

Gender Fictions

LESLEY LEE

Some months ago I set out to write a book review of *Gender and mathematics*, a collection of papers edited by Leone Burton. I was, at the time, also reading and greatly enjoying Valerie Walkerdine's book *Schoolgirl fictions* and had just purchased a copy of Cynthia Cockburn's *Machinery of dominance*, which focuses on gender issues in the area of technical "know-how". The first two books deal to a large extent with what happens to girls and women in school, and particularly in the mathematics classroom, and I could not read one without constantly confronting it with the other. Indeed, the two seemed to cry out to each other. Cockburn's book, with its clear description of the gendering process and the latter's profound effect on the positioning of women *vis-à-vis* technology, provided at times a solid purchase from which to view the other two books and helped to clarify some of Walkerdine's arguments by applying a similar analysis to the issue of women and technical knowledge.

The result of this joint reading of *Gender and mathematics* and *Schoolgirl fictions* (with asides to *Machinery of dominance*) cannot be called a book review of any or all of the three books. I do try to cover in some detail the content of *Gender and mathematics*, though I have reorganised its chapters in a way that allows me to best relate their content to the themes in Walkerdine's book. There is no attempt to present a complete overview of Walkerdine's book. And since Cockburn's work serves mainly to exemplify or clarify Walkerdine's positions, references to *Machinery of dominance* have been relegated to the notes. So that what I found I had written when I finally put a stop to this project was a paper on gender and mathematics which begins with *Gender and mathematics*, moves on to Walkerdine's work on this theme in *Schoolgirl fictions*, and to an inevitable confrontation of the two.

Gender and mathematics is the outcome of the sessions on Women and Mathematics at the Sixth International Congress on Mathematics Education held in Budapest, Hungary, in 1988. Fourteen presentations on issues of gender and classroom practice, curriculum and achievement, as well as the question of women's presence in mathematics, are brought together with an introduction and conclusion by Leone Burton who was, at the time of the congress, president of the International Organization of Women and Mathematics sessions. The chapters read very much like congress proceedings with all the diversity of interest, scope and ideological stance that one would expect to find at an international event.

Schoolgirl fictions is also a collection of articles, all by Valerie Walkerdine, grouped into thematic sections. Part I, "Schooling for girls", is composed of seven pieces first published between 1981 and 1985 which deal with the

education of girls and women. Part II, entitled "Fictioning femininity", is made up of eight pieces written between 1984 and 1989, some previously unpublished. They deal with psychoanalysis and the "fictional" representations of women. The final section, called "Working-class rooms", is the most personal part of Walkerdine's work, in which she tries to come to terms with herself as an "educated working-class woman" and with the "fictions" that produced her.

Contributions to Gender and mathematics: the "truths" about girls and women

Rather than examine the various contributions to the Burton collection under the headings she established, following her ordering, I would like to propose another organisation which will allow me later to connect more profitably with Walkerdine's work. At this point, I shall, therefore, review very briefly most of the fourteen chapters of *Gender and mathematics* under five statements or "truths" which are elements in the current "story" about girls and mathematics and which are in some chapters challenged and in other chapters reinforced by the various contributors.

Girls are given less attention than boys in mathematics classes

Gilah Leder, in "Gender and classroom practice", reviews a range of research on the differences in teacher treatment of boys and girls and reports on a recent Australian study which confirms that the practice of calling on boys more often and for higher-level questions persists in the mathematics classroom. Leder does not blame the teachers or the schools for this. She suggests that what goes on in the classroom is a reflection (and reinforcement) of the expectations and gender beliefs of the society around it, a society which still believes that "competing in mathematics is more important for boys than for girls".

It is interesting to look at Lyn Taylor's chapter, "American female and male university professors' mathematical attitudes and life histories", in the light of this first truth. Although her research involved a group of six male and six female university professors, it is remarkable to what extent the male professors dominate the report. Males are quoted over twice as often and much more extensively. This author, who feels that "times are changing" and who says "Hopefully there is less discrimination today", seems to find, nevertheless, that what the men had to say about women's (and their own) education in mathematics is of more value or more interest than what the women had to offer. [1]

Girls flourish in a mathematical environment which is loving, noncompetitive and supportive

Zelda Isaacson describes a mathematics course she taught to twenty-four women re-entering a science and technology program. Group work and discussion, investigative activities and confidence-building elements, as well as an attempt "to create a light-hearted classroom atmosphere", were the main features introduced to deal with expected fears, anxieties, and lack of confidence on the part of participants. Her chapter, entitled "'They look at you in absolute horror': women writing and talking about mathematics", contains the participants' negative memories of school mathematics as a site of competition, fear, panic and lack of encouragement, where peers and parents were not always supportive and the school organisation itself discouraged them. These are followed by quotations from women after the course indicating their appreciation of group work and the confidence and positive attitudes that had developed. Conclusions are drawn for the teaching of mathematics to girls, though Isaacson feels that "probably the most significant" influences on girls and women "are outside the control of teachers and schools".

Maire Rodgers, in "Mathematics: pleasure or pain?", came to conclusions similar to Isaacson's about the importance of a supportive, "light, lively and purposeful" atmosphere. She too suspects that "the move toward collaborative group work and language-intensive processes might benefit girls". Rodgers carried out a case study in 1987 which tried to identify "factors that had encouraged female students" to take Advanced-level mathematics (in three schools in Northern Ireland). She found that, like the boys, the girls chose A-level mathematics because they liked it and because of the "encouragement, support or enthusiasm of particular teachers". She also found that girls preferred "straightforward types of problems where they could follow recognized patterns" rather than those that required more versatility. Through her experience teaching family maths to parents and their nine-to twelve-year-old children, Rodgers found a model for providing "safe environments" in which young people, and presumably girls, could encounter "risky mathematical situations". In the context of "family math" enjoyment was found in the work being "hard". Humour, laughter, and play were considered very important elements in facilitating learning.

