Purdue study: Hands-on learning better

BY RICK CALLAHAN • THE ASSOCIATED PRESS • FEBRUARY 2, 2009

INDIANAPOLIS -- Youngsters taught science in classes where the goal was to design and build a device to perform a specific task scored significantly higher on a final test than students who got traditional classroom instruction, a Purdue University study has found.

The findings suggest that hands-on, problem-solving learning may have advantages over traditional lecture- and textbook-based methods of teaching students about engineering and technology, said Melissa Dark, a Purdue professor of computer and information technology.

"It's not just the hands-on work -- it's exploring science through the application of technology and exploring technology through the application of scientific principles," said Dark, who worked on the study. "Those two things build on each other."

In the study, eighth-graders who were assigned to build a water purification device -- and spent hours designing and building their systems -- scored an average of 20 points higher on a science test than students taught through traditional means.

The research involved 126 mainly 14-year-old students at a rural Indiana middle school who learned about the principles of water purification and water quality in science classes.

Half of them were taught through lectures and textbook readings.

But the other half did no actual reading and less than 10 percent of their classroom time was devoted to lecture-based teachings from the same textbook their counterparts used.

Instead, most of the students' time in the hands-on classes was spent in groups of three or four working to design and build a water-purification device to make water taken from the Wabash River suitable for drinking.
The students built their water purification devices from metal screens, sand, gravel, cheesecloth and other supplies bought at hardware stores.

As they designed and built their devices, their teacher roamed the classroom discussing the scientific principles of water purification with each group and posing questions to them about how they might improve their device.

After the course, all of the students took a test with both true/false and open-ended questions regarding water purification and water quality.

The students who built purification devices had an average score of 77 out of 100 points, while the traditionally taught students' scores averaged 57 out of 100.

The results of the study, which was funded by the National Science Foundation, appear in the current edition of the International Journal of Engineering Education.

Samantha A. Murray, the American Society for Engineering Education's K-12 coordinator, said the findings are "timely and relevant" considering the nation's growing educational emphasis on boosting youngsters' grasp of science, technology, engineering and math.

"The results of this study, while preliminary, challenge the traditional notions of engineering education," she said. "It hopefully will spur additional research efforts focused on the use of hands-on projects to successfully engage students in engineering concepts at an early age."

Dark said that in every test area the students who took part in the hands-on project learned more and showed a deeper understanding of the science ideas than the traditionally taught group.

Minority students and those for whom English is a second language saw the same benefits.

"Some of the results surprised us at how well the students were able to take what they knew and apply it and then answer the test questions based on their experience. But that was the goal – for them to learn," said Jody Riskowski, a former Purdue researcher who's now an assistant professor of biomechanics at the University of Texas-El Paso.

Dark said the study is one of the first involving middle school students to assess a new engineering education approach and compare the results to a "control" group taught through traditional means.

In Your Voice

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AlwaysaLaughYetr wrote:

I never figured out why it takes studies to figure out something that is so obvious. We all learn differently, but experience sticks in our minds much better than hearing some teacher tell us something. We have to reason it out in our own heads.

The best teacher I ever had in high school was not a certified teacher, but an engineer who was temporarily filling a teaching position. He used the book as an

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