Energy Technology
Energy and Power
Global Logistics & Supply Chain Management
Health Informatics
Informatics
Innovations in Science and Technology
Integrated Production Technologies

How Advanced Career Works

AC combines core college-ready academics and technical studies with hands-on STEM- and project-based assignments that center on a defined career field. When a high school signs up to participate, SREB provides:

- Ready-to-implement AC course work for students
- Access to the tools and technology needed to complete projects
- Comprehensive training and professional development for teachers
- Counseling for careers orientation
- End-of-course assessments
- Assistance to implement AC as a STEM academy

Want AC in your community? Email AdvancedCareer@SREB.org. Or you can call Gene Bottoms, Dale Winkler or Zach Riffell at (404) 875-9211.