Beth Marr and Sue Helme describe their experience as part of a collective creating materials and methods for a course aimed at adult women with three years or less of high school mathematics studying in a "bridging program". In "Women and maths in Australia: a confidence-building experience for teachers and students", they list the criteria used in their work: confidence building, interactive and cooperative learning, practical "hands on" activities, acknowledgement and accommodation of differences, provision of a relevant context. Also among the criteria was the need to "raise awareness about social and economic structures influencing our lives, particularly the lives of Australian women". This was not elaborated on, except to say that examples of current events would be used. The course began with "activities to generate a supportive

classroom atmosphere and build students' confidence in their ability to learn mathematics". Their materials were published in book form and the response from teachers has been very positive. The book has been found useful in mixed-sex classes at the high school level as well.

It was again in a question of a lower level of confidence in women and their need for support that distinguished the sexes in Joanne Rossi Becker's report of her study of 21 students in mathematics and computer science. Her report, "Graduate education in the mathematical sciences: factors influencing women and men", indicates that women and men have similar reasons for liking their respective disciplines, that men were more motivated to attend graduate school, and that the women "seemed to need strong encouragement from at least one person to try graduate study". Becker not only recommends a more supportive attitude towards women but also giving them the information that it is possible to do a master's degree in computer science without a strong mathematics background.

Girls do better with female teachers, female role models, and content that is more humanistic

"Humanizing calculus: a case study in curriculum development" by Mary Barnes and Mary Coupland describes a 16-hour course "designed and taught by women" which targeted adults, particularly women, outside the university with a view to giving them a chance to learn some "powerful ideas" in mathematics and science. In the case of the female students (only 40% of the enrollment), it was hoped that their interest, confidence, and opportunities for further study would be increased. An analysis of the content of the traditional calculus course led to the conclusion that its abstractness and accent on problems concerning "profits, weapons and machines" were particularly unmotivating for women. The abstractness of traditional calculus was dealt with by avoiding discussion of limits and differentiation from first principles and by the use of computers and manipulatives which shift the accent from the theoretical to the experimental. Traditional problems were replaced by ones based on issues of "responsibility and care" (population growth, endangered species, spread of disease,...) and a humanised history of the subject was presented. The traditional teaching methods were also found to be unappealing to women. Their competitiveness, individualism, authoritarian and teacher-centred style were found to favour the confident and assertive. Lectures were therefore complemented by discussions and small-group work. Positive feedback from the women who attended has encouraged the authors to design a second course in algebra and graphs.

Attempts to bring girls' realities into the mathematics curriculum in the Netherlands led to the introduction of embroidery, cooking, and knitting work for 12-to16-year-olds. Helen Verhage describes her experience as a member of a team (25% female) which had the mandate to revise the national mathematics curriculum, "making sure that the programme will *also* be attractive to girls and that it will provide girls, *too*, with a favorable perspective on the job market". (Italics are mine.) "Curriculum development and

gender” describes the context of “realistic mathematics education” in the Netherlands. The introduction of subjects that would be of interest to “female students and immigrants” led to a long list which included the above “female arts” as well as such diverse topics as tangrams, tessellations, wallpaper, crockery, and paper folding. The question of maintaining female stereotypes is raised but not dealt with. With only 15% of teachers being female, the probability of supplying adequate female role models is low, though it does not seem to be regarded as an issue here. In fact, the author sings the praises of a male colleague who taught embroidery to his class in spite of the negative reactions of other male teachers and students.

The effect of female role models on girls’ performance is just one of the many concerns examined by Gila Hanna, Erika Kündiger and Christine Larouche in “Mathematical achievement of grade 12 girls in fifteen countries”, an analysis of gender issues based on the results of the Second International Mathematics Study. They hypothesised that “the ratio of female to male math teachers may be an important factor in explaining sex differences in mathematical achievement”, or more precisely that “countries with negligible sex differences in achievement” would have “higher proportions of female maths teachers”. It is not clear how the “proportions of female maths teachers” were measured. For instance, when the authors say that in British Columbia only 3% of the mathematics teachers were female, we do not know whether this is a provincial figure for all levels of mathematics teaching, whether it is the figure for the teachers in the last year of high school (the level being tested), or whether 3% of those students who wrote the test had female teachers at the time. Only the latter interpretation tells us anything about the sex of the girls’ teachers at the time of the test; nothing seems to be known about the sex of their mathematics teachers throughout the rest of their schooling.

In this study the measure of mathematical achievement was taken uncritically to correspond to the global mark students got the SIMS test. Comparing the three countries with the smallest sex differences in marks (i.e. “achievement”) with the three having the greatest sex difference, the authors conclude that “our data do not support” the hypothesis. They cite the example of British Columbia where sex differences were minimal and the percentage of female teachers low, and the example of Hungary where sex differences were high and the percentage of female teachers high also (60%). They could as well have chosen Thailand where sex differences were low and the percentage of female maths teachers relatively high (52%), or Japan where sex differences were large and the percentage of female maths teachers low (5%). What is important here is that the authors concluded that differences in achievement could not be attributed to the variable “sex of the teacher” nor, perhaps, to proportions of female mathematics teachers. They were careful to explain in their conclusion that “This does not mean that these variables have no influence on math learning, but rather that their influence may be exerted in interaction with other societal factors”

Pat Rogers also challenges the importance of female role

models in her reflections on the Potsdam phenomenon entitled “Thoughts on power and pedagogy”. At the State University of New York College at Potsdam, female undergraduates are in a majority and yet there is only one female in a department of fifteen mathematics teachers. Rogers was interested in how such a patriarchal system, “a group of stern but loving fathers”, could produce such an astoundingly high rate of female success. She concluded that the way the teacher wielded power was the important factor and attributed female success to unbiased paternalistic teaching which aims at relinquishing authority (unlike typical patriarchy).

