

Science Teaching

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A program to boost science teaching in primary schools is having a spectacular impact on teachers, pupils and schools.

Geoffrey Maslen reports.



IF YOU START TONY MERRETT talking about Primary Connections, he won't stop even to take a breath. Merrett is principal of a tiny primary school at Gunbower in north-eastern Victoria and he reckons the science-based Connections is the greatest thing to hit the classroom since cuisenaire rods went out the window and computers came in the door.

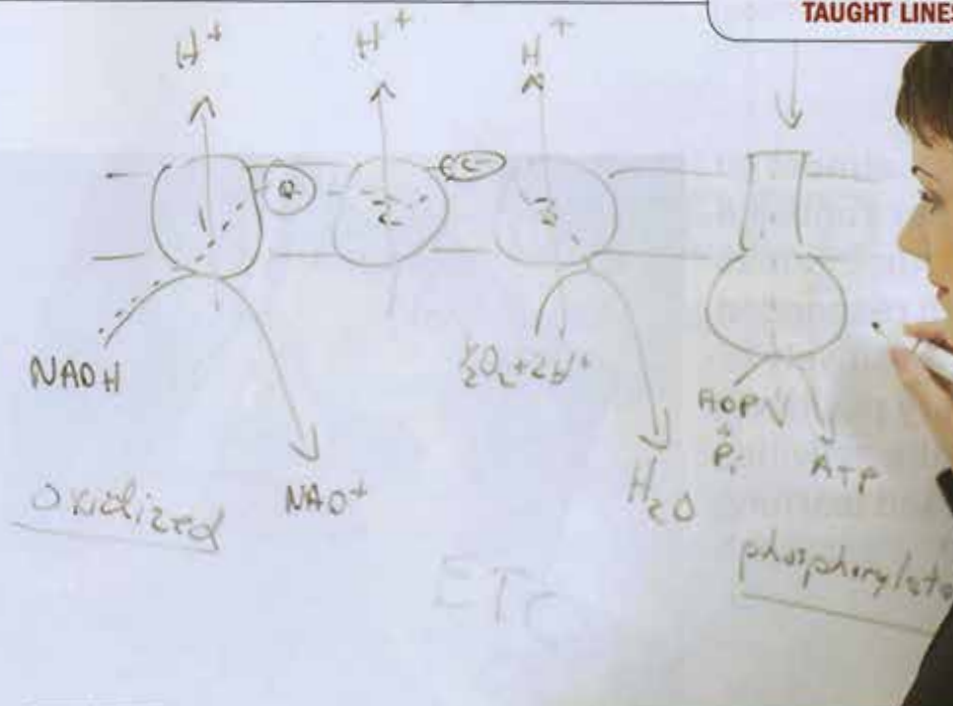
"It's a fantastic program, it really is," he says. "Most primary teachers are afraid to teach science because they think they lack the expertise but Connections allays their fears and shows them how to do it."

In a move that may rank as one of its most innovative and influential decisions, the Australian Academy of Science initiated a scheme to embed scientific principles into literacy teaching. It was a brilliant notion to link literacy – the driving force behind much teaching in primary schools – with science in a way that both teachers and pupils have found fascinating, and then to make it a whole-of-school approach so that science becomes as integral to learning as the three Rs. The program also incorporates professional development for teachers while also providing useful background information, practical classroom ideas and activities, and assessment guidelines. Student interactivity and the use of technology, including CD-ROMs and website support, give teachers confidence in tackling a subject that most have not studied beyond the last year of school.

The first eight units from the Primary Connections curriculum resource were tested in schools in 2005 and refined for rollout last year. The units have a scientific focus, span all years of primary school, and cover the four strands of the national curriculum statement: life and living, Earth and beyond, energy and change, and natural and processed materials.

The high quality of the curriculum resource units and a Questioning Minds DVD was demonstrated late last year when Connections won the 2006 Australian Publishers Association Award for Excellence in Educational Publishing in the primary teaching category.

"Throughout my career I have come to recognise that there isn't a child alive that doesn't like science," Merrett says. "And it's at the primary school level that children's wonderings and inquiring minds are nurtured and at this stage of their development their views and attitude to science will affect their future choices at secondary school and the careers they take up."



The desperate need to get more kids interested in science at primary and secondary school – and to think seriously about studying the subject in all its manifold forms at university – is obvious from the worrying statistics. Professor John McKenzie, dean of science at the University of Melbourne, points out that Australia is experiencing an alarming decline in the number of students undertaking science and mathematics at the senior secondary and university levels. McKenzie says the number of students studying science at university has fallen by 30 per cent since 2000 while in New South Wales among final year secondary students, enrolments in chemistry have dropped by 41 per cent and similar falls have occurred in advanced mathematics.

"For the national good and international competitiveness, we must insist on innovative curricula and signals that encourage students to participate in mathematics and science at every level of education," he says. "It is critical that universities promote the need for students to take mathematics and science at school if they are to study these subjects at tertiary level."

