STEM and career Exploratory classes

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BY DARRELL CHASE

Districts face increasing pressure to improve students' mastery of curriculum in the fields of science, technology, engineering and mathematics (STEM). Yet the number of students enrolling in science and math courses drops dramatically in middle and high school. At Sylvester Middle School, Chinook Middle School and Cascade Middle School of the Highline School District in Burien, Washington, we are trying to change this trend with an emphasis on STEM and career exploratory options infused into Career (Business) and Technical Exploratory Education classes. At our middle schools in the district, we strive to ensure success for every student by providing an environment that each student needs for intellectual challenge and for social and emotional development. As a result, each student will be taught how to communicate effectively, obtain and use information, solve problems and engage in active, lifelong learning.

An integral part of the program of studies in Washington's schools, for the middle school level in business and technology education, is a new but "old" basic for all students. It involves the application of business, mathematics and science concepts in such technological systems as, but not limited to, business software applications, desktop publishing, communications, construction and structures, manufacturing, aviation, communications, transportation, biotechnology, robotics, and power and energy. Students work individually and in teams to solve problems related to business and technology—its evolution, systems, tools, techniques, utilization, and social and cultural significance. Students are taught how to utilize, interact and live in a rapidly changing, highly technological society.

CTE Meets an Increasing Demand

In the last two decades, the source of a state's competitive advantage has become rooted in its workforce's ability to apply knowledge globally. High-wage/low-skill manufacturing jobs have moved abroad, and technological innovations are incorporated into every facet of the American workplace. In this new economy, all workers need to have a good formal education, be able to apply theoretical and analytical knowledge, and have the capacity to engage in continuous learning (ACT, "Ready for College and Ready for Work: Same or Different?"). A strong career and technical education (CTE) system is again critical to a state's economic success, but CTE remains saddled by a second-class image. Research shows that CTE engages and motivates students by offering them real-world learning opportunities, leading to lower dropout rates and greater earnings for high school graduates (Gordon, 2008). When CTE courses also incorporate more academic rigor, especially incorporating STEM learning, research shows that student achievement significantly increases ("Building a Science, Technology, Engineering and Math Agenda," National Governors Association, 2009). These findings suggest that CTE should be an important aspect of a state's broader middle and high school redesign strategy. CTE has the power to engage and motivate all students by giving them diverse opportunities to learn in applied settings.

Sylvester and Chinook

Sylvester and Chinook middle schools' technology education classrooms have been designed to give students the opportunity to explore many different areas of technology. Business and technology learning stations (modules) have been developed with a self-directed set of instructions for each station. This instructional program provides students with daily, hands-on experiences that enable them to focus on becoming technologically literate, active problem solvers, to explore career opportunities and business software, use math and science, and identify the educational avenues in which to pursue their interests.

The goals of our classes are to provide for academic, technical, exploratory and social growth of the students at the middle school level in business and technology education. This employs involvement with computers and business and technology tools, machines, materials and systems. It enables all students to derive meaning from concrete experiences in research and design that result from the integration of business, mathematics, science, humanities and engineering concepts.

Modules students are able to choose from at Sylvester Middle School

(Many of the same modules are also taught at Chinook Middle School)

First Quarter Business Education

- General Computer Knowledge and Windows Operating System
- Beginning "Qwerty" Keyboarding
- Graphic Arts: Drawing Programs/ Digital Cameras/Scanners/ Computer Animation
- Microsoft Excel: Database/ Spreadsheet/Graphs
- Microsoft PowerPoint: Multimedia Presentations/Communication
- Microsoft Word: Written Communication
- Microsoft Publisher: Desktop Publishing/Communication

Second Quarter Technology Education

- Research, Design and Safety in Transportation
- Research and Design on Structures and Bridges
- Structural and Design Engineering of Buildings
- Career Exploration Using Career Cruising
- Introduction to Flight/ Aviation—Aerospace
- Rockets and the Science Behind Them

We strive to provide instruction that enables students to make informed and meaningful educational and career choices by developing in each the ability to:

- Define business applications and technology.
- Explore business and technology systems.

