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Curriculum reform a key to ending science crisis

The failure of school science to respond to the changing needs of students and the changing nature of science itself has created a crisis in Australian science education that shows no sign of abating according to a new review of research.

Australian Education Review 51, *Re-imagining Science Education: Engaging students in science for Australia's future*, by Deakin University Professor of Science Education Russell Tytler was released by ACER on 15 May.

It calls for major curriculum reform, arguing that the time has passed for tinkering around the edges of a science curriculum that belongs to the past.

Using research presented at ACER's Research Conference 2006, *Boosting Science Learning – what will it take?* as a base for a broad and intense review of the literature, the review calls for a 're-imagined' science education that is focused not only on preparing future scientists, but also on engaging all young people in science.

"We see clear evidence that the curriculum and classroom practice are failing to excite the interest of many, if not most, young people at a time when science is a driving force behind so many developments and issues in contemporary society," Professor Tytler writes in the review.

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The review argues that school science is too heavily skewed towards the abstract conceptual canon of science, and too often ignores the realities of students' own lives and interests.

The review examines and models new approaches to the teaching of science across all levels of schooling: approaches that give less emphasis to the memorisation of content and more emphasis to the nature of science and how it operates.

Releasing the review, ACER chief executive Professor Geoff Masters said the 'flight from science' described by Professor Tytler was a worrying trend that required urgent action.

"Some critics of the school curriculum have been calling for a return to the past. But it is clear that, at least in science, past approaches are failing us. Science curricula of the future must be less crammed with facts and more focused on developing skills in using science to investigate real-world problems," Professor Masters said.

Russell Tytler is Professor of Science Education at Deakin University, Victoria. He has had a long involvement in national science curriculum and professional development projects. An active contributor to debate in the field, he is the author of numerous academic and professional publications.

Australian Education Review number 51, *Re-imagining Science Education: Engaging students in science for Australia's future*, by Russell Tytler with a foreword by Professor Jim Peacock, Australian Chief Scientist, is [available for download](#) from the ACER website. Print copies can be purchased from ACER Press. Contact customer service on (03) 9277 5447 or via email on [.JavaScript must be enabled to view this email address.](#)

Papers from ACER's *Research Conference 2006 – Boosting Science Learning: What will it take?* are also available on the [ACER website.](#)

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Curriculum debate needed

In this opinion article, published in *Education Review* on 16 May 2007, ACER's chief executive Professor Geoff Masters describes what a school curriculum should provide for Australia's students and argues that the time is right for a vigorous debate on the Australian school curriculum.

Last month's historic decision of state and commonwealth education ministers to begin introducing a national curriculum raises a question about the kind of curriculum now required in our schools. Is the challenge simply to iron out differences between existing state curricula? Is the answer to be found in curricula of the past? Or should we be taking this opportunity to redesign the school curriculum for the future? These questions deserve careful and broad community debate.

First, a school curriculum should provide young people with an excellent preparation for further learning, life and work beyond school. A question for debate is how well the present curriculum is doing this. For example, are current physics, chemistry and biology courses the only or best ways to prepare young people for careers in science, engineering and technology? Given that the nature of scientific work itself has changed, with more scientists working in multidisciplinary teams, often in more commercial contexts; that Australia faces a shortfall of perhaps 20,000 scientists over the next six years; and that relatively small numbers of senior secondary students are now taking these subjects, should we be radically rethinking the senior science curriculum?

How well do schools currently prepare young people with skills for life and work, including skills in teamwork, communication and problem solving? What about attitudes and values? Is there a place in the curriculum for features such as the International Baccalaureate's community service requirement? Posing questions of this kind is not an attempt to water down standards, or an attack on academic rigour; these questions must be debated if the school curriculum is to remain both rigorous and relevant.

Second, a school curriculum should make clear what students are expected to learn, know and be able to do as a result of going to school, as well as specifying minimally acceptable standards for skills such as literacy and numeracy.

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This focus on the desired outcomes of schooling is in contrast to an earlier preoccupation with inputs. In traditional classrooms, the job of teachers was to teach the syllabus, and the job of students was to learn. If teachers covered the syllabus, then they could be judged to be 'teaching', even if nobody in the room was learning. Today, greater efforts are being made to clarify and measure desired student learning. Not surprisingly, those who would prefer a return to the past oppose this focus on 'outcomes', erroneously linking it to a range of other perceived ills, such as constructivism, whole language and fuzzy maths. But the question for debate is what outcomes we now want from our schools.

Third, a school curriculum should promote the development of higher-order skills and deep understandings of subject matter. The development of basic skills is an essential but not sufficient objective of a national curriculum. For example, the ability to read and understand an opinion piece such as this depends first on basic skills in recognising and decoding words. But a deeper understanding requires skills of critical analysis: perhaps an ability to read between the lines; an understanding of the nature of an opinion piece; an appreciation of the stance a newspaper has taken on an issue; and an understanding of the connections and motivations of the writer. Higher-order skills of this kind are a defence against the control and manipulation of information and debate and are essential skills in democracies like Australia.

