

Editorial

Gender and Learning Settings: Issues From Yesterday to the Present

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In many Western nations, voices were raised in the late 1960s and early 1970s to draw attention to females' disadvantage in society generally and in education in particular. Mathematics, the "critical filter" (Sells, 1978) to many tertiary courses and related careers which were also linked to status and power in society, was identified and targeted for action. At that time, females' achievements and participation rates in mathematics and many other science-related fields were lower than males'.

Early research and scholarship in the field of gender and mathematics focused on documenting quantitative differences between males and females. In trying to explain the persistent patterns found, two assumptions, founded in liberal feminist thinking, appeared to underpin the mainstream research agenda: that there were no differences between males and females, and that the levels achieved by males were the norm to which females should strive. Research efforts uncovered a range of cognitive, affective, and environmental variables on which females and males differed. Explanatory models were postulated. Critically examined, it is clear that women were considered to be "deficit." To achieve "equity," efforts were thus directed at *changing* women. Many subsequent intervention programs took females aside in attempts to bring this about.

There have been many changes in the twenty five years since research in the field of gender and mathematics began. Progress had been made in closing the gender gap. Legislative changes and government policy initiatives have also played a role in challenging the status quo. Yet, equity in mathematics learning outcomes has not been achieved. Although more females now study more mathematics courses than in the past, participation rates in the most demanding mathematics options remain male-dominated. It is also now known that mathematics achievement levels can vary depending on the measure used to assess performance. At the highest levels of mathematics achievement and on the most cognitively demanding questions, however, gender differences found tend to favour males.

A complex of interacting variables has emerged as continued research efforts have expanded our understandings of the effects of gender on the learning of mathematics. The most recent major reviews of relevant research in Australasia (Barnes & Horne, 1996) and internationally (Leder, Forgasz & Solar, 1996) reveal the range of factors implicated. Gender has been found to interact with societal (e.g., race, ethnicity, class), contextual (e.g., home, school/institution, government, media), affective (e.g., attitudes, beliefs, expectations), and cognitive (e.g., abilities, learning styles) variables to influence mathematics learning outcomes. In more recent times, feminist theories have prompted and re-directed thinking in the field.

Traditional research paradigms, the ways in which research questions are asked, and the acceptance of male norms as the assumed standard have all been challenged.

A new issue confronting researchers concerned with gender equity in mathematics education has emerged in recent times. As pointed out in three papers in this *Special Issue* (Boaler, Gill, Leder & Forgasz) there has been a shift in focus from girls to boys as the educationally disadvantaged group. The issue has received much media coverage and prominent headlines. While not denying that boys as a group, have educational needs which are not adequately met by the contemporary educational process, it is difficult to sustain an argument that boys are disadvantaged with respect to the outcomes of mathematics learning. Yet, as evidence from articles in this issue suggest, there are some who believe this to be the case.

Recognising the considerable contributions of earlier work and the contemporary context in which research is conducted, new directions are needed. Fennema (1996), whose seminal research in the field placed "gender" on the mathematics education agenda, claimed that:

positivist scholarship should continue, particularly in order to continue the documentation of gender differences in participation and achievement in mathematics. However, an understanding of gender and mathematics based on studies done from this perspective is limited. Perhaps it is evidence of narrow vision, but I do not believe that we shall understand gender and mathematics until scholarly efforts conducted in a positivist framework are complemented with scholarly efforts that utilize other perspectives. (p.16)

Fennema (1996) suggested two paradigms which had great potential to extend knowledge in the field: cognitive science, and feminist perspectives. Current perspectives on gender issues in society make poignant Fennema's reminder to monitor general trends through traditional research methods. Leder (1992) has also suggested new research directions which can build on previous work and direct action for change:

Supplementing the more common large-scale studies with in-depth small-sample research should provide further insights into the factors that contribute to differences in mathematics learning within as well as between groups and should lead to more constructive ways of counteracting them. (p.617)

Several of the contributions to this *Special Issue* of MERJ have heeded the suggestions of Fennema and of Leder. In doing so, the challenge laid by Ellerton (1997) for mathematics education researchers to "adopt visions which take them into new territory" (p. 4) has also been taken up.

