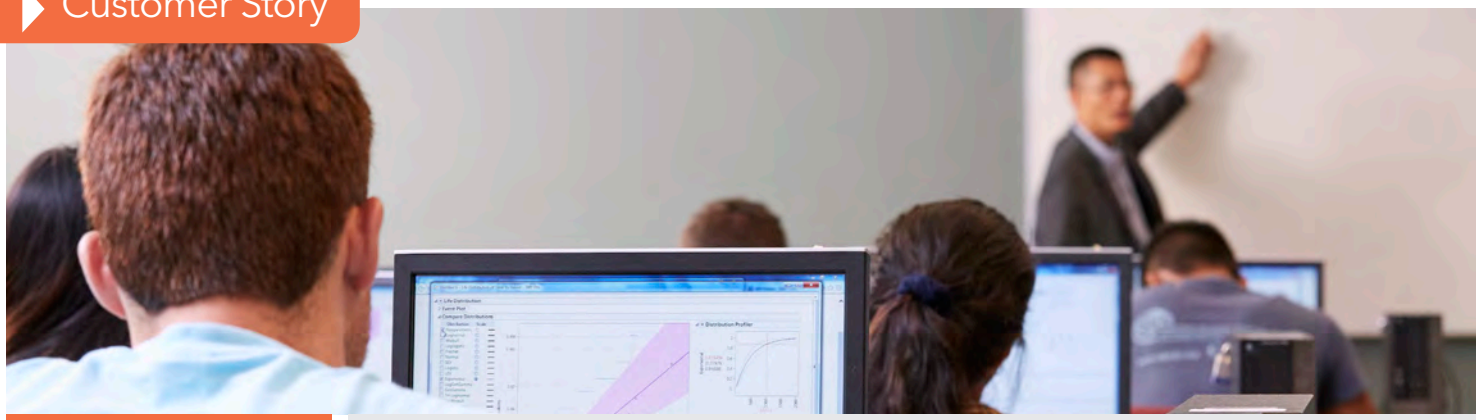
Customer Story



California Polytechnic State University

Challenge

Undergraduate engineering majors overwhelmingly end up in industry careers after they graduate. Preparing them to not only be successful, but to bring real innovation and a global worldview to their fields, is no easy task.

Real-world analytics unite engineering classrooms on two continents

Professor Jianbiao John Pan uses JMP® to prepare his engineering students for industry careers in an increasingly globalized marketplace

When undergraduates at California Polytechnic State University (Cal Poly) choose to major in engineering, they know they're destined for a career in an industry that rewards innovation – especially when that innovation is supported by precise and accurate analytics. As such, readying students for employment in the engineering industry has become the cornerstone of 21st century pedagogy in university-level engineering classrooms around the world.

Jianbiao John Pan, PhD, is a Professor of Industrial and Manufacturing Engineering at Cal Poly and an expert in microelectronics and electronic packaging. Each quarter, he teaches undergraduate courses on a range of topics, from the introductory level Engineering Test Design and Analysis to advanced courses including Quality Engineering, Design of Experiments, and Reliability Engineering.

Like others leading the way in engineering education, Pan seeks to energize his students through project-based active and cooperative learning.

Interactive JMP® analyses facilitate engaged learning in quality, reliability and design of experiments

The thinking goes that if you contextualize theory by couching it in relatable problems, students will be more intellectually stimulated. Bringing applications and hands-on practice into the classroom, however, also necessitates the ingress of new technologies that are more accessible to students.

For Pan, that means introducing his students to JMP statistical discovery software. "JMP is very powerful and has such dynamic graphics – I like that very much," he says. "You can easily manipulate the scale and type on both the y and x axis, and even change the font size. You have so much freedom." In his course on engineering test design, Pan says he relies on analysis models – Distribution, Fit Y by X, Matched Pairs and Fit Model. In more advanced courses, he adds design of experiments, quality and process, and reliability and survival capabilities to the mix.

By projecting JMP during his lectures, Pan demonstrates step-by-step even the most advanced concepts with interactive visuals that students can then replicate on their own, whether they follow along in JMP on a laptop during class or use JMP to complete assignments. "For many homework tasks and projects assigned in my classes," Pan says, "students will create plots and visualizations." These outputs are great not only for reporting and communicating results but also for deepening students' understanding of the concepts and theory underlying real-world challenges they may later come across while working in the manufacturing industry.

For example, in a recent final project, several students examined the crystallinity of polylactic acid, a versatile, biodegradable thermoplastic polymer produced from renewable sources like corn and sugar cane. The polymer's biodegradability makes it an ideal, more environmentally sustainable alternative to traditional commodity applications like food packaging and disposable tableware.

Since polylactic acid can be processed at a variety of degrees of crystallinity, Pan's students sought to identify and investigate those

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factors affecting crystallinity – and therefore also its potential as a viable alternative plastic – by varying polymer grade, dwell time and cooling rate. By analyzing the interactions of their variables, they were able to state with a high degree of confidence that material and cooling rate have a significant impact on crystallization.

"JMP helped us set up a series of experiments – and made the whole project go smoothly and quickly by enabling us to plan things ahead of time," says student David Otsu. "Because JMP is so easy to work with, we were able to adapt to changes and problems that arose as we went through that process."

Engineering students from the US and China work together to design solutions to real-world challenges

At Cal Poly, learning isn't confined just to the classroom or to campus alone. In addition to teaching during the school year, Pan leads a unique study abroad program for aspiring engineers known as Engineering in China, for which Cal Poly has partnered with Zhejiang University of Technology (ZJUT) in Hangzhou. In the summer of 2016, 11 students from Cal Poly and 22 from ZJUT studied quality engineering and worked together in teams to identify and solve real-world engineering challenges using JMP.

Over the course of the summer, Pan instructed students in the basics of quality engineering and ANOVA. Students then built upon what they learned by preparing a team project. In it, they were asked to identify an engineering problem for quality improvement within an existing system – a hospital, bank or transportation network, for example – collect data pertinent to that problem, analyze the data, prepare a presentation and produce a report.

When one team observed lengthy wait times and an inefficient registration system at a local hospital in Hangzhou, the students saw an opportunity for improvement. They set about engineering a solution that would improve the patient experience. To do so, they began by collecting data: number of patients by time of day, duration of wait times and length of time spent in the registration process. Students then analyzed the data and made improvement recommendations.

The learning objective of the program, Pan says, is not only to have students apply learned engineering concepts to existing systems but to "educate our students to function in a multidisciplinary international team environment. It's a very, very important skill – being able to work in a team, understand different cultures and navigate language barriers." And it's one that is especially relevant in the field of engineering today.

"It's so important to calibrate with the industry," Pan says. With so many global manufacturing companies looking to hire top-notch graduates, Pan ensures that his students leave Cal Poly with the right toolkit – a superior understanding of engineering concepts and theory, a demonstrated ability to work collaboratively with peers of all backgrounds and nationalities, and experience with the technologies of the trade.

Preparing students to enter industry careers after graduation

Several years ago, after attending a series of American Society for Quality chapter meetings in San Jose, CA, Pan says, he noticed that many industry leaders were using JMP. "I thought it would be a good idea for our students to know how to use JMP because so many of them will go on to work for these companies in California. "We provide the training, and with their knowledge of the software once they graduate, our students will have an advantage."

Solution

Students are encouraged to use JMP both in and out of the classroom.

Results

By using JMP to teach engineering, Pan prepares his students for competitive careers at some of the top companies not only in the US but around the world.

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