



A class

by

itself

A remarkable educational assignment enhances lives



BY ROYA JAVADPOUR

Nothing worthwhile comes easy, I warned my students on the first day of class in the graduate-level Technological Project Management course I teach. The class is part of the industrial and manufacturing engineering department's program at California Polytechnic State University in San Luis Obispo. The course project would require their full commitment because it would be a lot of work; however, it would be one of the most fun, valuable, and realistic adventures that they would experience during their education and possibly during their lifetimes.

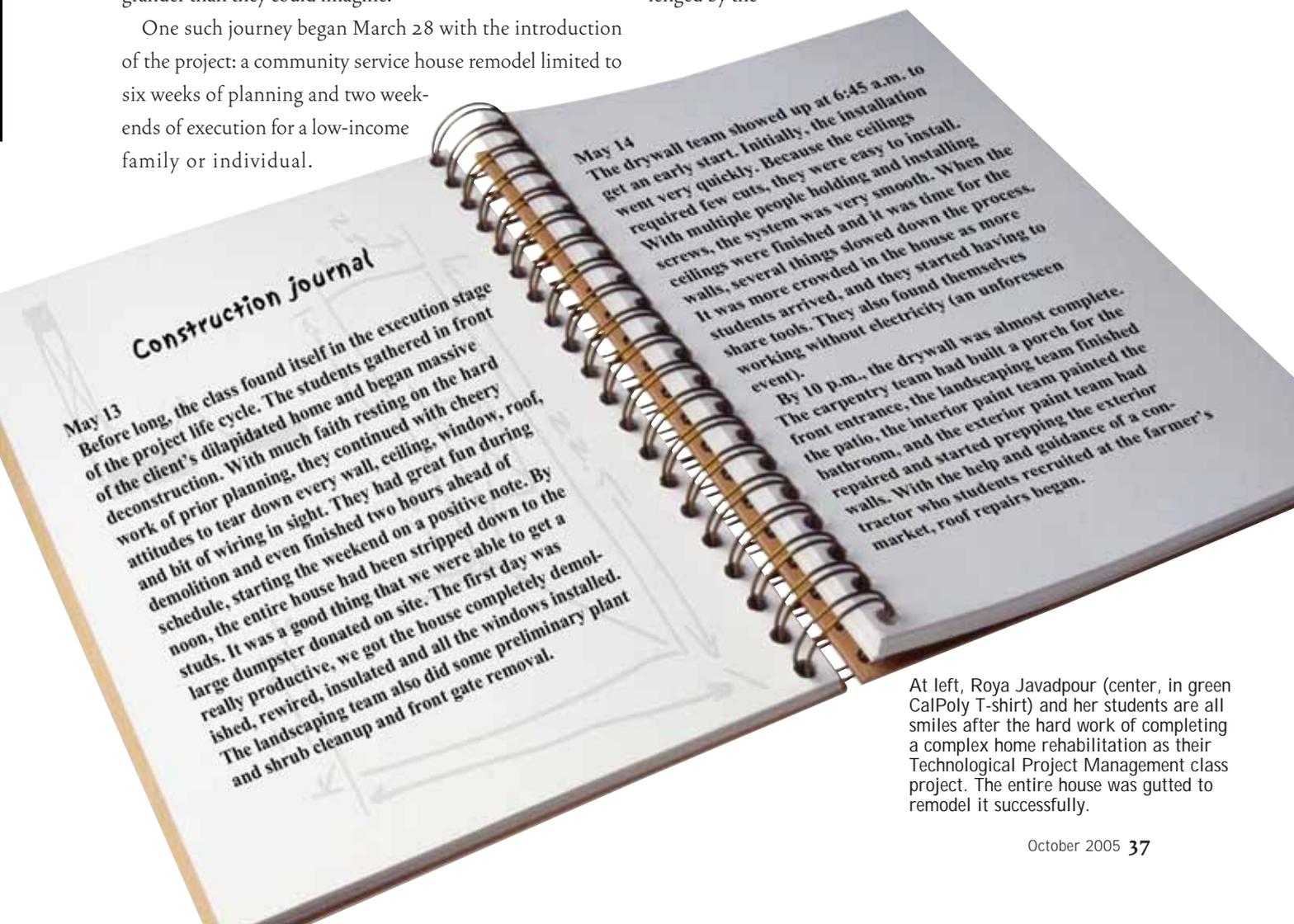
Designed for students who want to master project management by following Cal Poly's learn-by-doing philosophy, the course covers the basic issues and tools of managing projects in organizations and provides the opportunity for a real-world application of project management concepts. The course content follows the project life cycle, investigating projects from start to finish, but the best way to appreciate the complexities of managing a project and its personnel is through direct experience. With that in mind, students are assigned a service project leading to a journey filled with trials and triumphs far grander than they could imagine.

