

Inspiring the Next Generation of Engineers

At Puget Sound Skills Center, Students Meet Tough Standards and Succeed Doing What They Love

Puget Sound Skills Center

Customer Success Story

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—Rich Marshall, Instructor,
Engineering Design
Puget Sound Skills Center
Burien, Washington



Project Summary

Puget Sound Skills Center (PSSC) in Burien, Washington, is the first career and technical education (CTE) skills center in the state, and one of the largest. From its beginnings in 1966 in an abandoned school district building, the Skills Center has expanded to serve 18 high schools in five school districts—as well as private- and home-schooled students—in South King County. Entry-level job skills training for high-school juniors and seniors emphasizes application and context for skills, use of state-of-the-art technology, relevance to the workforce, and transition to college and work after graduation from high school.

Engineering design instructor Rich Marshall strives to inspire his 11th and 12th graders and build their confidence through self-directed study and collaboration with professionals on real-world projects. Marshall's students work in their field of choice and demonstrate mastery using 2D and 3D software tools like those that professionals use to evaluate their design ideas, solve design problems, prepare proposals, and present complex concepts.

Marshall brings both industry and business perspective to instruction. As Marshall's career progressed through all aspects of manufacturing—from sales of construction supplies to design and manufacturing of rigid insulation—he focused increasingly on state-of-the-art computer-aided design (CAD) and manufacturing (CAM). Marshall had the opportunity to supervise PSSC students' participation in his firm's education enrichment program, and discovered his passion for teaching.

For the last 13 years, Marshall has been instructing prospective engineers whose potential for success is evident in the college credits they earn through the U.S. Department of Education-sponsored Tech Prep program while still in high school, as well as the wages they earn upon entering the workforce. Students' personal achievements attest to the value of professional-caliber technology and self-directed study as well: Marshall says his students with attention disorders show special aptitude for drafting and animation.

The Challenge

With a vision to be the school of choice for career preparation and technical education, PSSC administration and instructors are working to reach all high-school students in South King County with the right programs to fit their needs.

The goal comes with challenges for PSSC instructors such as Marshall. Students' high-school instructors and parents continue to advise them that the only route to career success is through academic instruction and enrollment in a college or university. In Marshall's opinion, this conventional wisdom is false and does a disservice to students.

"Career and technical education is a great option that also can lead to professional success," says Marshall. "Students who aren't planning on going to college or aren't ready to do so need to know that they have alternatives."

The Solution

At the core of Marshall's approach to instruction are three elements: the opportunity for self-directed study; professional-grade, cutting-edge technology; and partnership with real-world engineers and firms. In his experience, these are the building blocks for learning that is driven by exploration and inspiration, rather than repetition.

Initially, Engineering Design students complete an introduction to CAD with tutorials. Then they choose the job they would like to pursue, and begin to study topics such as drafting, pre-engineering, industrial design, animation, machining, or rapid prototyping. They use software tools like those that professionals use, such as AutoCAD® software for 2D design and Autodesk® Inventor® Professional software for 3D digital prototyping. Marshall's classroom also has a small mill, a printer for rapid prototyping, and the hardware, graphics cards and

monitors that students would find in a professional environment—even a couple of drafting tables so that they get a basic understanding of manual drawing.

3D Visualization Required for All Projects

Marshall requires all of his students to master 3D technology, regardless of the field they choose to pursue. As soon as they complete introductory CAD instruction, Marshall's class learns to use Autodesk® VIZ software to model and animate their designs, see whether their ideas create the aesthetic effects they want, and make changes.

"Now 3D visualization is adding value in so many industries, from consumer products to entertainment and advertising," Marshall explains. "I see it as an essential skill that is also compelling for students. For example, digitally modeling mechanical, electrical and plumbing aspects of a building with AutoCAD® MEP software helps my class understand what they can do with design, development and drafting—which encourages more students to enroll in classes."

Collaboration Builds Confidence, Communication Skills

Collaboration is an essential part of instruction, as well. Students work with companies and organizations on real-world design challenges, to complete the state's senior project requirement. The assignment also provides Marshall's class with firsthand experience that is both empowering and compelling, as students find out the difference that their work can make.

