

## Hands-On Experience Helps Make Future Engineers

Dr. Jay Pinson, former Dean of the SJSU College of Engineering, saw that students needed problem-solving skills-especially hands-on experience-to become effective engineers. In rebuilding San Jose State's Engineering Department, Pinson developed relationships with the engineers responsible for Silicon Valley's successes.

Those engineers and entrepreneurs had been inspired to study engineering, by hands-on childhood experiences-whether working on farms and repairing water pumps, tractors and machinery, or in more urban settings, tinkering with mechanical objects and cars and building crystal radios.

These experiences were highly tactile: seeing how things work, and feeling them in handling screwdriver and wrench, pliers and probes. Sometimes these hands-on interests were hobbies, but often they were necessary to help families get ahead, or simply to survive. A few examples:

**Steve Wozniak** - Took top prizes for science projects at county fairs. Built his first computer when he was 13.

**Jennifer Doudna** - Berkeley biochemist who helped simplify genome editing - At age 7, she explored Hawaii's rain forests, fascinated by how things worked. A scientist's lecture on how cells turn cancerous inspired her.

**David Packard** - While still in grade school he built a radio. As an adult he remained a ham radio operator.

**Ed Ginzton** - At age 10 he built a crystal radio that failed to "work". Stored in a closet for six months, the radio worked-as soon as a local radio station was built in town.

**Persis Drell** - Stanford Linear Accelerator Center. Growing up, Drell met, some of the most famous of 20th century physicists, "and yet I was determined to be a mathematician." A college teacher made physics seem exciting to her. Now, using giant particle colliders, she studies elementary particle physics.

**Eugene Kleiner** - An apprentice toolmaker at age 15, he was immediately employed on immigrating to the United States. As an adult, he had a passion for restoring cars.

**Gene Amdahl** - As a teenager on a South Dakota farm without indoor plumbing, he designed a helicopter.

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In today's world economy, the energies of youth tend toward activities other than "vocational skills."

"At home, spare time is no longer spent doing things like dismantling gadgets, building model airplanes or taking apart old appliances with dad; there's no tinkering with cars, which are so computerized now you couldn't tinker if you wanted to. A 2009 poll showed one-third of teens spend zero time per week doing anything hands-on at all; the same as their parents. Instead, by one count, entertainment media eats up 53 hours a week for kids aged eight to eighteen." 1

Yet, man's history of innovation is linked to hands and the ability to grip tools.

"The conversation between hand and brain grew more complex, too. We advanced to the unique ability to visualize an idea, then create that vision with our hands. That's meant everything from developing tools to imagining airplanes to performing open-heart surgery." 2

The Tech Academy offers a productive alternative for summertime hours, engaging hands and brains in projects that also help build collaborative skills and a student's belief in his or her capabilities. These skills and capabilities are required by industries that depend on a mechanically inclined workforce.

"After NASA's Jet Propulsion Lab noticed its new engineers couldn't do practical problem solving the way its retirees could, it stopped hiring those who didn't have mechanical hobbies in their youth. When MIT realized its engineering students could no longer estimate solutions to problems on their own, that they needed their computers, it began adding remedial building classes to better prepare these soon-to-be professionals for real-world jobs, like designing airplanes and bridges." 3

At the Tech Academy, experienced teachers and college faculty, supported by industry professionals and college students, provide instruction in problem-solving techniques and current technology trends. In doing so, we offer middle school students an unique experience, an opportunity to envision what they might be doing when they reach a university:

"Students at Carnegie Mellon University asked to stay at school for a week after exams... so they could hang out and build things. Ed Schlesinger, a professor there, says that after a long period where theoretical work dominated at engineering schools, "when students talk to each other now, it's 'So, what cool project are you working on?' It's not enough to say I took these classes and got an A."

"Stanford University's Product Realization Laboratory, where students learn machining, welding and other hands-on skills, has seen membership jump to 750 from 450 over the past five years."  
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The Tech Academy of Silicon Valley is a hands-on, small group project experience-to expand a student's participation in math and science, and improve understanding of these disciplines for a world increasing relying on engineering and technology.

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