Educator's Corner : Agilent in Education

Case Study: Valencia

Systematic Innovation Engages Students at Universidad Politecnica de Valencia

Since 1990, Universidad Politecnica de Valencia (UPV) in Spain has embraced a new teaching ideology that addresses a global trend in engineering education. That is, to offer integrated engineering curricula to prepare graduates for society and the workforce.

Educators at UPV determined that when students are prepared with core engineering fundamentals and the ability to solve open-ended problems--as well as strong communications skills--they are equipped for future success.

This is the goal of UPV's industrial technology baccalaureate engineering program.

Students Drive Need for New Teaching Process

Educators at UPV received a wake-up call from their engineering students in the late 1980's. The course attrition rate within the engineering program was extremely high. This brought the president's team and educators together as a group to assess new teaching methodologies and new ways of ensuring students' success.

Their team developed a program, Educational Innovation Project (PIE), that makes students active participants in their education.

The educators team examined their course records to evaluate students' performance in their engineering classes. For example, in 1986, sixty-nine students were participating in one group of UPV's engineering program. After the first year, fewer than half of the students (30) went on to second-year engineering courses. After the second year, nine out of thirty students advanced to third-year engineering courses. After four years in the industrial engineering program, only five completed degrees. Eleven more students completed the degree program after six years of study. The faculty team began examining the factors contributing to the students' high attrition rate.

"With the traditional educational model used by UPV, students spent a lot of time in lecture and minimal time designing and applying what they learned in their theoretical coursework," said Enrique Ballester, director at the Technical Industrial Engineering School. "This traditional model allowed students to be passive recipients of their education--a fault of the

system, not the students. When it came time for students to take exams, they tended to cram and repeat the information we delivered in lecture. They did not have a full understanding of the concepts and theory we presented."

Professor Carlos Camina (c) designed a specific PIE for UPV's electronic engineering degree and worked with professors Roberto Capilla (l) and Juan M. Martinez Rubio. (r)

"With rapid changes and advances in technology, what students are learning today will be obsolete in five years. the ability to apply engineering fundamentals and then solve problems for specific technologies is crucial to our graduates' success." - Professor Roberto Capilla--Universidad Politecnica de Valencia

New Teaching Methods Prepare Students for Changing World

After examining the limitations of some teaching methods, the president's team decided that one of the key components of PIE needed to be an approach that would engage students in the learning process.

They designed PIE to create an educational process where students spend more than half their time applying theory to practical applications through hands-on lab work. Students have the ability to integrate theory and other ideas presented by their professors into their electrical designs. From this they gain a practical understanding of how theory applies to industrial applications.

Professor Carlos Camina designed a specific PIE for an electronic engineering degree and worked with professors Roberto Capilla and Juan M. Martinez-Rubio to formulate this PIE around core goals:

- Educate students on essential theories and fundamentals
- Balance and align theory with practical applications
- Invigorate the learning process in the classroom
- Connect technical data with applications
- Integrate multi-disciplinary concepts--focus students on only one subject per day

Skills, Not Just Facts

"What we are doing is providing our students with the necessary tools to solve problems," commented Camina.

Professors now engage students in learning activities that are centered around classroom laboratories. This eliminates the distinction between problems and practices. The major premise is that all learning activities must be centered on applications that require students to apply theory and demonstrate an understanding of concepts.

Key features of this new way of learning include: posing questions about key concepts; emphasizing design exercises; intensifying the use of

computers with commercial electronic instruments; and integrating engineering with other disciplines.

Concepts and theories are first presented to students in a problem statement which offers a description of the objectives. Together, students and professor perform a general analysis of the concepts. Students then work on problems and check proposed solutions with the use of computers and other instruments in the lab. This leads to subsequent lab and design activities.

"This model represents a balance between theory and practice, and an applied approach to teaching technical studies. We encourage students to work in teams to boost their design capacity as well as their communication and interpersonal skills," said Martinez-Rubio.

Lab Work Replicates Real World Experiences

Working with industry-standard equipment--the same instruments students will use on-the-job, after graduation--is an integral part of UPV's learning experience.