This Issue

In this *Special Issue* of MERJ, the focus is on *Gender and Learning Settings*. Much previous work has implicated the setting in which learning occurs in explanations of gender differences. In reading the contributions in this issue, it is not difficult to see that the learning context cannot be isolated from the complex of other interacting factors discussed above. The articles cover and reflect many different learning settings: school, tertiary, adult learners, single-sex groupings, ethnicity,

and the effects of the socio-political climate. The extent of common international concern about the issues is exemplified by contributions from overseas authors. In these learning settings, the roles and perspectives of various critical players are examined: students, parents, teachers, the curriculum, and the teaching approaches used.

Consistent with previous research findings and with some feminist perspectives is that consideration should be given to the needs of all students, male and female, in the coeducational classroom in order to achieve equity and benefit all students. More radical feminist positions emphasise the acceptance of male and female difference to reflect equity as long as each group's ways are valued equally. From this perspective, some argue in favour of single-sex mathematics education, for example. There are others, not immersed in feminist theory, who have turned to the single-sex alternative, not as the preferred learning setting but as a short-term intervention, based on perceived gender-based inequities within the context of an institution or academic discipline. Two papers in this *Special Issue* (Brandell, Carlsson, Ekblom & Nord; Leder & Forgasz) examine interventions of this kind. The aims were similar in both situations: to increase female enrolments in male-dominated fields, one in the tertiary field of computer and engineering science in Sweden (Brandell et al.), the other in a coeducational high school where female enrolments in mathematics at higher levels in the school were well below those of males. Brandell et al. discuss the process by which they gained acceptance for, and implemented, their new course structure. Leder and Forgasz examined parents' views and beliefs about the school's intervention program. Over a three-year period, support for the program had waned. Garnering support from stakeholders for projects which run counter to community beliefs appears to be a crucial element for interventions of this kind.

A third paper (Rennie & Parker) also focuses on single-sex mathematics classes in coeducational high schools. Here, however, the longer-term focus was on gender-inclusive classroom practice. Students' views and teachers' reactions to the project were explored. The teachers' experiences raised their awareness of the differences in the classroom dynamics of girls-only and boys-only classes and of their own teaching approaches which, in coeducational settings, might favour one group over the other. Boaler's paper is also concerned with pedagogical approaches in mathematics classrooms. She compared students' beliefs and achievements in a classroom using a traditional textbook-based method with a classroom using an open, project-based approach. Her findings, framed within Belenky, Clinchy, Goldberger and Tarule's (1986) theory of *women's ways of knowing*, revealed that the project-based approach had been advantageous for females, appeared not to disadvantage males, and seemed to engender a more equitable learning climate. The outcomes lend support to contemporary mathematics educators' beliefs about effective teaching and learning practices. Boaler's study, which focuses on a classroom model with "successful" outcomes for females, has provided valuable new knowledge. Gill's reflective essay suggests that more research of this kind is needed.

In her paper, Boaler also alludes to the tyranny of systemic assessment requirements. FitzSimons' paper explicitly examines the impact of the socio-political climate on the mathematics education offered to adult learners in the Vocational Education and Training sector. The effects, she argues, are such that

neither students nor employers are well-served by the imposed constraints, and issues of equity receive scant attention.

Differences in ethnic and cultural expectations interacting with gender are evident in the analysis of Jewish and Arab Israeli students' attitudes towards mathematics reported by Mittelberg and Lev Ari. In nations such as Israel, where research on gender issues in mathematics education is relatively new, adopting traditional quantitative research methods has provided an overview of general trends, allowing comparisons with the wealth of data from elsewhere.

Over the years, research on gender has produced much valuable knowledge. As yet, however, the attainment of equity in mathematics learning outcomes has not been achieved. The impetus for continued research in the field is as urgent today as in the past. Society at large has changed over the quarter century of intense efforts in the field. In some respects, the challenges confronting researchers on gender issues are greater. Gender is no longer prominent on political or educational agendas and research funding is highly competitive and limited. The focus on boys' issues, although not trivial, overshadows the efforts of those who wish to emphasise that there remain areas of disadvantage for girls. This *Special Issue* on gender and learning settings is thus particularly timely.

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