One such journey began March 28 with the introduction of the project: a community service house remodel limited to six weeks of planning and two week-ends of execution for a low-income family or individual.

The mission was to improve the quality of their lives. The remodel was restricted by a budget (to be fundraised), tool and equipment resources (to be donated or borrowed), and human resources (limited to the students and any volunteers they could recruit). Furthermore, the project's performance specifications were designed to meet the needs of our customer — the homeowner.

Through this endeavor, known as the Polyhouse Project, students engage in scheduling, supply management, project team recruiting, resource allocation, time/cost trade-offs, risk assessment, task coordination, team building, progress monitoring, and post-project assessment. Each team plans and manages its progress using appropriate project management tools and techniques, presenting informal status reports during the quarter. Students also contribute their own physical labor to the project.

This quest to remodel a home was a complex and uncommon effort. Students would manage themselves, the work, the money, and the progress; the full responsibility for the success of this project was in their hands. The project was further challenged by the



At left, Roya Javadpour (center, in green CalPoly T-shirt) and her students are all smiles after the hard work of completing a complex home rehabilitation as their Technological Project Management class project. The entire house was gutted to remodel it successfully.

a class by itself

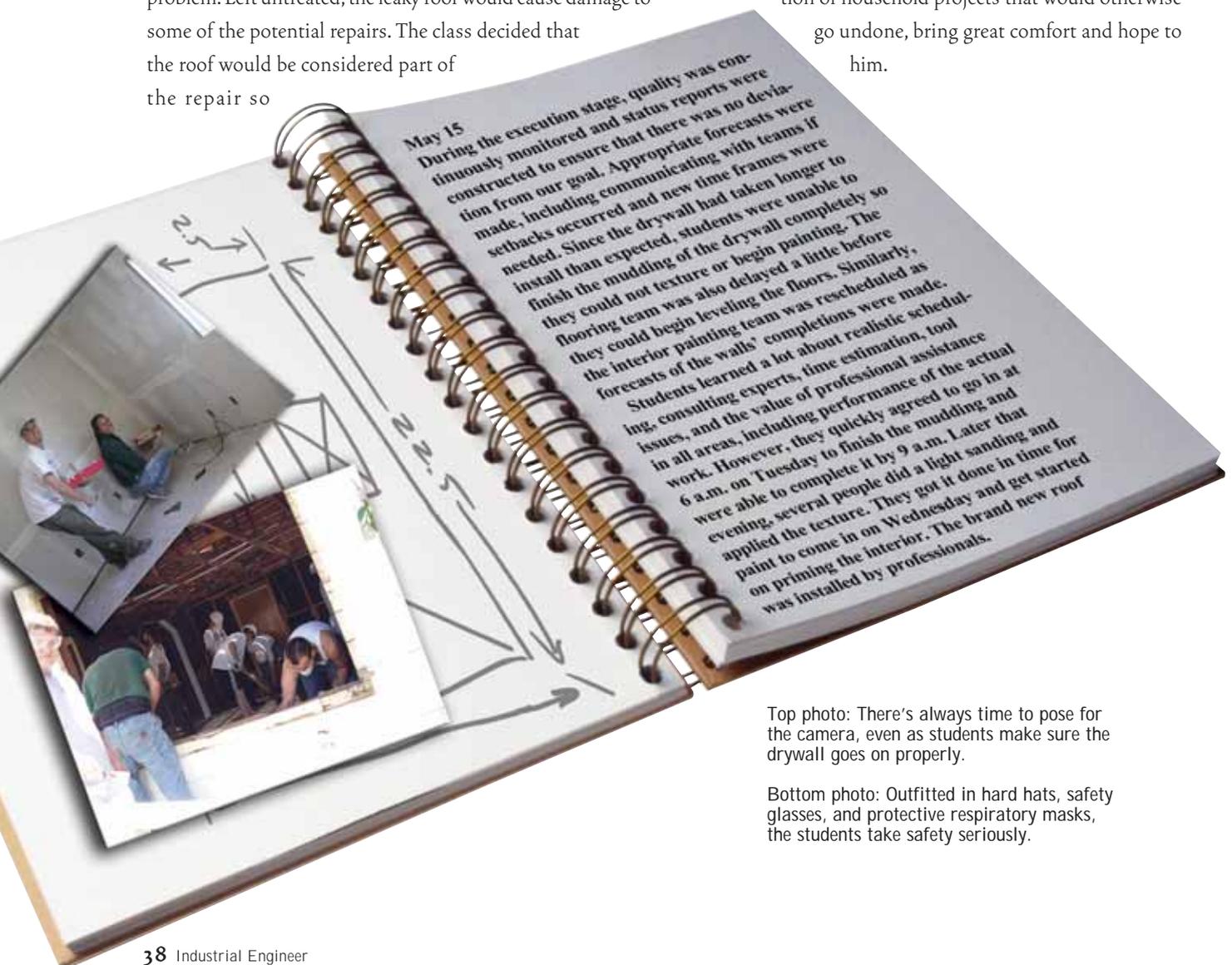
requirement that at the end there would be high morale and strong positive relationships all around.

