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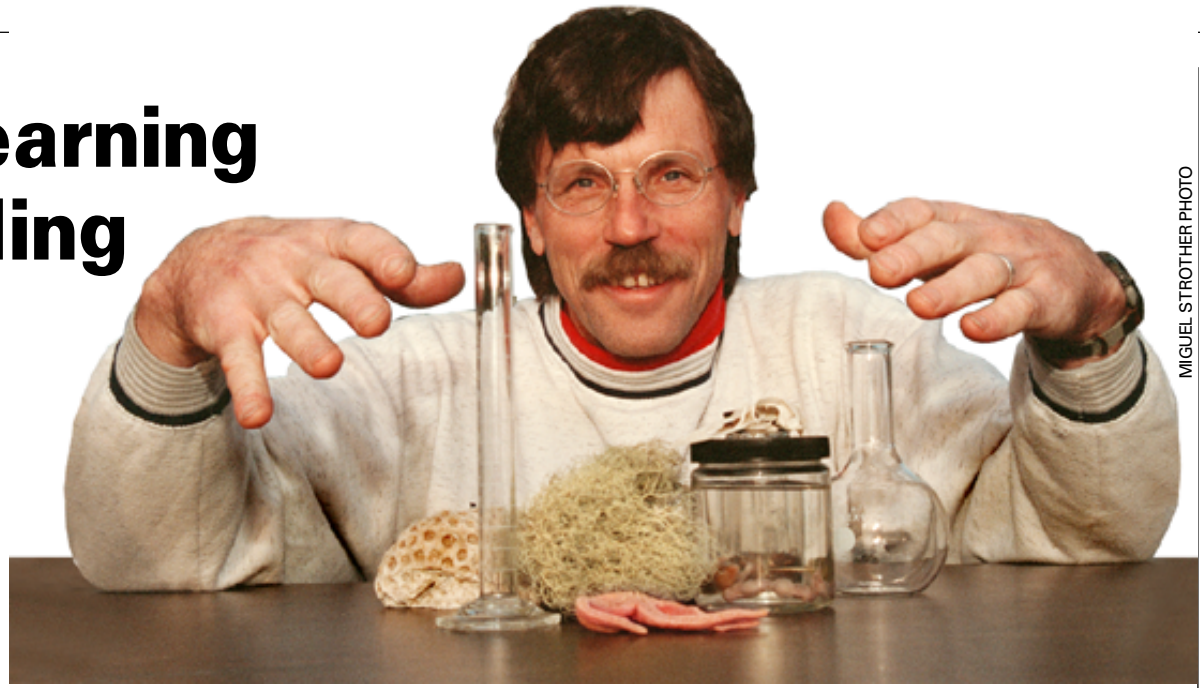
Research and discovery at the University of Victoria

Hands-on learning yields budding scientists



MIGUEL STROTHER PHOTO

Roth

By Becky Lockhart and Miguel Strother

What happens when young students are free to experience and learn about the world in the same way a curious scientist would? Given the opportunity to ask questions, conduct hands-on research, and prove and defend ideas, a child experiences education as a personal exploration — one fuelled by the desire to understand.

The idea of using this approach to instil scientific knowledge and bring the classroom to life is something that UVic education professor Wolff-Michael Roth has been studying for nearly 15 years. He advocates a different kind of educational experience — one with less emphasis on memorizing, interpreting the world through theory and two-dimensional textbook examples, and learning for the sole purpose of getting a grade.

Roth focuses his research primarily on science and mathematics because so few students continue these subjects after high school. He's interested in finding ways to change this trend.

A recent study by Roth revealed that students are better able to analyze data when given a hands-on opportunity to learn about the sciences using procedures similar to those a scientist would follow.

He found that Grade 8 students who had studied science by doing their own research — framing their own research questions and collecting their own data — were more competent at interpreting data and graphs than university science graduates who were intending to become science teachers.

"It's not because the Grade 8 students are smarter, it's because they were working with this kind of data on an everyday basis and were doing science in a way that resembles the activities of real scientists," says Roth. "The university students were simply memorizing book stuff. They weren't used to doing scientific research."

Students need the opportunity to choose what they work on, Roth says. And they have to work on real projects with real-world relevance that are of interest to them and are appropriate for their individual level of comprehension. "We don't learn by doing the fake activities that characterize much of current schooling," says Roth.

According to him, "When kids get involved with things like environmental activism, planting seeds, hatching salmon to stock creeks, or introducing butterflies into urban green spaces, they participate in issues that are of societal concern. They learn science while doing something that is of real importance — not to get grades, but to improve the world around us."

Roth's research shows that this kind of learning is successful because students are empowered to enact and develop their most fundamental human capacity — to make and adapt to the environment in which they live and learn. And because students decide what they focus on and how they learn, "they're so motivated that there's not a slack moment."

The hands-on approach is also integral to Roth's own research projects, and he spends much of his time in elementary school classrooms testing his teaching theories and observing their effects. A teacher himself for several years, Roth says it is in the classroom, not his fifth-floor UVic office, where many of his most important decisions are made.

"It is so important to actually be involved with your work rather than just theorizing about it," says Roth. "That's how I find my truest understanding of the topic."

SPARK

Becky Lockhart and Miguel Strother wrote this as a participant in the SPARK program (Students Promoting Awareness of Research Knowledge), funded by UVic, the Natural Sciences and Engineering Research Council, and the Social Sciences and Humanities Research Council.

facts from the EDGE

- Roth is Lansdowne Professor in Applied Cognitive Science in the curriculum and instruction department of UVic's faculty of education. He has received several awards for his research on teaching innovative science at the elementary school level, including the 1999 "Science Educator of the Year" award from the Association for the Education of Teachers of Science.
- Roth's research on science education is supported by research grants from the Social Sciences and Humanities Research Council (SSHRC), and his projects involve collaborative work with colleagues and the training of students. Roth has also received SSHRC research grants for several other projects, including his work on the impact of social and environmental restructuring on environmental and human health in Canada, and his studies on how abstract knowledge develops from activity and the role that gestures play in this process.
- After completing work on his master's degree in physics in Germany at age 25, Roth got his first teaching job in Labrador in an isolated village accessible only by plane, snowmobile and boat . He considers the years he spent there teaching crucial to his development as a science teacher. After setting up a makeshift science lab in the basement of the village school, Roth broke his class into small groups and encouraged them to be scientists. Instead of answering questions from textbooks, he got his students to ask their own questions and pursue the answers by doing hands-on research.

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National Association for Research on Science Teaching **www.narst.org/**

Something for adults and kids alike:

www.sciencemadesimple.com/ (Science Made Simple)

www.scienceworld.bc.ca/ (Science World Vancouver)

To find out more about Roth and his research, visit his website:

www.educ.uvic.ca/faculty/mroth/