Marshall cites the work his students have done using tools such as Revit® Architecture software to address community needs. For example, one female student designed a walk-through of a new design for a chancery, which helped that congregation



understand and approve the design. Other students have worked on upgrades to low-income housing in the Washington town of Des Moines, which secured federal funding. And as Washington real estate values rose with the rest of the West Coast, several of Marshall's students helped design affordable modular homes that the PSSC construction class built and sold to the public to site and install.

Students also find out how relevant their skills can be for pressing problems and business opportunities. Five of Marshall's students participated in a conceptual visualization using AutoCAD, Autodesk® 3ds Max® and Autodesk® Architectural Desktop software applications for a business and office park being developed at a decommissioned nuclear power facility about 40 miles west of the state capitol in Olympia. Students were provided with civil engineering drawings of two sites for the Satsop Development Park project, and asked to generate several student-developed office and industrial buildings on the property, as well as develop a fly-through visualization of the park—including both of the property's 650 foot high cooling towers.

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In the course of the two-month-long project, Marshall observes that his students worked at a fairly slow pace until the final deadline approached and the finished visualization was due to the Satsop Development Group. "It wasn't until the last week that they felt a sense of urgency and had to put in some all-nighters to get the work done, but they also gained an appreciation for the kind of pressure that professional animators face, and learned how to work under that pressure."

In addition to building and construction, PSSC students' work supports regional infrastructure and services. Marshall points to members of his classes who will work with the King County metropolitan transit district to learn how to survey, get GPS coordinates and plot them using AutoCAD® Civil 3D® software. Other students are interviewing police and fire personnel to develop preliminary plans for project architects' review, as these expanding public agencies assess their need for larger facilities using AutoCAD, Architectural Desktop and Revit Architecture software.

Standards Support Life-long Learning

His passion for teaching high-school students to do something they love also has driven Marshall to take the lead in the development of state instruction standards for introductory CAD, advanced CAD, architecture, mechanical, electrical and civil drafting. With the blessing of the Washington Office of the Superintendent of Public Instruction, Marshall and numerous instructors and business people worked with and looked at standards established by the American Design Drafting Association and at state standards from Florida, Connecticut, Ohio, North Carolina, and other states to create a set for Washington. These were adopted in 2004 as the Washington State Drafting Frameworks, which align with national Certification of Industrial Programs codes.

Marshall explains, "With statewide drafting standards in place, students can pursue specific competencies without having to redo coursework or learn requirements that vary by city or county." Marshall's 11th and 12th grade students can earn college credit at five state colleges and the Art Institute of Seattle while still in high school, without having to repeat instruction.

The Result

In fact, PSSC students can earn up to 36 community college credits, by taking Marshall's classes. To earn credits, Marshall's students must meet Mastery Program requirements based on the Marketing Education Resource Center (MarkED) program, demonstrate leadership capabilities, and meet Washington State Drafting Frameworks standards. Marshall's students fulfill these criteria by preparing drawings, tracking their projects and the proposals they put together, creating a portfolio of their work, and making oral presentations.

Marshall also instills a sense of personal responsibility in his students by requiring each one to assign a letter grade to his or her work. "It inspires students to challenge themselves," he explains. "When they have to meet their own high standards, they tend to step up to the plate."

Follow-up data indicates that students who complete PSSC instruction tend to go on to academic and professional success. According to the skills center, more than 85 percent have secured full- or part-time work and pursued post-secondary education simultaneously.

Marshall is also pleased that one quarter of the students in his winter 2008 class are female. "Young women need to understand that these are jobs that they can do and earn the same wages as men, and they have an advantage in the case of public works

and municipal projects," Marshall says. He encourages junior-high students who visit the skills center to pursue design engineering, as well.

Marshall believes that individual students' achievements as well as cumulative data send an important message to students and parents about the practical application of their studies. He says, "People forget how vast the range of opportunity is for engineers: They test products and build parts, not just finished products. I tell my students if they want to do something, they need an applied degree, and if they love what they're doing, it's not work."

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To learn more about Puget Sound Skills Center, visit <http://www.pugetsoundsc.org>.



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