Goals of the heart: Selecting a client

The first step in the project management process was to select a specific project. Students were provided with two candidate options. The first option was a local women's shelter that was in serious need of rehabilitation. The second was a disabled man's home that suffered from poor initial construction, disrepair, and a leaky roof. Videos were observed of both residences so that accurate assessments could be made. After debating the pros and cons of each house, the class reached consensus. The first house suffered from mold and would require a greater amount of time to treat and repair than two work weekends would allow. Furthermore, if the mold was not treated and the home was simply repaired, the untreated mold would damage the walls once more. The second home presented a similar problem. Left untreated, the leaky roof would cause damage to some of the potential repairs. The class decided that the roof would be considered part of the repair so

long as it remained within our time, resource, and budget constraints.

After careful consideration, the students chose the second home. Our selected client was a gentleman whose circumstances prevented him from making many necessary changes to his home. While riding his bicycle a couple of years ago, he was hit from behind and suffered major injuries, including a crushed spinal cord and shattered hip. Through several surgeries, doctors inserted four titanium rods, fused his spinal column, and removed a rib to repair the spinal column. The bone extending from hip to knee had to be cut off and the hip rebuilt, which also required hardware to be inserted. Prior to the accident he was very healthy, riding his bicycle 200 miles a week and working as a musician. He is now in constant pain, unable to walk more than a few blocks, and has difficulty lifting, bending, and kneeling. It was our goal to improve the safety and comfort of his home and, with the possibility for completion of household projects that would otherwise go undone, bring great comfort and hope to him.



Top photo: There's always time to pose for the camera, even as students make sure the drywall goes on properly.

Bottom photo: Outfitted in hard hats, safety glasses, and protective respiratory masks, the students take safety seriously.

BUILDING TRADITION

This is the second year of the Polyhouse Project, which began with Roya Javadpour's spring 2004 grad students. The first project, which was featured in the February 2005 issue of *Industrial Engineer* ("Extreme Home Makeover," page 14), involved remodeling the home of a disabled man who required wheelchair access throughout his home. To learn more about both projects, view a list of donors, or read the news coverage, visit www.polyhouse.org.

Goals of the mind: Course objectives

The goal of the course is exposing students to various strategies used in project planning with tools such as a work breakdown structure, a statement of work, and a responsibility matrix. Basic organizational structures and staffing strategies are introduced. Students learn scheduling techniques with risk assessment on project schedules, resource allocation, and time/cost trade-offs. As a result, their ability to develop, plan, structure, schedule, and control projects is enhanced.