Boys outperform girls in mathematics

The chapter by Hanna, Kündiger and Larouche was mentioned above in connection with the “truth” about female role models. The cited purpose of the paper was to “investigate sex differences in mathematics achievement”. By means of references to the literature and tables of results from the Second International Mathematics Study, the authors “demonstrate” female inferiority in mathematics. The discussion which follows does not explore the “fact” of female inferiority but attempts to show that several of the “explanations” for it do not hold water according to the statistics gathered on the SIMS test. Comparing test results from the three countries with the least sex differences to the three with the greatest, the authors claim they cannot find evidence in favour of the hypotheses that girls do better in single sex schools, that they achieve more if taught by female teachers, that girls’ underachievement has to do with a perception of mathematics as a male domain and, in part, “to their lower level of educational aspiration”. [2]

The chapter which follows takes the proof of girls’ inferiority to Singapore, using a random sample of the results of 88 boys and 88 girls on the 1986 0-level mathematics examination there. Berinderjeet Kaur, in “Girls and mathematics in Singapore: the case of GCE 0-level mathematics”, explained that “the main purpose of the data analysis was to find sex differences in mathematics attainment”. We are told at the beginning “that, on the whole, the girls were out-performed by the boys”. It appears further on that this statistic was derived from the population as a whole and not from the sample, since the sample was chosen so that “there were equal numbers of the same ability (i.e. grade)”. The author is very cautious in her interpretation of the test results. She warns that “To say that the present study has compared boys and girls of the type like with like by merely matching them in ability—defined by the score on an examination—is not true” and goes on to list the many other variables that might have been taken into account. She admits that the sample may not be representative and “cautions against over-generalisations and recommends that the present study be read in its context”. We will return to her contribution in the next section on sex differences in achievement in various mathematical tasks since this is where the core of her study is focused.

Seven-to thirteen-year-olds were the object of a study of sex differences in Greece. Evangelie Tressou-Milonas was looking at the possibilities of applying the British School

Mathematics Project (SMP) individualised mathematics program in Greek schools. Aspects of her research concerning girls' attitudes and performance are reported in her paper "True or false? primary school girls do badly at maths". She describes the high motivation of both sexes in the program and how the girls wanted to move ahead and in fact "surpass the boys". On the tests girls did better overall but left out more questions. "A relation was detected between the social class the children belonged to and their competence in maths as well as their reaction to a new work scheme" though no data or analysis of this is given. Sex differences in attitude did not appear and, as regards performance, the girls out-performed the boys. The author is very cautious in interpreting the results because of the very small sample size (21 boys and 28 girls) and the fact that the sample was not totally representative.

Even when their overall performance is comparable, boys do better at higher-level tasks and girls at repetitive, rule-following, lower-level tasks

All three papers dealing with the previous "truth" made at least some mention of sex-differences in areas of achievement within mathematics. Tressou-Milonas simply mentions that "Both boys and girls favoured particular subjects, not necessarily the same". Kaur, in her Singapore study, actually focused on the differences in areas of achievement, which is why she selected her sample by matching test grades between the sexes with about equal numbers getting "A"s, "B"s, and so on (though it appears that the actual mean score of the boys in the sample was higher than that of the girls). She too found girls and boys had different preferences when it came to choosing problems in the choice section of the 0-level exam. More girls chose the questions dealing with algebra, graphs, and two-dimensional vectors, whereas more boys chose the mensuration question. Boys in the sample performed better than girls on mensuration and statistics problems, did slightly better on probability questions, and significantly better in arithmetic and geometry. As well, boys did better on "questions that contained a spatial element". From this, the researcher concluded that girls do better on drill questions and rote learning whereas boys out-perform girls on fractions, proportionality and spatial visualisation. In an attempt to get at "possible reasons for observed differences" the author quotes Wood—"It appears that rote learning is more congenial to females"—and Jones on the "female tendency to keep to methods they have been taught, to reproduce techniques, to show caution, to avoid being wrong and generally to use a method with which they feel confident and secure and which is approved by the teacher". She also raises the spectre of genetic factors influencing spatial ability and possibly even quantification skills. Kaur seems to feel that these "truths" have been confirmed by her study though she does raise some interesting new questions about possible interpretations of the data. For example, she wonders if the girls' problems with fractions and proportion are due to discomfort "with comparison factors" and whether there is any link between

quantification and spatial abilities. We are reminded in the conclusion that one must be very careful about "over-generalizing" the results. For example, "although the examination scores have been used to pass judgement on spatial ability, one must not rule out the possibility of pupils being drilled on examination-type questions". Caution is also advised because of the absence of consideration of such variables as motivation, intelligence, social class, teacher attitude and teaching methods, math-related experiences in other subjects, and the variation between schools.

Hanna, Kündiger and Larouche also found sex-linked differences in performance on specific questions and categories in the SIMS test. In fact, "for all but Sets there were significant differences consistently in the boys' favour". In order of girls' decreasing performance with respect to boys', the topics are: sets, algebra, number systems, geometry, finite mathematics, analysis and probability. In this analysis by content and country there are no cases of the girls doing better. The authors use these statistics to select the three countries with the least sex differences and the three with the most but do not engage in any discussion on the topics as such. Boys' superiority on probability tasks with girls doing least poorly at algebra seems to be compatible with Kaur's Singapore study, though one should beware of neat comparisons since the questions asked under these topics were certainly significantly different.

In Maire Rodgers' paper, "Mathematics: pleasure or pain?", the subject of sex-related preferences in particular parts of the course (a sixth form course in Ireland) was discussed at some length

It appeared that girls preferred what they considered to be more straightforward types of problems where they could follow recognised procedures and had most difficulty where the initial formulation of the problem was not so obvious to them. Boys preferred problems in which they encountered variety and which they found easy to visualise and disliked what they considered to be boring and repetitious [p. 33]

Reflecting on the work of Rosalinde Scott-Hodgetts on how primary schooling "predisposes girls to develop a step-by-step serialized style of learning", Rodgers wonders to what extent girls' preferences are a part of a self-fulfilling prophecy.

