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Gender Still Matters in Australian Schooling

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ABSTRACT
In the 1980s, gender issues and a focus on girls' and young women's participation in SET was a significant issue in Australian education. Much has changed, however, with current policy paying scant attention to gender as an issue in SET. Léonie Rennie was a co-organiser of the Sixth International Gender and Science and Technology conference held in Australia and in this article presents her personal reflection on some of the changes and possible reasons for the apparent lack of interest in gender in SET in Australia at the current time. The article documents policy and other milestones relating to gender in school science education over the last three decades and presents recent evidence suggesting that the aims of gender-inclusive education have not yet been achieved.

Gender Still Matters in Australian Schooling

In October, 2009, Professor Elizabeth Blackburn was named as Australia's first woman Nobel Prize recipient. An article published in *The Age*, a well-read Australian newspaper, captured the spirit of much of the press coverage of the event. It was entitled, "What's a nice girl like you doing with a Nobel prize?" (Darby, 2009). In the reporter's defence, it should be pointed out that he was parodying a question reputedly asked of Blackburn when she was at university: "What's a nice girl like you doing studying science?" Now, wrote Darby, Dr Blackburn had the last laugh.

Darby (2009) also noted that Blackburn's interest in science was sparked by a chemistry teacher at her Tasmanian school, underscoring the importance of schooling in determining future careers. That was in the early 1960s, and now, more than four decades later, the press about women's and girls' achievement in science still regards their sex as a major issue of comment.

Some two decades ago, education in Australia was actively raising awareness of, and giving policy attention to, education for girls in science, mathematics and technology. This seems no longer to be the case. In this article, I offer a personal reflection on some of the policy and other milestones relating to gender in school science education over the decades of the 1980s, 1990s and into the first decade of this century. I then review recent evidence about the current achievement and participation of girls and young women in SET and suggest that the aims of gender-inclusive education have not yet been achieved.

GENDER-INCLUSIVE EDUCATION IN AUSTRALIA: SOME POLICY MILESTONES

Interest in girls' education became explicit in Australian government circles in 1975 when the Schools Commission released the findings of an inquiry into unequal educational opportunities and outcomes for girls. This report, *Girls, School and Society* (Schools Commission, 1975), resulted in the establishment of a Working Party on the Education of Girls in 1981. The outcome, *Girls and Tomorrow: The Challenge for Schools* (Commonwealth Schools Commission, 1984), was a major milestone in the Government's support for encouraging girls in science and mathematics. The slim, but well-researched, *Girls and Tomorrow* report confirmed the need for national policy – most Australian states and territories had already produced their own policy statements in various forms. *The National Policy for the Education of Girls in Australian Schools* (Commonwealth Schools Commission, 1987) emerged as the first national policy. This substantial, purple volume contained a précis of the policy framework for easy reference inside the fold-out front cover. There were four key objectives: raising awareness of the educational needs of girls; equal access to and participation in appropriate curriculum; supportive school environment; and equitable resource allocation. Each objective was expanded into priority areas for action, and there was an undertaking to report annually, and publicly, on progress. The first annual report appeared in 1988 (Department of Employment, Education and Training, 1988) in a matching purple cover, but following reports were not made so publicly accessible.

Parallel to these government actions, the Australian Science Teachers Association (ASTA) began to work more proactively to support girls in science. Also in 1984, a national symposium was held, entitled *Science in Australian Schools: Today's Problems and Tomorrow's Challenges*. This was a joint initiative of ASTA, the Australian Government-sponsored Curriculum Development Centre and the Australian Academy of Science, the peak body for science in Australia. From this symposium, ASTA developed and published a policy about girls and women in science education (ASTA, 1987). As a direct result of the ASTA policy, *The Australian Science Teachers Journal* published a special issue focused on gender-inclusive science and technology education (Treagust & Rennie, 1989). Every single article contributed to this theme, and the special issue was sometimes used as a reference text in some teacher education classes.