Students are made aware of various people and team roles and responsibilities essential for the effective implementation of projects. In addition, they learn the appropriate use of computers in planning and controlling projects and monitoring progress (actual vs. planned and earned value). Students learn techniques to manage conflict along with the following personnel development opportunities:

- Analytical, writing, and presentation skills: Research a specific topic, analyze a problem, think creatively, suggest a solution, and prepare a written or oral presentation of the solution.
- Collaboration skills: Work effectively in a team, interact well with others, exercise leadership, sell ideas, adapt to changes, and manage a project.

Accentuate the positive: Project definition

With the selection of the client, the project life cycle began. We visited the house to assess its state and ask for our client's wish list. Students quickly found themselves in the midst of the definition stage. In this stage, goals, specifications, tasks, and responsibilities were established. During the house visit, students were taken aback by the deterioration of the house and quickly realized the extent of the work they would have to perform, which would be a whole lot.

Based on the wish list, the initial project scope was drafted; however, the final project scope would be dictated by the amount of donations gathered throughout the quarter and risk assessments of the tasks. As a result, the following team and individual roles were formed: fundraising, logistics, exterior paint, flooring, roof, carpentry, electrical, interior paint, drywall, kitchen, landscaping, Web page administration, and safety/quality control. Students volunteered their efforts on various teams until the class was evenly distributed. Each team picked a leader and developed their team charter, outlining the policies and procedures they would follow and the communication plan to assure its effectiveness over the course of the quarter. Teams also developed a clear statement of their role in the project, along with their mission, vision, problem statement, and objectives.

The project coordination team, which was critical, was selected by the whole class to supervise and bring together all project areas under a common mission and vision.

Putting it together: Project planning

As the course progressed, students found themselves in the planning stage of the project's life cycle. In order to build the project plan, each team generated a hierarchical structure list of primary work elements under its responsibility. This work breakdown structure included initial estimates of work effort (man hours). Accompanying the work breakdown structure submission was a description of the proposed performance standards for the key deliverables and a preliminary plan for how the proposed standards would be achieved. From the work breakdown structure, each team generated a list of material and equipment that would be needed to achieve its planned work. Since the primary purpose of generating the list was for budgeting, all material and equipment items included quantity, type, style, and costs, which were extended to a grand total. Each team also developed an initial project network along with a responsibility matrix broken down to an appropriate degree to allow for assignment of responsibility to individuals.

By May 4, the teams completed their project plans, including:

- Work breakdown structure
- Plan for integration with other teams
- Time estimates
- Recruiting plan
- Training plan
- Assessment of needed technical assistance
- Gantt schedule

a class by itself

- Risk assessments and contingency plans
- Quality assurance and performance measurement plans
- Material and other resource requirements
- Safety plan

The project coordination team developed the overall project plan, which included the overall team structure, the Gantt schedule for the whole project, reporting times, the responsibility matrix, and the project closeout plan. The project coordination team was responsible for developing the statement of work to be presented to and approved by the client prior to beginning the work, and the team had to obtain any permits required to do the construction and schedule the county inspection to be completed in a timely manner.

An overall plan for standards of performance, monitoring and controlling performance, and safety policies and practices was also established for the project. This plan served as the basis for the responsibilities of the quality control/safety inspector.

Throughout the project planning phase, the fundraising team was busy contacting local businesses and individuals for support. By the end of the six-week planning phase, the class had raised more than \$32,000 in monetary and in-kind donations — enough to proceed with a complete overhaul of our client's house, including the installation of a new roof.

EDUCATION REFORM

In an effort to promote engineering education reform, Purdue University will be the first university to offer graduate degrees in engineering education. The school received permission to begin the academic program from the Indiana Commission for Higher Education last spring.

Offering master's and doctoral degrees in engineering education, the school anticipates enrollment of 10 full-time graduate students this fall and more than 40 within five years.

The school projects that its engineering education graduates will pursue careers in academia, business, government, and foundations as well as find opportunities as professionals in K-12 educational systems. Administrators hope that by 2007 the department, collaborating with the College of Engineering and the College of Education, will educate and certify high-school teachers with an emphasis in engineering.

Working the plan: Execution

Working six days over the course of two consecutive weekends, the students and their volunteers completed their construction work (see the sidebar “Construction Journal”).