The two remaining chapters

Two papers are left out of the above discussion of Burton's book because they do not really fit my "truth" categories. Prudence Purser and Helen Wily, who ask "Where have the mathematicians gone in New Zealand?", look at the decreasing numbers not only of mathematics graduates but also of those going on to higher degrees in their country. Their study covers the period from the 1972/73 academic year to 85/86 with an update on the last page of the paper for 86/87 and 88/89. Although the overall number of mathematics graduates (at all levels) was found to be decreasing, the decrease was greater for men than women. A decrease was also found in the number of graduates continuing to study for more advanced degrees. What is notable here is the low ratio of women to men continuing to take advanced degrees and this "has been consistent over the

14-year period". Shifts in occupational groups of mathematics graduates indicate that fewer are entering teaching and more going into computers and statistics. The decline in mathematics graduates entering teaching is considered "alarming".

The last chapter in the book, "Women and mathematical research in Italy during the period 1887-1946", by Fenaroli, Garibaldi and Somaglia, is intended as a historical response to the question of "women's inferiority in mathematics", a first response to the need for a detailed and impartial analysis of women's scientific production in mathematics in Italy from 1887 to 1946, "the period of taking up of awareness".

Apart from a few anecdotes from the six papers published on the subject of women and mathematics during this period, we are given mainly a statistical account of women's presence. We learn, for instance, that the Loria collection of 14,500 published articles contained 175 papers by (66) women. In the Italian journals reviewed, 62% of the articles were written by women and in congress proceedings between 5 and 6% of communications were given by women. Of the six papers on the subject of women and mathematics in the Loria collection, five were written by men. Opinion as to the place of women in mathematics seemed to be equally divided between those who saw a "glorious" future for women in mathematics and promoted co-education, and those who felt that women had no hope of achieving anything in the field of mathematics research and were opposed to co-education.

After what appears to have been such an ambitious review of the Italian scientific literature, it is disappointing to read only a few statistics on the relative absence of women in the field of mathematics research. There are several hints that the authors did indeed get into some analysis of the actual work of some of the women listed, but it is not shared with the reader. Nor is there any analysis or commentary on the statistics that are presented, except for a few brief asides such as a comment on the fact that "85% of women and 33.4% of men wrote 5 papers or more" in the Italian journals—the authors "conclude that more women than men limited their engagement in research". In the next sentence they infer that this was due to marriage and responsibility for childcare. They then go on to say that "of course both men and women stop scientific production because of difficulties with university career advancement and the links to the supervision of research". This is followed by two examples of women ceasing their academic publications because of the deaths of their male masters.

This is an appropriately ambiguous and confused ending for *Gender and mathematics*. The reader is left puzzled as to the aims and conclusions of the research and what exactly the authors intended to contribute to the gender and mathematics debate. There are no hints as to the position of the authors in that debate, not even a hint as to the sex of the authors.

In her brief conclusion to *Gender and mathematics*, Leone Burton seems herself to set aside gender considerations when she sums up the book as a plea "to respect the learner in *her* or *his* attempts to make sense of the new in

the context of the old and to respect the discipline of mathematics education [...]" (Italics mine.) The very last lines of the "Conclusion" are worth quoting for their non-committed, cautious nebulousness, properties that characterise the entire collection:

Ensuring that societies can be enriched by the mathematical contributions of their citizens and that individuals can feel positive about themselves in relation to the learning and use of mathematics is very obviously neither a straightforward nor a simple task. The challenge is there. [p 157]

They provide as well a wonderful jumping-off board for a leap into *Schoolgirl fictions* where Walkerdine sets about turning the fictions of femininity inside out and in the course of this passionate rampage tackles head-on the "truths about girls" that were so cautiously addressed and replicated in *Gender and mathematics*

Walkerdine's contributions in *Schoolgirl fictions: the "truths" about girl and women*

Walkerdine questions "the veridicality of claims to truth about girls" and the "will to proof" which seems to lurk behind them". Truths about girls in relation to mathematics are part and parcel of an elaborate social construction concerning what it is to be a woman, to be feminine. Walkerdine views femininity as an immense and very powerful fiction and indeed refers to "the fantasy of woman" that permeates "current pedagogical practice". If we are to address the five truths on girls and mathematics from Walkerdine's perspective, it is crucial to first understand her position on the "fictioning of femininity" and on how this fictioning is sustained and becomes fact in the mathematics classroom. [3]

Walkerdine views the gendering process, or "the fictioning or femininity", in the wider context of the process of differentiation in general, or as she calls it, the creation of the "Other", whether that Other happen to be girls, God, Mother, the Man of Reason, or even "the old pedagogy". Her view of the results of the process of differentiation is more nuanced than Cockburn's (see note [3]) in that there is a less clear division of people into the camps of oppressor and oppressed. She does not, for example, find the "unitary feminist position of women as oppressed, powerless, etc." particularly helpful. For Walkerdine, women and girls "are not unitary subjects uniquely positioned, but are produced as a nexus of subjectivities, in relations of power which are constantly shifting, rendering them at one moment powerful and at another powerless". The particular positionings of women as teachers and girls as students are the main preoccupations of Walkerdine in Part 1 of *Schoolgirl fictions*. Schooling, for Walkerdine, is one of the "powerful practices" in which the fantasy of femininity becomes fact.

To fully understand what happens to girls in mathematics and how the "truths" are constantly created and sustained in the mathematics classroom it is necessary to look at reason itself. [4] Walkerdine refers to reason or "the Cogito" as a philosophical doctrine which was transformed "into the object of a science in which reason became a capacity invested within the body, and later the mind, of the man, from which the female was, by definition, exclud-

ed". "The rational self was in this sense a profoundly masculine one from which the woman was excluded, her powers not only inferior but also subservient. The "thinking subject" was male; the female provided the biological prop both to procreation and to servicing the possibility of "man". In "proving" the inferiority of girls and women as rational beings we legitimise their exclusion not only from mathematical but all scientific endeavour. In a reflection on "Reason and gender" in Chapter 6, Walkerdine briefly reviews the history of the legitimation of this exclusion from the 19th century scientific view of woman, "whose failure to reason was produced through incapacity rather than oppression", to the view that it was physiologically "dangerous for women to reason" (not to mention the danger for the "future of the species"), and finally to the modern discovery of "the female intellect" which is seen as more suited to nurturing rationality through the caring professions. Although Walkerdine fails to mention the continuing attempts by the scientific community to produce "incapacity" theories which legitimise the exclusion of women from scientific endeavour by situating the problem in women's bodies (from craniometry through genetic and the present hormonal theories of female inferiority), her historical review does remind us of the central role of science in continuing to define reason as profoundly masculine.