Having awareness of various career choices (and the postsecondary education required for that career) supports students'

readiness for the future.

- Utilize a problem-solving strategy to solve business- and technology-related problems.
- Use the basics of science and math in solving real-world problems.
- Develop a positive self image by being successful in hands-on experiences.
- Develop skills in the safe use and operation of computers, basic hand tools, machines, materials, and processes of business and technology.
- Identify talents, abilities and interests in business and technological fields.
- Develop cognitive (mental), psychomotor (physical), and affective (ethical) problem-solving skills by researching and developing, designing, producing, operating and analyzing business and technology systems.
- Identify various business- and technology-related careers, the opportunities in these fields, and their educational requirements.
- Appreciate the nature of technology and its impact on the individual, society and the environment.

Cascade Middle School Shows off Project Lead The Way

In 1997, Project Lead the Way (PLTW) was created to address the nation's shortage of STEM professionals. Today, there are 3,000 PLTW schools in 46 states. PLTW has designed a tightly aligned system of curricula, professional development and assessments. All courses are project- and problem-based learning experiences in which students apply math and science to real-life engineering situations. After taking foundation courses in the eighth, ninth and 10th grades, students move into specialized courses such as civil engineering and architecture in the 11th and 12th grades while completing a full sequence of math and science courses. Each course offers entire curriculum units built upon national math, science and technology standards. Teachers must become certified during a two-week summer workshop at an affiliated university before teaching the program. PLTW also has developed a series of standardized end-of-course examinations that can result in early college credit. Other PLTW programs exist in aerospace engineering programs and biomedical sciences.

At Cascade Middle School, we are teaching four modules that are from the PLTW's Gateway to Technology, which incorporates science, math and engineering as well as leadership components. The modules are: design, modeling, automation and robotics. Design and modeling uses solid modeling—a mathematical technique for representing solid objects—to introduce students to the design process. Utilizing this design approach, students understand how solid modeling has influenced their lives. Students also learn sketching techniques and use descriptive geometry as a component of design, measurement and computer modeling using the Inventor program. Using design briefs or abstracts, students create models and documentation to solve problems.

In automation and robotics, students trace the history and development of automation and robotics. They learn about structures, energy transfer, machine automation and computer control systems. Students acquire knowledge and skills in engineering problem solving and explore requirements for careers in engineering.

Suggestions for Starting More Middle School Programs

Having awareness of various career choices (and the postsecondary education required for that career) supports students' readiness for the future. Students must also have the knowledge and skills needed to access the learning paths that lead to attaining career goals. We believe this should be started at the middle school level. In order to meet the middle school CTE program goal of providing opportunities for career exploration and STEM education, middle schools should:

- Give the highest priority to expanding CTE curriculum options, especially in the area of design and technology where math, science and engineering concepts and career exploration can be merged into the program. This expansion would help eliminate the current misalignment of the middle and high school curriculum and begin to effectively prepare students for both high school math and science and also CTE courses.
- Implement a variety of exploratory and STEM modular programs (like those listed above in the sidebar on page 35) that can target students across ability or achievement levels, which will provide additional opportunities to strengthen students in objectives examined in standards of learning tests.
- Allow students to explore a wider range of CTE topics. While we believe priority should be given to the topics studied most intensively in high school—technology education, math and science—the family and consumer science program can also be improved with the use of modular units.

Helping Students Succeed

All mid-level students can be expected to benefit from this approach, especially those students in grade eight who are preparing to transition to the high school and who are beginning to make decisions about the direction their high school and postsecondary education will take. By using this approach we can help ensure that education is helping to engage students in STEM learning so that they may go on to pursue STEM careers and provide the workforce with qualified workers. T

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