Australia's STEM report card – "Overall fairly consistent achievement but with high inequity for specific populations of students"

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Australia maintained a status quo for PISA 2003-2012, remaining within the second band of countries that lie above the PISA average for scientific and mathematical literacy. While our government complains that we are 'failing', in fact there are only a proportion of countries that have significantly outperformed Australian students in these areas over this timeframe. However, if the Australian data are disaggregated gaps and inconsistencies in student achievement are identifiable in relation to socioeconomic status, Indigeneity, and geographical location (i.e., rural and regional schools). Of particular concern in Australia is that these components have a compounding effect in certain schools where there are high populations of Indigenous students and those from low SES backgrounds.

The achievement gaps are actually not new and have been considered in government policy for educational planning for some time. What is new is that accessibility to international data sets like PISA and TIMSS provide the 'hard evidence' regarding the extent and size of these gaps. McGaw raised this issue nationally in 2007 referring to the 'prevailing long tail' of low achievers evident in these international results. As highlighted by Thompson, de Bortoli and Buckley (2013), even though the overall performance of Australian students for PISA 2012 and 2009 were static for science with a slight decrease for mathematics, it was the gaps between the subgroups of students that appeared disproportionate. For example:

- Students in the lowest quartile for SES attained a mean score of 463 for mathematical literacy compared to students in the highest quartile who achieved a mean score of 550 points representing 2.5 years of schooling. These results were identical for scientific literacy. A full description of the impact of SES is available from Panizzon, Westwell & Elliott (2013).
- Indigenous students achieved a mean score of 417 for mathematical literacy compared to 507 for non-Indigenous students representing 2.5 years of schooling with similar results for scientific literacy.
- Students attending metropolitan schools achieved a mean score of 511 for mathematical literacy while those in rural schools attained a mean score of 444 representing 2 years of schooling. Again, results were similar although slightly less for scientific literacy demonstrating a difference of 1.5 years of schooling. A major National survey was conducted in Australia to explore the issues facing rural and regional teachers in the teaching of science, mathematics and ICT in 2006 (see Lyons, T., Cooksey, R.W., Panizzon, D. L., Parnell, A. & Pegg).

PISA data are explored here but these same gaps also emerge for TIMSS. Further corroboration of these inequities also emerges from the results of our National Assessment Program Numeracy and Literacy (NAPLAN) program, which is conducted annually (see Shepherd & Bonnor, 2014).

Clearly the challenge for educational authorities, school leadership and classroom teachers is to find ways to address the needs of these students recognising that within each of the subgroups there are students achieving in Bands 5 and 6. Given this diversity, it makes the task of thinking about how learning, teaching, classroom environments, and other factors, such as parental participation might be re-conceptualized to address these achievement gaps.

Promising movements in Australia

In terms of our Indigenous students, a recent report from Paige, Hattam, Rigney, Osborne and Morrison (2016) identified a number of key priority areas for addressing the gap in STEM specifically. Some of these include:

- Embedding Indigenous STEM workforce targets in the National government's *National Innovation and Science Agenda*;
- Funding the continuation of Indigenous STEM outreach/engagement programs in universities;
- Establishing partnerships and support STEM programs within Indigenous communities; and,
- Improving Indigenous school completion, numeracy and literacy rates.

The latter priority is a long-standing issue with Biddle estimating that 20% of the gap in Indigenous achievement relates to the high rates of absenteeism of these students, especially in regional and rural locations of Australia. Quite simply, improve the rate of attendance and learning is likely to improve. Yet, attempts to alter this single factor have not been widely successful because teachers and school leadership cannot do this alone. It requires 'buy in' from families and the broader community. While the emphasis here is around Indigenous students, the same priorities are also applicable to students from low SES backgrounds and those attending regional and rural schools.

Importantly in Australia, we are beginning to see some traction with programs aimed at minimizing the inequity prevalent in education more broadly. In particular:

- Grants are readily available to academics and other educators to implement programs focused on raising the literacy and numeracy of Indigenous students in the primary years;
- Universities are awarding scholarships with the goal of increasing the enrolment of students from low SES backgrounds by 20% by 2020 in line with the Bradley Review of Australian Higher Education (Bradley, Noonan, Nugent, & Scales, 2008);
- Departments of Education are attempting to increase the number of highly accomplished Principals and teachers working in rural and other hard-to-staff locations across Australia (Australian Government, 2015);
- Government authorities targeting Indigenous health and wellbeing by identifying students with poor sight and hearing; ensuring safety within communities; and raising awareness around the importance of nutrition;
- The allocation of 7,500 scholarships by the National government to assist employers in providing job-specific training for all new employees; and,
- A National policy with supporting funds aimed at subsidizing local business to build employment within local rural and regional communities thereby reducing urbanization and unemployment.

Positive outcomes are beginning to emerge in response to some of these strategies, such as an increase in:

1. The proportion of Indigenous 20-24 year-olds achieving Year 12 (final year of schooling) or equivalent from 45% in 2008 to 59 % in 2012-13.
2. The enrolment of Indigenous students in higher education institutions with the majority of these enrolments being females (Department of Education and Training, 2014).
3. The enrolments of students from low SES backgrounds over all other types of students in higher education (Edwards & Radloff, 2013).

Ensuring greater equity for Australian students regardless of their cultural background, where they live or their economic status is imperative for the future of the country. While governments are usually relied upon to fund and direct most interventionist programs, it is often the initiative that begins within the community itself that creates the most change and impact. One such example is the Science and Mathematics Academy at Flinders (SMAF) devised and implemented from the ground up to maximize the opportunities for students from low SES locations by facilitating ongoing access to Year 12 physics, chemistry and specialist mathematics (Panizzon et al., 2013).

So, whether large or small in scale Australia needs to unify efforts if we are to reduce the inequity in relation to science and mathematics as outlined in this paper. Pivotal to achieving this outcome is a futures-directed policy framework that integrates educational, health, economic and political perspectives to create greater cohesion and consistency in the way we address what is long-standing inequity in Australia.

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