It is this "will to proof", this necessity to constantly retell "the stories", to produce the truths "afresh", that leads Walkerdine to wonder what "fears and desires construct such fantasies and fictions, and read them back as fact", in this case facts or truths about the mathematical inferiority of girls. She considers "Man" as an elaborate fiction invested with a "fantasy of total control".

Female equivalence, or an absence of difference, therefore presents a constant threat to sexual difference and to the existence of "man" as supreme and omnipotent mathematician, the architect of "reason's dream", created in the image of God, "the divine mathematician" [p. 62]

Mathematical reason is viewed as

an elaborate construction, a discourse itself constructed out of fear, a power built on the terror of powerlessness. If "woman" is subservient in this fantasy, then any failure to find difference threatens the very possibility or existence of that power. The stories have to be constantly retold, the truths produced afresh. [p. 62]

Thus, according to Walkerdine, the whole enterprise of "truths about girls in mathematics" serves the status quo, sustaining the fantasies of the mathematical endeavour and the position of power to those who participate in it. The fiction of girls and mathematics has to be maintained in order to keep at bay man's fears of powerlessness. Girls have been fictioned as the Other of mathematics

It is therefore not with any intention of proving or disproving "the truths" about girls in mathematics, their Otherness, that Walkerdine tackles some of the same areas as the authors of *Gender and mathematics*. In fact, she feels that women's attempts at disproving such truths constitute a futile defensive battle which can never be won: "If we, as women, enter that game, we are continually caught in the

circuit of claim and counter-claim." Walkerdine's contribution is to undermine "the very claims upon which the "truth" about women is founded". She attempts to turn the tables on this proof" and to examine "the elaborate fears and desires" that have led to the construction of such "facts", "such fantasies and fictions". For Walkerdine, the question is not "are the arguments true?" but rather "How is this truth constituted, how is it possible, and what effects does it have?" With this in mind, let us examine Walkerdine's contribution to the five "truths" that emerged in considering *Gender and mathematics*

Girls are given less attention than boys in mathematics class

Walkerdine delves much more deeply into the differential treatment of boys and girls in the classroom and provides a portrait which situates the question-directing behavior of teachers, as described by Leder, in a much wider context than simply the teacher's belief that it is more important for boys to compete in mathematics. She also tries to give us some idea of the profound effects of this male-centred classroom dynamic on both women teachers and girls.

Walkerdine sees the silencing of girls as just one of the effects of the contradictory positioning of girls in the classroom. Silencing is the subject of a long chapter in *School-girl fictions*: "On the regulation of speaking and silence: subjectivity, class and gender in contemporary schooling". Since the "truth" we are dealing with here has to do with verbal attention, it is worth briefly reviewing some of Walkerdine's understanding of speaking and silence as it manifested in the classroom. In her first chapter, "Sex, power and pedagogy", Walkerdine suggests that the reason girls are relatively successful in early education is because in early schooling the material and institutional position of women as mothers and teachers is more powerful. "The very power of women in this transitory situation, between the domestic and the academic, is precisely what permits the early success of girls". Boys must struggle "to redefine the situation as one in which the women and girls are powerless subjects of other discourses". Boys often resist this "quasi-domestic power" by silence. Is the silence of girls in later schooling a manifestation of a similar resistance to a power that has escaped them?

Walkerdine warns us that "the issue of silence and speaking is not a simple matter of presence or absence, a suppression versus an enabling". She traces the development of the role of language in the "new pedagogy of experience and natural development". Once talk had become "dissociated from the passive regurgitation" of the old pedagogy, it could take its place as "an aspect of freedom, of the facilitation of language" and another "natural" aspect of the natural child. Silence was pathologised as the "absence of language" and mothers were the chief targets of blame. Language was to have a central role in the new pedagogy, which was itself a manifestation of the shift, begun in the nineteenth century, from overt to covert regulation of the population. Emotion was to be personalised and overt conflict was to be transformed into rational argument, passion into "feelings", and the irrational into the rational under the loving guidance of the mother and teach-

er. "Like natural reason, natural language was allowed, permitted, desperately facilitated."

A classroom where girls are given less attention than boys, where girls are asked fewer and less challenging mathematics questions is, in Walkerdine's view, one in which both girls and their female teachers are placed in psychologically painful and damaging positions. It is a classroom where girls are officially sex- and class-neutral children, treated "like boys" in the fiction of progressive education and where, at the same time, they are excluded from that fiction by another equally powerful fiction, that of femininity. They are covertly or overtly praised by teachers and approved of by peers for their helpful, industrious and considerate behavior and at the same time pathologised as "drudges" and as the failures of progressive mathematics education for the same behavior. Walkerdine does not deny that greater attention is given to boys in mathematics class. Her contribution to this truth is to situate it in the wider context of the classroom dynamic where it becomes one minor, understandable, and unparadigmatic element.

Girls flourish in a mathematical environment which is loving, noncompetitive and supportive. Girls do better with female teachers, female role models and content that is more humanistic(5)

Walkerdine, a former primary school teacher herself, reflects on a very specific classroom setting, that of a modern British primary school with mixed-sex classes and a female teacher, with "child-centred practices", i.e. with children learning at their own pace in an active environment (through "play", not "work"). In this setting, the Other, the undesirable, becomes the old authoritarian, passive, hard-working, rote-learning pedagogy. This "progressive", motherly, non-competitive and humanistic setting appears to be the ideal one where girls will "flourish" mathematically. It is hard to imagine how in such a "natural", happy, playful, constructive setting there could be so many painful experiences for girls and the women who teach them.

