

Innovations in Australian Science Education

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by

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Abstract

Australia is a culturally diverse nation with a desire to build a strong knowledge and innovation based economy. Effective science education programs are a vital key to making this a reality. The *Science in Schools (SiS) Strategy* is the Victorian Government's response to this challenge. Initiated in 1998, the *SiS strategy* has changed the face of science education in Victorian schools. The innovative programs that this strategy has developed initiate and develop relationships between a wide range of groups including students, teachers, parents, scientists, engineers, tertiary institutions and industry. As well as changing the way that science is delivered in schools, these programs also need to be inclusive of, and responsive to, the diverse cultural needs of the Australian community.

1. Introduction - The Australian Cultural Environment

The *Science in Schools (SiS) Strategy* is a major educational and financial undertaking by the Victorian State Government in Australia. This strategy has been devised and developed in a country with a diverse multicultural population. Australia's citizens come from more than 100 nations and speak over 130 languages, thirty of which are indigenous. English is Australia's official language. Our schools and colleges therefore provide studies in English as a Second Language (ESL) to both students and adults who are not native speakers of English.

As well as providing training in English, training in more than thirty Languages Other Than English (LOTE) is available to primary-aged students. Training in over forty languages is available to secondary students. Given the diverse language base of the users, *SiS Strategy* materials are therefore developed in consultation and collaboration with providers of ESL and LOTE.

Australia is diverse not only in languages, but also in cultural practices. It is therefore important that the *SiS Strategy* resources and programs are both culturally inclusive and sensitive. To this end opportunities that make links across cultures within the context of science are exploited. The diversity and richness of Australia's multicultural population gives an added dimension to the delivery of science

educational materials and programs. An acknowledgement of Australia's cultural diversity underpins all aspects of the delivery of the *SiS Strategy*.

2. Overview of the Science in Schools (SiS) Strategy

School education has a vital role to play in progressing the knowledge, skills base and culture of innovation that is required to ensure a prosperous future. The *SiS Strategy* is a key initiative of the Victorian Department of Education & Training (DE&T). This strategy undertakes to support teachers in becoming providers of highly effective and engaging science and technology schools programs. In order to maintain and extend young people's enthusiasm for science, technology and innovation, classes need to engage students by being relevant, stimulating, challenging and innovative and focus on current science and technology content.

While there is a stronger focus on gaining improvement in the science area of the curriculum, many of the *SiS Strategy* projects also target components of the technology key learning area, particularly those that relate to the application of science. The Information Communications Technology (ICT) component of science and technology teaching is integrated into all projects with a strong emphasis placed on ensuring students and teachers are world class in their knowledge and application of ICT.

The *SiS Strategy* is an integrated suite of elements that respond to identified needs in the Victorian education environment and drive improvements in science teaching and learning from a variety of angles. The following diagram illustrates the Strategy.

3. Operating context

The *SiS Strategy* operates within a policy environment guided by the Science, Technology and Innovation (STI) High Level Objectives and DE&T's Goals and Targets.

The *SiS Strategy* focuses on the particular STI objectives of:

- developing the skills base;
- improving community awareness and understanding;

and the particular DE&T Goals and Targets of:

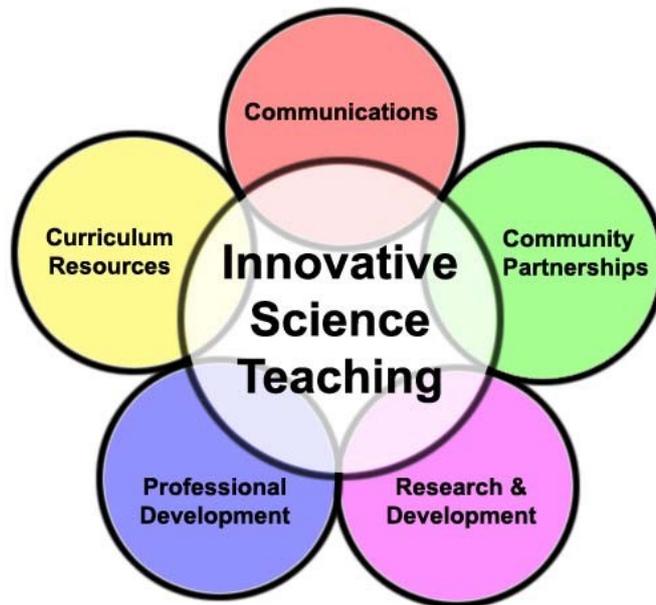
- improving the standards for literacy and numeracy in primary schools;
- increasing the percentage of young people who complete Year 12 or equivalent;
- increasing participation and achievement in education and training in rural and regional Victoria and among groups where it is presently low;
- increasing adults' participation in education and training and hence the overall level of educational attainment and literacy levels in Victoria and
- making near universal participation in post-compulsory education and training the norm in our society.