Research into human learning has made clear the importance of deep understandings of concepts and principles. Knowledge of facts and procedures is crucial, but deep understandings allow knowledge to be organised and conclusions to be reached about what knowledge is relevant to a problem. School curricula that emphasise large amounts of factual content can work against deep understanding. International studies show that, while Australian students are outperformed by students in many other countries on tests of factual knowledge, they are among the best performers in the world on tests of higher-order reading skills and the application of mathematical and scientific concepts to everyday problems. Should we be giving greater emphasis to factual learning in our schools?

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Fourth, a school curriculum should be flexible enough to allow teachers to address individual needs and local contexts. Children begin school with very different levels of development and readiness, and large differences between students are found in each subsequent year of school. In some subjects, such as mathematics, these differences appear to increase over time, so that, by the end of primary school, the highest achieving students can be as much as six years ahead of the lowest achieving students in their grade. Under these circumstances, treating all students as though they are equally ready for the same syllabus can lead to frustration for less advanced students and boredom for the more advanced.

Research is clear: a one-size-fits-all approach is less likely to result in successful learning for all students than teaching which first identifies and then takes account of individuals' levels of progress and readiness. Research also is clear about the importance of connecting teaching to the interests and motivations of individual learners, of helping students to understand the relevance of what they are learning and of giving students a positive image of themselves as learners. Efforts to develop more customised (or student-centred) approaches to teaching and learning are not a 'new age' obsession with making students feel good, or a rejection of the importance of explicit teaching; they are research-based strategies for improving learning. The question is: What kind of curriculum best supports these strategies?

The time is right for a vigorous debate on these and other questions about the Australian school curriculum.

This article was originally published in *Education Review*. ('More Curriculum Debate Needed,' by Geoff Masters, *Education Review*, Vol 17, No. 03, May 16 2007, P19.)

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ACER endorses the ARACY Commitment to Young Australians

On 3 May 2007, ACER endorsed a statement of seven principles concerned with enhancing the physical, mental and emotional wellbeing and development of children and young people. The statement was developed by the Australian Research Alliance for Children & Youth (ARACY). ARACY began in 2002 with ACER being one of its original members. One of the Alliance's founders and Research Committee members, Dr John Ainley, signed the Commitment to Young Australians on behalf of ACER, along with representatives of a diverse group of other prominent organisations.

ARACY harnesses Australia's considerable expertise through leaders in early childhood and adolescent development, paediatrics, epidemiology, education, youth justice, the social sciences, population statistics, and economics, joining forces with top-level policy makers, service providers and other relevant organisations.

The Alliance encourages collaboration across these boundaries to boost the ability to uncover solutions to problems affecting children and young people, which include costly social problems and increased inequity in health, education and other outcomes in Australia. It also provides a platform for members to share knowledge, experiences, expertise, data and information. ARACY is funded by federal and state governments, philanthropic organisations and the corporate sector.

ARACY has developed a research agenda in consultation with stakeholders, and work has commenced to develop a national clearinghouse and an integrated data network enabling data to be shared across a range of primary research bodies.

For more information on ARACY, please refer to <http://www.aracy.org.au>.

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ACER UPDATE

Financial stress in Australia study

The Australian Bankers Association has contracted ACER to conduct the project Financial Stress in Australia: Incidence, Influences and Dynamics. The new project will build on work by ACER and the Melbourne Institute in 2004 using data from the Household Income and Labour Dynamics in Australia (HILDA) study. The work is to be completed by October.

Refinement of the Learning and Teaching Performance Fund Adjustment Process

The Australian Government Department of Education, Science and Training (DEST) has awarded ACER the contract for the Refinement of the Learning and Teaching Performance Fund (LTPF) Adjustment Process. The LTPF was established in 2003 to reward universities that demonstrate excellence in learning and teaching. The project will review the statistical adjustments for student, institutional and course characteristics that are used in the LTPF process. The project will be completed by July.

ACER launches revised website

ACER launched its new-look website on Monday 21 May 2007. Apart from revised design, the site features improved menus, a 'print friendly' function and customised entry points on the homepage to help visitors find information under particular categories. The site will be developed further over the coming months. Please visit www.acer.edu.au

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CEET Working Paper 65

CEET Working Paper 65 by Chandra Shah and Mike Long looks at policies, programs and measures that encourage the mutual recognition of qualifications and cross border mobility. It describes developments in the EU and in Australia and New Zealand. Labour mobility and mutual recognition of skills and qualifications: European Union and Australia/New Zealand is available on the CEET website www.education.monash.edu.au/centres/ceet/

The Centre for the Economics of Education and Training (CEET) is a joint venture of Monash University's Faculty of Education and Faculty of Business and Economics and the Australian Council for Educational Research (ACER). CEET undertakes research, research training, consultancies and dissemination on the economics and finance of education and training.

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