And yet this is the setting where the "fictioning of femininity" in girls becomes fact. As children, girls are expected to behave like boys, to conform to the portrait of the "natural child" (active, open, exploring and, one might add, messy, noisy, inconsiderate, and often rude). For girls, another list of expectations and behaviour is reinforced, which Walkerdine sums up as "nice, kind, and helpful". Good behaviour, hard work, helpfulness, and so on, are sometimes covertly and sometimes openly encouraged in girls by the teacher. Girls are enlisted as "sub-teachers", "guardians of the moral order, keepers of the rules" (though they are both needed and despised in these roles). The result of these contradictory expectations is that girls are put in a losing position whatever contradictory expectations is that girls are put in a losing position whatever behaviour they opt for. If they behave as boys they are considered unfeminine and not liked by their peers; if they become "sub-teachers", demonstrate hard work and good behaviour, they are considered incapable of brilliance, of

conceptual understanding — future teachers, at best. Their success is tarnished by the Other of hard work and even when they out-perform the boys on tests and exams their achievement is not valued. For many girls, and particularly for those who do well, the psychological effect is one which Walkerdine describes as "splitting", which although it is a defence mechanism, an attempt to remain "sane" while "being positioned like a boy and a girl", brings with it tremendous suffering. The effects, which Walkerdine found persisted into the lives of the female academics she studied, are "silence, lack of confidence, the suppression of anger and hostility" and "apparent docility".

The positioning of female teachers in the school system is riddled with painful contradictions as well. In the new pedagogy teachers are clearly defined as the nurturers of reason. Not themselves the possessors of conceptual understanding and rationality, they are nevertheless to nurture it in children. They are to work very hard so that the children may play, to be passive loving servants to each child in their care. With the introduction of "progressive education", "women teachers became caught, trapped inside a concept of nurturance which held them responsible for the freeing of each little individual, and therefore for the management of an idealist dream, an impossible fiction". Caught in a net of unreal expectations, an unrealistic mandate, teachers also have to develop survival strategies. Those that stay in teaching often pay lip service to the new pedagogy while maintaining the old. They actively recruit girls as sub-teachers and insist on order and discipline while praising the boys for non-conformity and their "ability to break set".

Boys outperform girls in mathematics. Even when their overall performance is comparable, boys do better at higher-level tasks and girls at repetitive, rule-following, lower-level tasks

In Chapter 6 of *Schoolgirl fictions* Walkerdine recounts her reaction to an analysis by Hilary Shuard of the results of a British study in which, according to Walkerdine, Shuard concluded that girls, in spite of being conscientious and hard-working, "perform better on those aspects of mathematics which are taken to require low-level rule-following". Hard work and rule-following are offered as reasons for girls' "failure" in mathematics.

Walkerdine's response could as well be aimed at any of the authors who touch on this theme in *Gender in mathematics*, the studies and interpretations being so similar to Shuard's. Her first question is: "How does it come about that the attributes which on one level might be considered good qualities—industriousness and diligence—are understood as causal of girls' apparent failure in mathematics, and how are such accounts presented as scientific evidence?" Walkerdine accepts the data that girls are hard-working and well-behaved, and so on. Nor does she contest the marks on the test that Shuard analyses: girls performed better on 11 out of 91 items (which the researchers deemed "easier") and boys performed better on 14 items. She does point out that this means there was no significant sex difference on 66 of the items, a "fact" that does not

seem to have elicited any attention elsewhere. And she notes the slippage from the opinion that the questions on which the girls did better were considered “easier” to the statement that “girls are good only at those aspects of mathematics which are low-level” and the girls’ “low-level skills” “are produced by rule-following, rote-learning, and improper conceptualization”. Walkerdine does not raise the question how certain questions were identified as “easier”, though it is possible that the fact that girls did significantly better on certain questions ensured that they would be classified in this way. (Nor does she critique the statistical enterprise in general and the biases in its development [6])

Walkerdine takes issue instead with the way in which certain observations about girls are presented as “hard evidence”, “hard fact”, or truths. In her brief review of the historical production of such facts, she traces the roots in cognitive psychology of the notion of “real understanding”, which has replaced the old theory and practice based on “rule-following” and “rote-memorization”, the Other of mathematics education. Yet “those explanations that allow girls’ success at all say that it is based on rule-following and rote-learning, not on proper understanding”. In fact, the non-rule-following behaviour of boys is produced as evidence of an ability to “break set” and an indicator of a propensity for conceptual or “real” understanding.

Real understanding involves correct reasoning, and here Walkerdine’s whole thesis, developed in *The mastery of reason*, comes into play. We are reminded of the investment of reason in the male body, leaving women in the role of procreators and servants incapable of rational thought. In their role as servants of reason, women were at first excluded from educational institutions, and then when their struggles meant they could no longer be excluded, they were admitted to the extent they could “prove themselves equal to men”. Walkerdine believes that “the terms of the debate” have not changed today. “It is still up to women to prove themselves equal to men” while at the same time all the attention is focused on their “failure”, a failure which is guaranteed by the very definition of reason and monitored by science.

In an article which appeared in Volume 10, Number 3, of *For the learning of mathematics*, Walkerdine refers to the vicious circle of “pathologisation of difference”. When girls’ very success can be read as a failure in “real understanding” and boys’ behavior problems and poor performance read as a potentiality for conceptual understanding, then one senses that “some fiction is being created to account for what it is necessary to prove time and time again: the inferiority of the Other”.

Different worlds

While the authors of *Gender and mathematics* are enthusiastically engaged in the business of “claim and counter-claim” and exploring the widely accepted “truths” about girls and mathematics, Walkerdine is pulling the conceptual rug out from under their feet. She is not particularly concerned with the arguments for or against such truths but asks: how did these truths come to be, whose interests are served by their maintenance, and how do they affect the

lives of women and girls?