Meanwhile, members of the McClintock Collective, a network of science teachers in Victoria, were developing a resource book of gender-inclusive teaching strategies in science. This excellent publication, *Getting into Gear* (Gianello & Dick, 1988), was funded by the Curriculum Development Centre as a teaching resource, and this book made a significant contribution to the teaching of science and technology in schools in ways that were clearly gender-inclusive. The Curriculum Development Centre had considerable funding over 1988-1989 to produce materials to support teachers in promoting girls' participation in science and mathematics, and this body supported a number of programs, including several issues of the professional development magazine *GEMS* (Gender Equity in Maths & Science). The 1989 special issue of *The Australian Science Teachers Journal* added to the available resources, underlining the impressive progress that had been made during the decade of the 1980s. In 1991, when the sixth international Gender and Science and Technology (GASAT) conference was held in Melbourne, enthusiasm on the ground was still strong, but the surge of explicit support from governments for girls' education was beginning to wane.

Responsibility for education in Australia is fragmented and politicised. Not only is there a department of education in the national Australian government, each of the eight states and territories also has its own government and its own education department. Whereas the influential Commonwealth Schools Commission's reports of 1975 and 1984 were prepared under the auspices of the Commonwealth government, by the late 1980s, national decisions about education were increasingly being made and policies agreed by a body comprising the Ministers of Education in each State and Territory and the Commonwealth. During the 1980s and into the 1990s, this body was called the Australian Education Council (AEC). It supported the 1987 National Policy (Commonwealth Schools Commission, 1987) and proposed that it be reviewed in 1991. The AEC led this review and published the *National Action Plan for the Education of Girls 1993-1997* (AEC, 1993). This plan retained the four key objectives of the 1987 National Policy listed earlier, and proposed eight new priorities designed "to bring about equal educational outcomes for girls and boys" (AEC, 1993, p. vii). To complement the new Action Plan, the Gender Equity Taskforce and Reference Group, working under the auspices of the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA, previously called the Australian Education Council) held a conference in 1995. The resulting publication, *Gender Equity: A Framework for*

Australian Schools (Gender Equity Task Force, MCEETYA, 1997), includes the conference papers and sets out 10 principles for action central to the notion of gender equity.

The 1997 document, *Gender Equity: A Framework for Australian Schools,* is the most recent, in fact the only, document currently listed under gender equity on the MCEETYA website[i]. The MCEETYA Four-year Plan 2009-2012 on Educational Goals for Young Australians (MCEETYA, 2008) mentions the word "gender" once. There are only two goals: Australian schooling promotes equity and excellence; and all young Australian[s] become successful learners, confident and creative individuals, and active and informed citizens. Under the first goal is the commitment that all students must be provided "with access to high quality schooling that is free from discrimination based on gender, language, sexual orientation, pregnancy, culture, ethnicity, religion, health or disability, socioeconomic background or geographic location". (MCEETYA, 2008, p. 7). This statement recognizes many variables with perceived links to disadvantage and/or discrimination, adding sexual orientation and pregnancy to the list in the previous statement of national goals for schooling.[ii]

The attention given to gendered differences in educational outcomes during the 1980s was often framed in terms of making schooling better for girls, whereas there is considerable evidence that gender-inclusive teaching actually makes schooling better for both boys and girls. However, the perceived focus and special attention given to girls led to a backlash in the 1990s, dubbed "what about the boys?" (Australia was not the only country where this occurred.) Proponents promoted the disadvantage suffered by boys, citing as evidence their poorer literacy skills, lower retention rates and their poorer behavioural record according to school suspensions and expulsions, compared to girls. A national parliamentary inquiry resulted in an influential report entitled *Boys: Getting it Right* (House of Representatives, Standing Committee on Education and Training, 2002), and this was followed in 2003 by a response from the federal government committing significant funding to a number of programmes (Minister for Education, Science and Training, 2003). Commentators such as Gill (2005) pointed out that casting boys as the "new" disadvantaged was inappropriate as these characteristics of disadvantage were hardly new. Further, it was argued, indicators of boys' and girls' situations were being compared in a selective way, and focusing on the separate needs of boys and girls failed to address the underlying gender power order which led to these differences. There is not space here to address the socio-cultural constructions of gender that are at work in the gendered outcomes of schooling; suffice to say that these matter, but recently seem to have faded from active consideration. There is a combination of factors contributing to this disinterest, not least the cyclical nature of government interests and priorities, and now different priorities are evident.

