Founded in 1997 to address the shortfall in students’ science, technology, engineering, and math (STEM) skills, Project Lead the Way (PLTW) has built a project-based learning program on a foundation of Autodesk® 3D software. PLTW programs engage middle- and high-school students with the software tools and challenges solved by engineers every day, bringing significant improvement in students’ prospects for academic and professional success.

Another Moonshot

In 1957, Americans had their comfortable sense of world leadership dashed by the launch of the Sputnik I satellite. Caught off guard by the Soviet Union’s technical achievement and fueled by public anxiety about national security, Congress responded by passing the National Aeronautics and Space Act, which led to the creation of the National Aeronautics and Space Administration (NASA).

On the 50th anniversary of Sputnik’s launch, the declining math and science skills of U.S. students are cause for concern among the nation’s scientists, educators, and political leaders. Their fears are well founded at a time when new and pressing issues—from climate change to dwindling natural resources—demand new solutions to sustain quality of life and national prosperity. In fact, University of California, Berkeley, Chancellor Robert J. Birgeneau has called green energy this generation’s “moonshot.”

Despite national, state, and local efforts to improve STEM education, student retention in higher-education science and engineering programs is dwindling. Project Lead the Way cites an estimate from the National Center for Educational Statistics that attrition exceeds 50 percent nationally. It’s a paradox that suggests the need for a program or resource beyond academics, to engage and sustain students’ interest in STEM-related studies and careers.

Students Tackle a Wide Range of Real-Life Challenges

Project Lead the Way was founded to address this issue. Formed in 1996, the not-for-profit organization partners with public schools, institutions of higher education, and the private sector to promote pre-engineering courses for middle- and high-school students. Ultimately, PLTW aims to increase the quantity, quality, and diversity of engineering technologists graduating in the United States.

The PLTW curriculum is based on a proven three-pronged methodology comprising activities-based learning, project-based learning, and problem-based learning, or APPB-learning. It’s designed to make math and science relevant for students by engaging them in hands-on, real-world projects to which they apply the skills they’ve learned in the classroom. Courses expose students not only to mechanical and electrical engineering, but also to other engineering disciplines within building and construction and civic infrastructure.
PLTW aims to increase the quantity, quality, and diversity of engineering graduates in the United States.

At the core of PLTW instruction is Autodesk design software. Used by many engineers working in these fields worldwide, Autodesk software gives PLTW participants the chance to gain real-world experience using the same tools that professionals use. Niel Tebbano, vice president of PLTW, says that Autodesk applications met the organization’s high standards for curriculum software, which led the organization to select Autodesk as a vendor partner in 1996. “We periodically evaluate software and vendor options, and Autodesk software continues to remain the best choice, with the widest breadth of technical capability compared to other engineering software applications,” says Tebbano.

Autodesk’s mission is to provide PLTW students access to the essential tools that can help them learn to solve problems in product development, industrial design, architecture, building structure and systems, and the roadways, pipelines, and utility networks that serve the public. Since Autodesk software is prevalent in more than 1,300 North American institutions of higher learning, PLTW participants who choose to continue their education get off to a good start. Those who decide to go straight to work after graduation also benefit from familiarity with the technology used in the field.

Teachers Learn to Transcend Boundaries
Skilled instructors also are essential to PLTW’s success. The National Science Board reported that the number of certified science and math teachers at the middle- and high-school levels has declined. At the same time, a 2007 U.S. Department of Education study underscored the importance of instructor training, revealing the negative impact on student learning that results when teachers are not properly trained on educational technology. Recognizing that because of scarce funding and resources, schools and educators may be underprepared to teach pre-engineering, PLTW provides a two-week professional development immersion experience for each course instructors will teach. Educators are equipped with the knowledge and

Some 200,000 students are expected to have completed PLTW coursework in the 2007–2008 school year alone. In addition to the anecdotal experiences of thousands of instructors, research shows the positive effect of PLTW and Autodesk’s partnership on tens of thousands of students.