The following is a summary of what the class was able to accomplish:

- They tore the entire house down to bare studs, including taking all the ceilings out and stripping the roof.
- Rewired the entire house and updated the electrical panel, insulated and dry walled the walls and ceilings, and textured.
- A new roof was installed by a local roofing company.
- Installed new windows throughout house, built window sills, and added new blinds.
- Put recessed lighting with dimmers in all rooms.
- Installed laminate flooring in the living room and kitchen, carpet in the bedrooms and study.
- Installed new kitchen cabinets. Bought and installed a new dishwasher and stove.
- Tiled the bathroom.
- Built a closet for the bedroom.
- Painted the interior and exterior.
- Installed baseboards for all rooms.
- Landscaped the yard and built a porch and patio with solar lights.
- Bought a new sofa and a dining table and chairs.

The class project and assignments provided students with an opportunity to apply decision tools, frameworks, and past experiences to analyze real problems and risks in a systematic manner. They also had opportunities to examine their personal communication styles and assess their capabilities in numerous one-on-one and team situations. The project required participants to display good listening skills, empathy, tact, and persuasiveness to accomplish team goals through people. The students became aware of a variety of motivational, authoritarian, and influence techniques used in project management.

Through hands-on involvement in a real project, students were able to test their abilities to take action when needed, to make midcourse adjustments on plans, and to recover from unexpected problems. The house project provided a rare educational platform that went beyond the classroom into the implementation. Working closely with others provided students with opportunities to think about their values, how they operate in team environments, and what they want to achieve in the future. In addition, it allowed students to learn about



May 20
 We began the second weekend on schedule! The carpet was installed in the bedrooms; the flooring team completed the kitchen and living room. Landscaping started laying the pavers for the walkways, exterior paint team finished the primer coat, and interior paint was also busy painting. The kitchen team started assembling the cabinets. The students are beginning to realize the payoff from all their work.

May 21
 No problems installing the kitchen cabinets. The landscaping team finished the walkways by early afternoon and added flagstones from the porch to the patio area. The exterior and interior paint teams made great progress.

May 22
 We did it! Most of Sunday was spent touching up and finishing tasks. We were able to get new appliances for the kitchen and new furniture for the living and dining rooms. Students built a custom closet for the bedroom. Baseboards were installed in all rooms, as were new light fixtures. By 5 p.m., the students had finished all the work they had set out to do and cleaned up the site. The house looked great and ready for the client's arrival. He was overwhelmed and surprised by the work that had been done.

Dramatic differences are the nature of home makeovers, evidenced here by the before (top) and after (bottom) shots of the kitchen.

and experience some of the problems faced by other people, becoming more sensitive to the needs of others.

Reflections

To summarize what my students accomplished in the spring quarter of 2005, I would have to say Wow! It is amazing to imagine what the students set out to accomplish and how they were able to exceed every goal. The professional conduct and attitude among the team members was commendable. The project was carried out successfully, on time, and within budget. It received broad media coverage by the local press and regional TV stations during both weekends in several news segments. The course and project was an example of how learning-by-doing made a real difference to a disabled and disadvantaged individual, and the entire San Luis Obispo community was made aware of Cal Poly student outreach.

The project terminated with a post-project assessment and the handoff of the rehabilitated structure to the client. Letters of appreciation were sent to donors of in-kind items and cash, as

well as to volunteers. Special gratitude was extended to Barbara Withers, Ph.D., of the School of Business Administration at the University of San Diego for her guidance and support throughout the project as well as to the staff of Social Services in San Luis Obispo, Calif., for helping to find clients.

The many lessons that the students learned from this project — the concept that planning makes all the difference, that one single person cannot accomplish as much as a group can, that things always take longer than expected, that communication is imperative for success and good team dynamics, that gratitude for others' work and help should be readily expressed — were all confirmed. The project helped students understand the qualities of success and the importance of showing initiative and integrity. Equally important was the rare personal satisfaction that comes from helping others. Finally, they learned the value of a committed team and gained real experience in managing a project, realizing that nothing worthwhile comes easily. ~

Roya Javadpour, Ph.D., is a professor in the industrial and manufacturing engineering department at California Polytechnic State University in San Luis Obispo, Calif.