Progress against these goals will be measured against the following targets:

- by 2005 Victoria will be at or above national benchmark levels for reading, writing and numeracy as they apply to primary students;
- by 2010, 90 percent of young people in Victoria will successfully complete Year 12 or its equivalent; and

- by 2005, young people aged 15-19 in rural and regional Victoria engaged in education and training will increase by 6 percent.

4. The elements of the Science in Schools Strategy



4.1 Research and Development

The *Research and Development* element of the *SiS Strategy* has developed and trialled a change model that enables schools to effectively improve the teaching and learning of science. This project has operated in 224 schools, with 98,000 students and over 2,000 teachers participating. The project has identified eight 'Components of Effective Teaching and Learning'.

1. Students are encouraged to actively engage with ideas and evidence.
2. Students are challenged to develop meaningful understandings.
3. Science is linked with students' lives and interests.
4. Students' individual learning needs and preferences are catered for.
5. Assessment is embedded within the science learning strategy.
6. The nature of science is presented in its different aspects.
7. The classroom is linked with the broader community.
8. Learning technologies are exploited for their learning potentialities.

The result of this extensive research project is *School Innovation in Science*, a program for the state-wide implementation of the change model developed by the *Research and Development* project.

4.2 Professional Development

The *Professional Development* element of the *SiS Strategy* offers a wide range of programs that aim to improve teachers' competence and confidence in teaching science. The programs

- train teachers to implement the *School Innovation in Science: Leading Change Program*;

- are offered in a variety of PD delivery modes (eg. school based, one-off needs, online access);
- provide teacher reward and recognition in the form of study tours; and
- provide support for industry placements for teachers to experience cutting edge science and technology.

Professional development is critical to the effective implementation of the *School Innovation in Science* program for the state-wide implementation of the change model developed by the *Research and Development* project.

4.3 Community Partnerships

The *Community Partnerships* element of the *SiS Strategy* aims to improve the connection between the classroom learning of science and technology and the broader application of science and technology. *Community Partnerships* is comprised of a comprehensive suite of programs targeting major stakeholders within the community including schools, families, science and technology industries and tertiary institutions.

The programs have varying reach, from broadly accessible initiatives with more diffuse impact to intensively focused initiatives with significant direct impact for more limited audiences. In all programs there is particular emphasis on the communication of science beyond the confines of the classroom. Through the *Community Partnerships*, practising scientists, students, teachers, parents and members of the broader community communicate in meaningful ways. The projects help break down the barriers between practising scientists and the lay public and give students the opportunity to make real contributions to the science arena.

The short term outcomes of *Community Partnerships* are:

- to increase the relevance of science for students;
- to expand the skills and knowledge of science and technology teachers; and
- to raise community participation in science teaching and learning.

The long term outcomes of *Community Partnerships* are:

- to provide models for involving the community in the teaching and learning of science and technology; and
- to provide resources to support science and technology teaching.