McKenzie, a fellow of the science academy, was one of the instigators of Primary Connections and he says the results from the trials have been spectacular: "In primary schools if you try to embed a science program into the curriculum you're probably doomed to fail because their focus is on literacy and numeracy. But by putting science modules into the literacy program, kids learn about science while also learning to read and that has had an amazingly successful outcome."

Similarly, a report on the trials by academics at La Trobe University in Melbourne and Edith Cowan University in Perth refers to the "profound and positive impact" the program has had on teachers, pupils and schools. The report says half of the 106 trial teachers had not completed any science studies beyond year 12 and half had not attended any science professional learning programs in the previous year. Many believed they lacked the ability to teach science effectively yet, after using the program, they had become significantly more confident about linking science and literacy teaching strategies. The amount of time devoted to teaching science increased and the subject "moved from being an afternoon-only topic to one

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taught across mornings and afternoons as science and literacy teaching were integrated".

Boosting scientific literacy among the young is urgent as revealed by assessments showing that barely half the pupils in year 6 across Australia have reached proficiency standard according to national criteria, the report says. Likewise, a national review of the status and quality of science teaching in primary schools raised concerns about the amount of science being taught and about the confidence and competence of teachers to teach the subject.

Although the evidence of the poor state of science teaching and student learning is alarming, none of it is particularly new. Five years ago, a report commissioned by the federal government deplored the standard of teaching science in Australian schools. The report described it as "one of great variability but, on average, the picture is disappointing" and noted that in some primary schools science was often not taught at all. It criticised the emphasis on "chalk-and-talk" teaching in secondary schools and said this style offered little challenge or excitement to students as was reflected in the declining number of students studying the subject.

"There is wasteful duplication among the states and territories of effort in preparing curriculum resources and resources for the professional development of teachers," the report stated. "University science teacher education is under-resourced and close to crisis, with faculty staffing profiles much smaller and older than 10 years ago."

Yet having sat on the report for years, the federal government has now commissioned the same academics to identify how to improve the teaching of science. Professor Denis Goodrum, head of education at the University of Canberra and the academic who headed the last inquiry, has been asked to take up the reins again. He says that while the 2001 report on the status and quality of teaching and learning of science in Australian schools had

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prompted improvements in primary school science, it had had little impact in high schools where the issues were still the same as they were five years ago.

Education Minister Julie Bishop says the second inquiry is intended to provide "an action plan of measures" the government could implement. Bishop says that many of the original recommendations required the co-operation of the states and territories and this had proved difficult. She is considering introducing incentives in the form of scholarships or bursaries for students studying to become science and maths teachers while her department is also examining options for establishing "adjunct teaching positions" for retired scientists, engineers and other scientific professionals to offer their skills to schools.

Meantime, the elements that seem to have made Connections so successful in inspiring primary teachers and their little charges could serve as a model for improving science teaching in secondary schools given the way the principles are based on sound learning theory. In developing the teaching and learning model, a group of educationists from the various states decided on an inquiry and investigative approach so that students work from questions to undertake investigations and construct explanations. Contemporary "constructivist learning theory" suggests that learners actively construct knowledge and derive personal meaning from their experiences. To aid this, the children have the opportunity to present their developing understandings using a wide range of texts such as student journals, posters, tables and captioned diagrams, as well as via information communication technologies that include PowerPoint presentations and digital cameras.

A survey of teacher attitudes after the trails found that almost 90 per cent said their pupils had responded positively or very positively to the activities and learning approach. More than 75 per cent said their classes had learned more science and the quality of science learning was higher than with any previous

teaching. Pupil and teacher perceptions were corroborated by later tests that showed the mean achievement scores for a sample of year 5 pupils more than doubled after just one unit and that 85 per cent were working at or above level 3 on the national scientific literacy progress map – the proficiency standard for year 6 students.

The project is now sponsored across the nation by the science academy in partnership with the federal Education Department which last year assumed responsibility for funding its further development. As a national scheme, it is a collaborative effort among the key groups involved in the teaching of both science and literacy, and includes state and territory education departments, Catholic education offices, independent schools, professional associations and the Australian Academy of Technological Sciences and Engineering.

Tony Merrett has no doubts about the impact of Connections on his 70 pupils, the other three full-time teachers at his school and the way science has become a talking point within the Gunbower community. In his enthusiasm for the program, he made a submission to a parliamentary inquiry into the promotion of mathematics and science education and described the difficulties primary teachers faced in teaching science. He suggested ways their training, both pre-service and ongoing, should be improved and called for a structured professional development course to be implemented to help the many teachers who have yet to experience Primary Connections.

The course would be offered by universities as four modules that teachers would complete over a total of eight days. On successfully finishing the course, they would receive some form of professional recognition for their effort with completion linked to registration or re-registration with the state institutes of teaching. "What a great way to increase cross-sectoral links between training institutions and schools and improve the capacity of primary school teachers to deliver science education!" Merrett concluded. ■