

Australian Academy of Science

Review of the Department of Education, Science and Training's Annual Report 2002-03: Encouraging student participation in the enabling sciences¹,

A submission to the House of Representatives Standing Committee on Science and Innovation

9 August 2004

Summary

The Australian Academy of Science is grateful for the opportunity to contribute to the Review of the Department of Education, Science and Training's Annual Report 2002-03: Encouraging student participation in the enabling sciences. The Academy agrees that the low numbers of students enrolling in the enabling sciences is cause for concern.

The comprehensive *Review of Teaching and Teacher Education* conducted by the Department of Education, Science and Training in 2003 has provided a sound basis for action to address some of the issues.

Backing Australia's Ability – Building our Future through Science and Innovation outlines a number of excellent measures by the Australian Government to boost innovation, science, technology and mathematics in our schools and to raise science awareness.

Whilst these initiatives provide the groundwork, by no means can we afford to be complacent. The declining enrolments in the enabling sciences threaten to erode the very core of Australia's ability to remain a strong and independent innovator, manufacturer, and provider of expert knowledge and skills. We must reverse the current decline in enrolments in the enabling sciences and then monitor the situation closely. We must continue to invest in initiatives such as these in the long-term, to sustain our international competitiveness as a knowledge nation.

Factors inhibiting student participation in the enabling sciences at the secondary and tertiary levels; and how greater participation in the enabling sciences might be encouraged.

- School science experiences all at levels must be relevant and engaging for students if we are to achieve greater participation in the enabling sciences.

A strong foundation in science education at primary school is essential. This can best be achieved by supporting primary school teachers, many of whom have no background in science and consequently lack confidence in their ability to teach it². The Academy has recently received funding from the Department of Education, Science and Training to undertake the second stage of its new Primary Science and Literacy Project. This Project specifically addresses the two important inhibitors to more widespread teaching of science in primary schools – teachers' lack of time (by combining science with literacy) and teachers' lack of confidence (by providing professional learning programs for teachers and accompanying quality curriculum resources). The new initiative builds on the success of the Academy's *Primary Investigations* program.

Students often see junior secondary school science as neither relevant nor engaging³, contributing to a decline in science enrolments in the post-compulsory years of schooling. There are initiatives, such as CSIRO Education's CREativity in Science and Technology (CREST) program⁴ that successfully address this situation on a limited scale, and these need to be encouraged and adequately resourced. In addition, a national approach is needed to revitalise science in our junior secondary schools. The pilot of the Collaborative Australian Secondary Science Program (CASSP) demonstrated that this could be done. The Academy strongly endorses the recommendation from the Prime Minister's Science, Engineering and Innovation Council's Working Group on Science Engagement and Education, that a national program be developed

¹ The 'enabling sciences' are taken to include chemistry, mathematics and physics.

² Goodrum, D, M Hackling and L Rennie, *The status and quality of teaching and learning of science in Australian schools - a research report*, Department of Education, Training and Youth Affairs, Canberra, 2001.

³ Ibid.

⁴ See www.csiro.au/crest

and implemented in junior secondary schools⁵ to engage students in learning science through greater emphasis on investigation.⁵

- The lack of adequately qualified teachers of enabling sciences in secondary schools is a major cause for concern and a contributor to the declining enrolments in these sciences. For teachers to enthuse their students and encourage them to continue study, they must convey a passion for, and a thorough understanding of, their subject area and its importance to society.

The comprehensive review of teaching and teacher education conducted by the Department of Education, Science and Training in 2003 explored this issue at length and has identified a number of relevant actions in the *Agenda for Action*⁶. The Academy agrees with the review's recommendations that teachers of science and mathematics should not pay more HECS than other teachers, and that incentives such as payment of HECS debts should be implemented. The Academy further believes that teachers of enabling sciences should be recognised through differentiated salary structures.

The *Agenda for Action* also identified actions for facilitating career change entry to teaching. The Academy supports efforts to attract suitably qualified professionals from relevant professions such as engineering to reskill as teachers. The Academy emphasises that it is not a solution to provide short courses as quick fixes to turn those teachers without a background in the enabling sciences into mathematics, chemistry or physics teachers.

While a State issue, clustering schools where small schools do not have sufficient enrolments in an enabling science subject such as physics, can be a satisfactory way of ensuring that adequately qualified teachers are available for students in smaller schools.

Innovative online, television and other distance education approaches should be explored to support country secondary schools to continue to offer enabling science subjects.

- Many university entrance requirements for tertiary science courses are not providing incentives to study science in secondary school. Universities should be encouraged to emphasise genuine science prerequisites at secondary school.
- The lack of quality information about science careers is a contributing factor to declining enrolments in the enabling sciences. Careers in cutting-edge areas of research such as nanoscience, bioinformatics, materials science and biotechnology are attractive to students. Courses leading to these careers require enabling sciences as prerequisites. Too often though, careers advisers, science teachers and other providers of careers information to students do not have sufficient first-hand knowledge of these careers and are therefore unable to adequately inform their students of these options.

Professional learning programs such as the Academy's annual three-day *Science at the Shine Dome* conference provide teachers with the opportunity to update their discipline knowledge and expose them to the range of exciting careers involving cutting-edge research. This structured program includes interaction with early career researchers, which develops teacher-scientist networks and further enhances the first-hand exposure of teachers to scientists doing real-life research. Excellent teachers must be provided with excellent career enhancement opportunities.

Strengthen the ability of universities to generate and transfer new knowledge

- Continued expansion of National Competitive Grant Schemes and further encouragement of investment by industry in university research coupled with appropriate funding for infrastructure would enhance the generation of knowledge. Enhanced transfer of knowledge is possible through a variety of inter-related initiatives.
- The Academy applauds the initiatives in *Backing Australia's Ability 2 – Boosting Innovation, Science, Technology and Mathematics Teaching* – which bring undergraduates and early career

⁵ *Science Engagement and Education – Equipping young Australians to lead us to the future*. Report to the Prime Minister's Science, Engineering and Innovation Council by the Working Group on Science Engagement and Education. Canberra, 2003. www.dest.gov.au/science/pmseic/meetings/11thmeeting.htm

⁶ Department of Education, Science and Training, *Australia's teachers: Australia's future. Advancing innovation, science, technology and mathematics. Agenda for Action*, Committee for the Review of Teaching and Teacher Education, Canberra, 2003.

researchers into schools. This direct interaction will have the effect of exciting the students' interest in science and will expose teachers to cutting-edge research.

The placement of secondary students and teachers into research institutions to carry out their own research projects is also an effective method of exposing them to real-life scientific research and opening up career possibilities. CSIRO Education's Student Research Scheme and Teacher Research Scheme, the Walter and Eliza Hall Institute's GTAC initiative plus various university in-service activities and student placements are examples of such programs.

Conclusion

Revitalising school science and attracting and retaining appropriately qualified teachers of chemistry, mathematics and physics are vital to reversing the declining enrolments in the enabling sciences.

Ensuring careers teachers and those advising students have better information about career options that have enabling sciences as prerequisites is also important.

The Academy would be available to expand upon this submission should the Standing Committee wish to follow up on any of the issues raised.

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This document has been prepared on behalf of the Australian Academy of Science by Professor John McKenzie, Secretary, Education and Public Awareness. The timeline has precluded obtaining endorsement by the Academy's Council prior to its submission.