Key programs within *Community Partnerships* include *Science Partnerships*, *Scientists and Engineers in Schools*, *Family Science* and *Student Science Fellowships*.

i) *Science Partnerships* are collaborative experiential community based projects undertaken by science and technology organisations in partnership with schools. These partnerships aim to increase student knowledge and skills in the application of science and to promote connections between schools and industry. In 2002, partnerships existed between 38 industry organisations and over 190 specific schools. Resources developed within in these projects are made available online for the benefit of all schools.

ii) *Scientists and Engineers in Schools* are partnerships where scientists and engineers work for an extended period with students and teachers on school-based projects. These partnerships aim to enhance teacher confidence and knowledge and to promote the

relevance of science and engineering. In 2002, 500 students and 60 teachers are participating in 58 projects.

iii) *Family Science* is a website of home and school based activities (outside school hours) designed to encourage family participation in science. This program aims to assist parents in encouraging their children's interest in science and to promote a wider awareness of science in the community. In 2001, 500 schools were financially subsidised to undertake local *Family Science* activities.

iv) *Student Science Fellowships* are partnerships that aim to motivate participants to pursue science related careers. They also aim to improve school links with science and technology organisations. Annually, 50 outstanding Year 11 science students are awarded a prize of \$1000 and a 10-15 day placement with a mentor scientist, engineer or technologist. The placements involve a broad spectrum of science and technology industries and tertiary organisations. Through these programs, students are engaged in making a hands-on contribution to science and technology.

4. 4 Curriculum resources

The *Curriculum Resources* element of the *SiS strategy* provides high quality, innovative multimedia resources to support the teaching and learning of science and technology. The aim is to increase the availability and use of relevant and stimulating curriculum resources to facilitate improvement in teaching and learning. The success of these resources is dependent on the clear communication of science in ways that are engaging and appealing to the audience.

Key programs within *Curriculum Resources* include *Science and Technology Education in Primary Schools (STEPS)*, *Science Trek*, *goamazing.com*, *Early Years Science* and the *Sample Science Program*.

i) *STEPS* is a series of 23 science and technology multimedia modules for the Early Years, while *Science Trek* is a series of 18 science and technology multimedia modules for the Middle Years. The student materials are designed to engage students and motivate their interest in particular topics. They model pedagogical best practice and provide comprehensive teacher support materials. The modules for this award winning resource have video, CD-ROM, print and website components. These resources are available to schools in all education sectors.

ii) *Goamazing.com* is a website that provides current science, mathematics and technology teenage-focused news stories with support materials for teachers. It designed to engage 14-17 year olds in the science underpinning their daily lives. The website was made available to government and non-government schools in 2002.

iii) The *Early Years Science* website is currently under development. This website aims to provide innovative materials to assist teachers in the more effective implementation of science in the Early Years classroom. It will have a particular emphasis on the teaching of literacy and numeracy through science and technology. The resource will be available to schools in all sectors of education in 2003.

iv) The *Sample Science Program*, completed in 2001, provides a framework for science curriculum planning. The program is designed around the stages of schooling and the outcomes identified in the Curriculum Standards Framework that defines the curriculum

delivered in Victorian schools. The program has been made available to all teachers on CD-ROM and via the *SiS Strategy* website.

4.5 Communications

The *Communications* element of the *SiS Strategy* provides a range of programs to inform relevant stakeholders of the strategy and all relevant information for accessing the programs and resources. This communication is vital to optimising the efforts of the other Strategy elements. *Communications* programs increase the awareness and understanding of the high quality science and technology teaching programs and materials that are available through the *SiS Strategy*.

Communications programs include the organisation of conferences and events, the delivery of papers and workshops at a wide range of state, national and international conferences. *Communications* also produce promotional materials and articles for the media to keep schools and the broader community informed.

5. Summary

Victoria is recognised as a national leader in innovative science education. The *SiS Strategy*, and the *Science Innovation in Schools* project that has developed from it, are initiatives that will have a far-reaching influence on the evolution of science education in Victorian schools. Our schools are meeting the twenty-first century challenges of developing educational programs that will enable Australia to develop a strong knowledge and innovation based economy. At the same time they must meet the needs of a culturally diverse population. Effective science communication that helps establish strong links between schools, parents, the scientific community and industry is essential if schools are to meet these challenges. Further information about the *Science in Schools Strategy* can be found on the website at: <http://www.sofweb.vic.edu/au/science>.