Yet it is not simply in relation to these “truths” that these books stand out in such stark opposition. From the dedications and introductions the reader is aware that the two books emerge from very different visions of the world and the issues of gender. Before concluding, it is worth returning to the first few pages of the two books and reading them with our attention sharpened by the preceding analysis.

Dedications

Book dedications are rarely taken as seriously as they ought to be. How often does a reviewer deal with or even mention them? And how many of us skip over them as we do most of the blank or semi-blank pages that open a book, rushed as we are to get into the meat of Chapter 1? Yet some insights can be gained by noting the author’s choice of people at whose feet she lays her entire work.

Gender and mathematics is “dedicated to future generations of women in all parts of the world in the hope that they will be able to benefit from conditions of equality of opportunity that will render redundant further considerations of gender bias”. *Schoolgirl fictions* is “For Helen, Jo, Pam, Jo and Joan and the many working-class women who have struggled to obtain an education”. The first is aimed at future generations of women, the second at actual women living and struggling now—not women in general all over the world but specific working-class women. But more important, the first situates the problem in “gender bias” and the solution in “equality of opportunity”.

Walkerdine is critical of equal opportunity solutions to a problem she perceives as extremely deep rooted and powerful. “If girls’ and women’s power is a site of struggle, constantly threatening the tenuous grasp of male academic superiority, then any engagement with these issues in practice cannot rest upon a rationalistic base of choice or equal opportunities.” [7]

Walkerdine’s dedication raises the issue of class, which is absent not only from the dedication but from the entire *Gender and mathematics* collection. Gender and class are fundamental themes in Walkerdine’s analysis of the school experience of girls, though she admits that while “gender and race have become common currency, it has become almost impossible to speak about class”. Although *Gender and mathematics* is very explicitly concerned with gender, it is surprising that among the more than twenty contributing authors, none found it necessary or even useful to consider class (and only one chapter even mentions the word) in their analysis of classroom practice, curriculum and achievement. [8]

Walkerdine’s “Preface”, Burton’s “Introduction”

Walkerdine chose to write a short preface to her work. In the very first sentence she situates herself as a woman “For many years, like many other women, I was a school-girl”. There are twelve ‘I’s in the first paragraph. It is a personally revealing piece where she describes her own sense of powerlessness as a woman in such terms as “struggling”, “infantilized” and “terrified”. Her situation is

linked to that of other women: "What words will take us from the position of schoolgirls", "*We can tell other stories*". (Italics are mine.) It is a preface of intimacy and solidarity with other woman and yet it immediately challenges traditional feminist analyses of the situation. She questions a "roles and stereotypes" analysis and the theory of an "existential feminist voice that has been silenced". She raises the hope that women can blow apart the fictions that have formed and subjugated us by exploring the existing stories and uncovering the "other stories", those that tell how our "socialization does not work".

Whereas Walkerdine situates herself immediately as a woman and adopts a personal stance, Burton avoids the personal or any mention of herself as a woman. She does allow herself the occasional use of 'I' in comments such as "I too found that women..." and the last paragraph "I recall..." in which she recounts an experience at a seminar in China. As the editor of a collection of articles, Burton had a very different task to undertake in her "Introduction". IOWME, the group that organised the sessions from which the book emerged, is composed of both women and men. It is made up of individuals and groups who "share a commitment to equity in education" and who are "interested" in gender and mathematics issues. It aims to provide "a forum" and "current information" and "to encourage and disseminate information" related to women and the mathematical sciences. There is no feminist analysis or any overt ideological stance. "Interest" and not commitment to change, is the basis of adherence. In its stated aims the group is not even necessarily interested in increasing the participation of women in mathematics. It only claims to "encourage and disseminate research related to" strategies and programmes with this in mind. While Walkerdine's preface closes with the hope that her book will contribute to blowing apart the fictions that position women, Burton expresses the hope that hers will be a start in "identifying trends" and "drawing attention to the complexity of the issues pertinent to providing equal opportunities in mathematics education".

Conclusion

In most of this review I have presented the two books as "confrontational"—not only when I looked at the dedications, preface, introduction and so on, but also to some extent in examining the five "truths". Safely poised in their academic garb of neutrality, the contributors to *Gender and mathematics* end up reinforcing, subtly and not so subtly, the "truths about girls".

Is there something the two books have in common? In my opinion they are linked chiefly by their, albeit very different, denials of gender. *Gender and mathematics* ends up gently drowning the issue. Boys-have-problems-too and what's-good-for-girls-is-good-for-boys and the-times-are-changing. Oppression (gender and class) is denied both personally in the lives of the female authors as well as collectively. Walkerdine denies gender in the sense that she views it as a fiction, a cruel fiction that has become fact.

This review has not done justice to the richness of Walkerdine's work. I have, in fact, extracted those portions of *Schoolgirl fictions* which throw Walkerdine into the very

debate she feels women should avoid, a debate which might qualify as one which helps "the fictions" to flourish and oppression to be denied. Indeed, on this latter theme of oppression, Walkerdine has a great deal to say which is of importance for mathematics educators. She is of the opinion that that our omnipresent developmental model of "stagewise progressions" can only "engage with oppression" as "individual pathology". What is needed, in Walkerdine's view, is "an understanding of development as specific to social and historical circumstances".

There is a particularly poignant poem in *Schoolgirl fictions* which sums up Valerie Walkerdine and her work. It begins with

You kill me with your gentle oppression

and ends with the lines

You will no longer take away

my past

for today I take my life into these two hands

I am a time-bomb

and I have started ticking

Several of the contributors to *Gender and mathematics* hint that much more research needs to be done on gender issues in mathematics. [9] Hanna, Kündiger and Larouche conclude their paper by pointing out the complexity of the issue:

The study highlights the fact that the issue of gender differences in mathematics is very complex and should be explored from many different perspectives [p 96]

Schoolgirl fictions provides a very "different perspective" to those academics in IOWME who wish to continue their work on gender issues and, hopefully, the injection of energy which may start them "ticking" anew.