Over the last three or more decades, Australia has become a much more multicultural country whose citizens are much more aware of the consequence of differences on a range of variables. Worldwide changes, particularly those relating to globalisation and immigration, have created new imperatives for education. Currently, a National Curriculum is being developed under the auspices of the Australian Curriculum, Assessment and Reporting Authority

(ACARA). The documentation underpinning its development describes cross-curricular matters to be built into each subject, including science. These are:

- Indigenous perspectives, which will be written into the national curriculum to ensure that all young Australians have the opportunity to learn about, acknowledge and respect the culture of Aboriginal people and Torres Strait Islanders.
- A commitment to sustainable patterns of living which will be reflected, where appropriate, in national curriculum documents.
- Skills, knowledge and understandings related to Asia and Australia's engagement with Asia. (ACARA, 2009, p. 13)

The document is explicit in its reference to Indigenous perspectives and Australia's place in the world. In contrast, the word "gender" does not appear. In just three decades Australian education has turned full circle, and gender issues seem no longer to be of concern. Yet, in Europe, for example, the writers of the European Commission's document entitled *Science Education Now: A Renewed Pedagogy for the Future of Europe* (European Commission, 2007) are quite explicit that gender does matter. Its third recommendation states "Specific attention should be given to raising the participation of girls in key school science subjects and to increasing their self-confidence in science" (p. 17).

ARE GENDER ISSUES A CONTINUING CAUSE FOR CONCERN IN AUSTRALIA?

In the 1970s and 1980s, concern about gender issues in science, mathematics and technology had grown based on the recognition of differing educational outcomes for boys and girls. In simple terms, there were perceived differences between boys, on average, and girls, on average, in three key areas:

- subject interests and choices,
- confidence in their ability in science and mathematics, and
- achievement (although difference was dependent upon how achievement was defined).

Again, in simple terms, differences were explored and explained in terms of boys' and girls' interactions with each other and with their teacher, in the context of culturally-based gender stereotypes and expectations. Simplistically, one may argue that if differences based on sex no longer exist, then gender is no longer a matter of concern. As the introductory anecdote about Professor Blackburn makes clear, there remain culturally-based gender stereotypes about males' and females' achievement in science. Whether or not there remain quantitative differences in subject choices, confidence and achievement can be judged by examining recent evidence. PISA, the Programme for International Student Achievement (OECD, 2006), is a good place to start.

Achievement and Attitudes of Australian Students

In 2006, over 14,000 15-year-old Australian students participated in the PISA assessments. Table 1 provides an overview of the results for Australian boys and girls on the scientific literacy scales used by PISA. There is insufficient space here to provide much detail about the PISA assessment and readers are referred to the comprehensive information available from the OECD (2006) and the OECD website. To interpret the tables below, it helps to know that scores are scaled to a mean of 500 and a standard deviation of 100. If the mean difference between boys and girls on a scale is divided by 100, the result gives a measure of effect size.[iii]

Table 1 shows that the Combined Science scores are the same for males and females (zero difference), so it might appear that Australia has no sex difference in scientific literacy. However, there are small but statistically significant differences on several of the subscales that contribute to the Combined Science score for scientific literacy. It can be seen that males have performed at a higher level on three subscales: explaining phenomena scientifically, physical systems, and earth and space systems. Females have performed at a higher level on identifying scientific issues and knowledge about science. As an effect size of 0.2 is considered to represent a small but noticeable effect, some of these differences may be considered trivial, even though they are statistically significant.

Table 1 Effect sizes for Australian Males and Females in Scientific Literacy

PISA Scales	Effect size, male mean – female mean
Combined Science	0
Science Competencies	
Identifying scientific issues	**-.21***
Explaining phenomena scientifically	**.13***
Using scientific evidence	-.03
Knowledge of Science	
Physical systems	**.26***
Living systems	.01
Earth and space systems	**.16***
Knowledge about Science	**-.10***

* mean difference is statistically significant.