Agilent has partnered with UPV for more than fifteen years. The relationship between the two is constantly growing, with UPV incorporating more of Agilent's electronic test instruments in its laboratory facilities.

Recently, UPV purchased electronic workbenches that include oscilloscopes, digital multimeters, frequency counters, function generators and power supplies. these instruments are networked with personal computers. this allows students to control instruments and record measurement data which is then analyzed using software packages such as Agilent VEE, Agilent's visual programming language.

President Justo Nieto at UPV has been instrumental in establishing and developing the vision for UPV's engineering program. "This experience has facilitated creativity and encouraged our students to generate new ideas.. Students now know how to build things, solve problems, and manage data," said Nieto.

Students Working Harder; Learning, Enjoying More

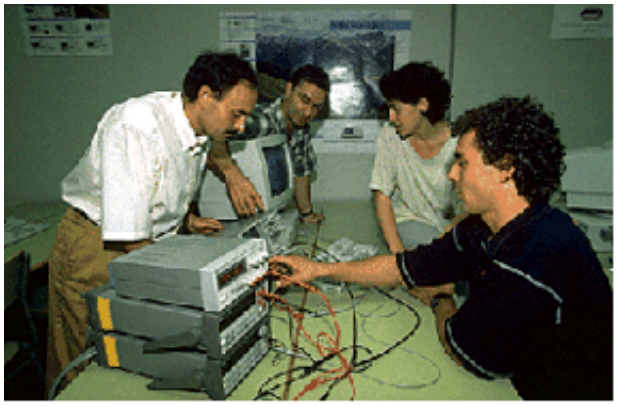
After establishing the PIE in the early 1990's, the faculty team noticed a dramatic increase in class participation and success. Surveys verified that students are happier with their courses under the new program.

With the continual evaluation process, students are also spending more time in teams preparing for courses and studying materials. Student Salvador Olivares Fuster comments, "The PIE program has been an important part of my learning. What I like most is applying theory to solve problems. In the lab, we use personal computers to control the Agilent test instruments. This helps us analyze signals and the circuits we are designing. We can make a signal adjustment and see the changes immediately. We can then go back to analyze, redesign and test new solutions--the kinds of things I hope to be doing at my first job."

Interdisciplinary Studies Planned for Future

Nieto alludes to upcoming changes for the twenty-first century. He states, "In the future, we will advance into interdisciplinary studies, and focus more attention on teamwork among students and faculty members, especially since teamwork is critical in industry.

"Students need knowledge of society, socio-economics, law, ecology and other disciplines in order to have a broad understanding of the world around them. By moving to more of an interdisciplinary education approach, our students will be technically strong and competitive."



By working in teams and devoting more time to hands-on work in the laboratory facilities, the quality of our students' learning has improved dramatically. "

Working with industry-standard test instruments they will encounter after graduation has been an important part of their learning experience." - President Justo Nieto Universidad Politecnica de Valencia

UPV students have the advantage of working with leading-edge industry-standard equipment that prepares them for real-world challenges. Agilent is committed to working with educational institutions to provide test and measurement equipment that helps prepare students with practical, creative, problem-solving abilities--and helps schools to:

Save Time
"When the equipment arrived, there was a booklet of ready-made exercises with it. We tried them and they were easy to use and efficient. They were definitely a time-saver for us."

Charlot Michel
Polytechnic University de Cergy
France

Save Money
"With the educational discount Agilent offers, it makes it difficult for other manufacturers to compete. It's not that other instrumentation is bad, it's just that Agilent basic instruments have such high performance for the money...there's no question what to buy."

Dr. Mardi Hastings
Ohio State University
Columbus OH

Stay Informed
"At Agilent, our commitment to education goes beyond providing products that replicate real-world lab environments. It includes services and support that include teaching tools, a World Wide Web site, Agilent journals, and other publications."

Marsh Faber
EMD Education Program Mgr.
Agilent Technologies

Stay Competitive
"Agilent offers us basic instruments that fit the needs of the under-graduate classroom, and because they are also industry standards, they best emulate the work environment."

Amin Karim
DeVry Institute of Technology
Oakbrook Terrace IL

For more information on Agilent's Education Program, products, services, and support, call:

U.S. 800.452.4844
Canada 800.387.3154