Notes

[1] It is a common experience that in public settings men frequently do most of the talking even when they are in a minority. (See Deborah Tannen, *You just don't understand*) My own experience with running sessions in a union setting on the subject of "la condition feminine" was that a single male participant was able to monopolise the discussion even when the subject was the experience of women as wives, mothers, and workers. It is one thing to acknowledge that boys are socialised to perform verbally in the public setting of the classroom and to try to redress the balance by calling on girls more. It is quite another to reinforce the situation by actually calling on boys more and then to excuse it as simply a classroom reflection of the "expectations and gender beliefs" of society at large.

[2] The paper is quite shocking on several fronts. Firstly, there is no questioning or critical approach to either the literature or the test instrument itself. We are given two statements about girls' under-achievement: "Many studies to date have shown that by age 13, boys are significantly superior to girls in both their mathematical performance and their attitudes" and "that the male advantage is especially pronounced among high-scoring exceptionally gifted students with boys outnumbering girls 13 to 1". Then a list of research which attempts to explain male advantage through biological (hormones, genes, brain organisation), environmental, and psychosocial factors is given, once again with absolutely no criticism or mention of any counter-research. One is left with the impression that all research is equally credible, and without any orientation as to the state of the debate today. As was mentioned above, the authors, the authors also seem to accept the test instrument as a pure unbiased test that can actually measure "achievement" (whatever that means) in 15 different countries.

Yet it is in the statistical analysis, or ‘discussion’, where the authors attempt to account for these findings” that one is left totally dismayed. The hypotheses are not clear, the statistics slippery, and the results confusing. For example, in the “explanation” (discussed under “3rd truth”) about the proportion of female mathematics teachers, it is not clear what the hypothesis is. The first paragraph mentions that girls’ achievement might be negatively affected by a perception of mathematics as a male domain and by a fear of success (boys won’t like them), and that it is positively affected by involvement of older girls in the role of tutors and counsellors. The second paragraph begins: “In this light, it would seem reasonable to suggest that the ratio of female to male maths teachers may be an important factor in *explaining* sex differences in mathematical achievement, since it most likely affects the degree to which girls subscribe to the notion that maths is the preserve of men” (Italics are mine). The argument goes on to say that “according to this reasoning, countries with negligible sex differences in achievement would be expected to have higher proportions of female maths teachers”.

Here we are referred to a brief table of data with entries for six countries under “Female maths teachers (%)” and told “our data do not support it (this notion)” What exactly is the “notion” that is not supported? Are we to conclude there is no support for the hypothesis that girls’ underachievement might be due to a perception of mathematics as a male domain? Or is the unsupported hypothesis that girls do better with a higher ratio of female to male mathematics teachers in their country? And what about the effects of “older girls” as tutors and the fear of success? Each of the sections in the discussion is equally fuzzy so that when I got to the “Conclusions” and read that “The analyses indicated that differences in achievement could not be attributed to these (contextual) variables”, I was left wondering what those variables were and what exactly had been demonstrated.

[3] Cockburn gives, I think, a very clear description of how the fiction of femininity or the fiction of woman/girl is sustained. “Gender, it is by now widely accepted, is not the same thing as biological sex. People are born more or less one physical sex or another, and on this basis they are ascribed a gender. They are then “brought up” socially to live that gender: masculine or feminine”. This gendering process begins at birth, is reinforced by the schools, and continues in the work place. Not only does all behaviour become gendered, objects and even thought itself are gendered in our society. “Gender is part of our tools for thinking, for ordering and understanding the world”, according to Cockburn, who refers to Genevieve Lloyd’s work on the “genderization of ideas”. [1984] Although different societies vary in what they consider to be feminine, Cockburn finds one constant: “inequality between men and women” to the benefit of men. “We have no choice but to suppose that the social process of gender construction, formulations of gender difference, are important mechanisms in sustaining male dominance” Cockburn situates gender differentiation within the wider context of social differentiation. “The social processes of differentiation and separation serve power, whether that of a class, a race or a sex. They are universal devices of oppression”

[4] Cockburn refers to reason as “the philosophical concept that underlies modern science, technology and industry. Reason and rationality are gendered in that the “Man of Reason” was conceived of as precisely “transcending the feminine”, with the consequence that women are excluded from rationality and this exclusion “is a constitution of femininity itself”

[5] I have grouped the second and third truths together here since they combine to provide an almost perfect description of the classroom setting that Walkerdine is reflecting on. The fourth and fifth truths are dealt with as a piece for similar reasons.

[6] For a critical discussion of the development of statistics, see, for example, *The mismeasure of man* by Stephen Jay Gould.

[7] Cockburn, in *Machinery of dominance*, refers to the “good-natured concept” and the “notionally open door” of equal opportunity. From her research on women and technical know-how, she concludes that changing the situation “requires a more radical perspective on change” than that offered by equal opportunity schemes which essentially are concerned with “a pushing open of doors”. In her view, it is not a case of simply clearing up the myths and making women want to enter non-traditional fields, though she agrees this work also needs to be done. The fact that there is “no queue at the open door” is not a simple problem of “gender bias”. There are historical processes of tremendous power and longevity sustaining division of labor in society and at work”.

[8] Cockburn also finds it impossible to untangle gender from class in her attempt to analyse the position of women *vis-à-vis* technology. She describes how class relations and sexual domination have been encoded in the new electronic technology.

[9] Indeed if the papers in *Gender and mathematics* are indicative of the state of research internationally, it would appear that only negligible amounts of research time and money are going into the gender question in mathematics. Nearly all of the papers are either reflections on research that was not primarily concerned with gender issues, or tales of small studies or teaching experiments undertaken by the authors with little or no financing. Nor does one get the impression that there is a research agenda on gender issues in the mathematics education community.

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