Source: Tables 2.1c, 2.2c, 2.3c, 2.4c, 2.7, 2.8, 2.9, 2.10 retrieved from http://www.oecd.org/dataoecd/30/20/39704105.xls

If the PISA Australian data for the science attitudes subscales are examined, as presented in Table 2, we again see small, but statistically significant, differences between males' and females' mean scores. Males appear to be more confident, assign a higher general value to science, enjoy science more and be more aware of and optimistic about environmental issues than females. In contrast, females demonstrate more concern for the environment and accept greater responsibility for sustainable development than do males. These differences are quite stereotypical. They also indicate that sex differences in attitudes and achievement remain, and although they are not consistent, they are gender stereotyped.

Table 2 Effect sizes for Australian Males and Females in Science Attitudes

PISA Scales	Effect size, male mean – female mean
Self-concept in science	**+.22***
General value of science	**+.13***
General interest in science	-.02
Enjoyment of science	**+.09***
Awareness of environmental issues	**+.18***
Concern for environmental issues	**-.22***
Optimism regarding environmental issues	**+.21***
Responsibility for sustainable development	**-.20***

* mean difference is statistically significant.

Source: Table 3.21 retrieved from http://www.oecd.org/dataoecd/30/61/39704258.xls

Participation in SET of Australian Students

Determining whether or not sex differences remain in subject choice requires examination of enrolment trends in physics, chemistry and biology. Year 12 (age 17 years) is the final year of secondary schooling Australia and data are readily available for total subject enrolments in this year. However, it is more difficult to obtain these data by sex, so the data in Table 3 have come from two sources. This table provides percentage of cohort data for the years 1980, 1998, 2001, and an average for 2004-2006 (a variation because the data were sourced differently). It can be seen that the stereotypical differences of males preferring physics and females preferring biology clearly existed in 1980, and have persisted almost unchanged over the years. The enrolments in chemistry, however, had become more similar by 1998, and the difference favouring males is now small. It is noticeable that the percentage enrolments in all subjects have decreased. This is explained first, by the increase in retention rate into Year 12 after 1980, with larger total numbers in year 12, and second, by an increase in the range of subjects available for students from the 1990s. Many more students now choose subjects other than science.

Table 3 Science Subject Enrolments for Year 12 Australian Males and Females (%)

Subject	1980*		1998*		2001**		2004-2006**	
	Male	Female	Male	Female	Male	Female	Male	Female
Physics	45	14	27	10	25	9	23	8
Chemistry	44	23	22	19	20	16	19	17
Biology	38	64	20	33	18	32	19	33

* From Goodrum, Hackling, & Rennie (2001, p. 41)
**From Ainley, Kos & Nicholas (2008, p. 23)

What happens in school is a precursor to students' post-school choices and success in finding and retaining employment in adulthood. Here there is space to offer just one piece of evidence relating to those students who begin tertiary education. The chart in Figure 1 (attached as Appendix A) is sourced from the *OECD Education at a Glance 2008*, and shows the proportions of females enrolled in four clusters related to social sciences, sciences, humanities and health. These data are international and show that Australian data are similar to that of many other OECD countries: females represent only about 30% of the enrolments in the sciences, but well over 70% of the enrolments in health and welfare. Gender still matters.

The comparisons I have made in Tables 1 to 3 and the OECD data in Figure 1 show differences, but they do not explain those differences. Explanations can only be built by examining carefully not only gender, but a range of the factors at work within subgroups defined by variables such as culture, geographic location, ethnicity, socio-economic status and so on, an analysis beyond the scope of this paper.

SUMMARY

In sum, the position and performance of girls and young women in science in Australian schools suggest that gender still matters in education, but for the time being, not much notice is being taken of it in policy circles. In fact, I have been unable to uncover any systematic current research into gender and science education. In writing this article I have looked back at old policy documents and lots of teaching resources, and I know that the contents of many of them would be quite fresh to some of today's teachers. The scholarly analyses conducted over the last three decades by Australian researchers (Parker's 1997 explication of the meaning of gender-inclusive science education is an example) have left a valuable legacy and we have yet to make full use of it.

ENDNOTES

[i] Since July 1, 2009, MCEETYA has become the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA).

[ii] Interestingly, it also replaced the word "sex" with "gender". Changing terminology has been an issue in educational policies (see Gilbert, 1996).

[iii] The effect size calculated in this way is in standard deviation units. An effect size of 0 indicates no difference between group means and an effect size of 1.0 indicates a difference of one standard deviation.