2 U.S. Department of Education, “Effectiveness of Reading and Mathematics Software Products: Findings from the First Student Cohort” (March 2000).
Students Take to Engineering in 3D, Naturally

So what happens when students and teachers take part in PLTW’s pre-engineering curriculum with all the rigors of applied math and science?

At Preble High School in Wisconsin’s Green Bay School District, kids are using Autodesk 3D mechanical design software to model and then build super-mileage and electrotron vehicles that are winning top prizes in state competitions. They also participate in regional and national competitions, including Skills USA, where Preble’s architecture students took home first place in the “Green Home” category.

Meanwhile, Bloomington Kennedy High School students in Minnesota are designing, building, and selling a motorcycle through “Project Chopper.” Inspired by their experiences, students exhibit an infectious enthusiasm. In Minnesota, Nashwauk-Keewatin High School’s first 17 PLTW pupils were so enthusiastic about the program that enrollment in the next class more than doubled.

And PLTW participants’ skills are flourishing. According to Northridge Middle School teacher Pamela Raines in Minnesota, students have “hypertext minds,” grasping concepts easily when presented with 3D software and project-based assignments. Preble High School teacher Jeremie Meyer observes that his mechanical engineering and manufacturing students naturally gravitate to 3D and model-based technology—tools that he believes educators need to learn and teach to prepare students for their future.

Meyer and colleague Ryan Freude, who teaches civil engineering architecture and architectural drafting courses, find their pupils’ success rates soar with the PLTW curriculum and Autodesk software. Freude’s students provided a local engineering firm with professional renderings of a medical facility under development, simulating what the building would look like at completion. Preble students have gone on to internships and jobs in engineering and manufacturing at companies such as Boeing and John Deere.

Experts Hold up PLTW Programs for Model Education

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At Duke University, Dr. Gary Ybarra says PLTW students are more likely to succeed in college engineering courses because they know how to use Autodesk software applications. Ybarra is Professor of the Practice, Electrical and Computer Engineering, Pratt School of Engineering. He notes that the PLTW experience helps kids hit the ground running in college. Research shows that program alumni tend to achieve a 3.0 grade point average or better while enrolled in four-year university programs.¹

According to Atlanta’s Southern Region Education Board (SREB), PLTW students showed higher achievement in mathematics and a higher level of math and science course completion. They also were more engaged in using technology and teamwork to solve real-world problems. SREB judged PLTW to be richer than conventional career and technical studies programs currently offered and cited the importance of completing an academic sequence and pre-engineering courses together.1

More PLTW graduates intend to pursue advanced and engineering studies, as well. According to TrueOutcomes, 80 percent of these high-school seniors plan to attend college, compared to 65 percent of seniors nationwide. More than half plan to enroll in engineering or engineering technology programs in college, while the national average is just 10 percent.2

Just as notable is the effect on groups that are historically and consistently underrepresented in engineering occupations. PLTW reports that Hispanic and African American student participation is double these groups’ representation in postsecondary engineering programs nationwide. While women make up just 20 percent of engineering graduates and 10 percent of the engineering workforce, these figures could change as female students’ enrollment in PLTW pre-engineering courses outpaces the nation’s women who are pursuing mechanical, electrical, and computer engineering degrees.3

These measurable differences in student participation and achievement suggest that PLTW has come up with a formula for success that doesn’t depend on academics alone. Coursework based on real-world engineering challenges and professional-grade Autodesk 3D software tools drives pupils’ capabilities beyond the levels made possible solely by academic or physical instruction.

It’s no wonder that the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine concluded that PLTW should serve as a model for pre-engineering educational programs.4 Greater numbers of new scientists and innovators would make discovering answers to climate change, disease, and poverty seem less like a moonshot and more of a sure thing.

Project Lead the Way coursework introduces students to many different types of engineering—and opens their minds to potential career paths. PLTW curriculum components include the following:

- Introduction to Engineering
- Digital Electronics
- Principles of Engineering
- Computer Integrated Manufacturing
- Engineering Design and Development
- Civil Engineering and Architecture
- Aerospace Engineering
- Biotechnical Engineering

Learn More
To learn more about Autodesk software and Project Lead the Way, visit www.autodesk.com and www.pltw.org.