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Appendix A

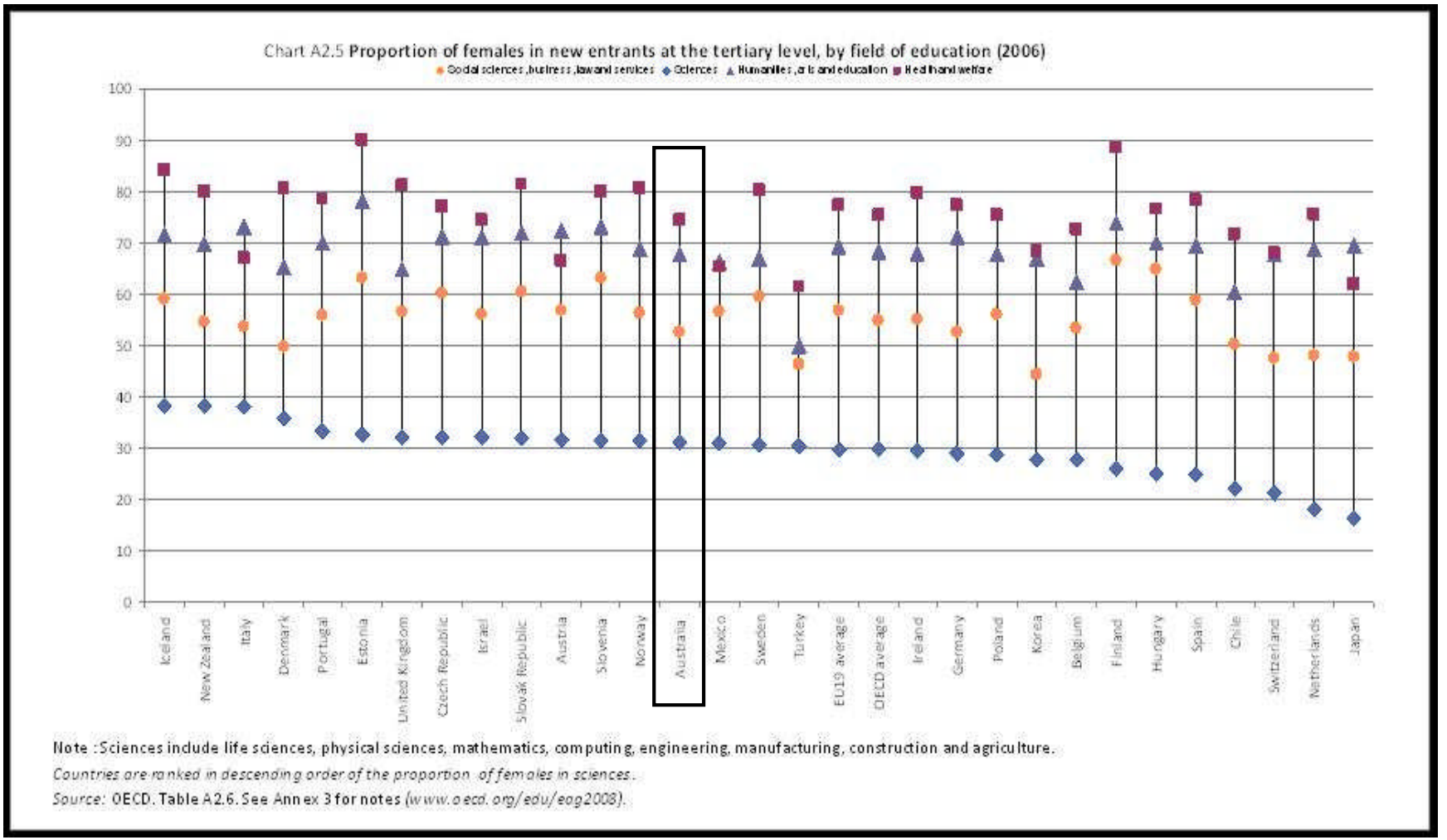

Figure 1. Proportion of females entering tertiary education in 2006

(Based on Table A2.6., p. 70 from OECD (2008), Education at a Glance 2008: OECD indicators www.oecd.org/edu/eag2008. Reproduced with permission.)

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