

## What is 'meaning' in gender research?

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This is a paper about girls in mathematics. In it I give an account of a piece of research which I consider to be theoretically adequate for the work that I wanted to conduct about gender. It addresses the complex questions that people who do any research in mathematics education want to understand better: questions about learning and individuality, about thinking, about expertise. It links these with questions of power, control, dependence and change, and in so doing provides a different story about girls in mathematics.

### Introduction

How do girls become gendered students in the secondary school mathematics classroom? Posing the research question in this form took some considerable time and a cursory reading of it gives no indication of the difficulty I had in formulating it. To arrive at this point I had to deal with questions at the theoretical level that concerned a basic assumption in mathematics education. I spent a long time trying to reconcile the theories of the gendered subject that mathematics education offered with what my own teaching experiences told me about girls in mathematics. In trying to unravel this knot of problems I was led to theories that I saw as more successfully able to account for what I saw happening in classrooms. These theories developed outside the field of mathematics education provided me with the conceptual resources to look at and think about the issue of girls in mathematics differently. What this entailed was questioning the essentialist girl of the gender project, something I was reluctant to do given its current status within mathematics education.

In the first section of the paper I look at the conditions which contributed to the way I carried out the research. I look at the assumptions about the gendered subject that presently underpin gender research in mathematics education. But because I wanted to provide a different story about girls in mathematics I journey outside binary logic and draw on ideas and concepts from recent social and political thought to develop understandings adequate for my purposes. This very situated piece of research about girls learning calculus is in a sense, then, a response to Leone Burton's (1995) challenge of doing research differently. In it I offer an alternative way of understanding subjectivity which can explain gender difference.

In the middle section I discuss the theoretical precepts which enabled me to carry out my work. I cite poststructuralist theories of language as providing the resources for this approach but in doing so I am mindful that those texts in this field which do engage, explicitly or implicitly, with this theoretical position are few in number. And those that do neither present a unified challenge nor universal approach to what constitutes gender research in mathematics education.

The final section is concerned with analysis. I analyse the accounts of experience given by participants and used as research data. What I am particularly interested in is the way in which students' use of language is linked to student meanings. I present and explain a theory of how meaning is achieved in the course of using it on my own material, centring the analysis around the concept of 'discourses' and students' positioning in relation to them. I discuss some of the methodological issues involved in the production and in the interpretation of accounts by telling the girls' stories, through different eyes from those that look through the lens of standard scientific methods.

## The notion of the 'subject' in gender research

Gender inquiry in mathematics education has gained considerable rhetorical expedience both within and outside academic circles to such an extent that it threatens one with nothing more to say. Work by mathematics educators, both feminist and non-feminist, engaging with this issue has provided valuable understandings of the issues (Fennema, 1996) in which girls could be read not only as a fable of mathematics education but also as a means of transforming the school mathematics story. For the past thirty years the discussion has mainly been about images of girls in schooling and representation of young women in mathematics. More latterly the focus has included woman-centred research that privileges female difference. I will look at these two projects in turn.

The liberal feminist project, underlying what the gender/mathematics literature categorises as *Phase Three: Women as a problem in mathematics* (McIntosh, quoted in Rogers and Kaiser, 1995, p3) stresses the importance of equality of opportunity. Its perceptions of differences in the participation and achievement of girls from boys in school mathematics have generated an extensive body of research that maps the field, documents differences in learning style, achievement, or career choices, reports on school-based projects, seeks explanations, and offers compensatory measures to enhance girls' post-school options. Consequent to this work there has been an extensive engagement with the policy process the result of which has led to the implementation of a number of curricular and pedagogical programmes that are seen to promise improved emancipatory educational practice for girls.

These strategic projects are themselves an instantiation of the 'modernist' impulse. They accept uncritically a set of Enlightenment assumptions about individual freedom, critical reason and progress and their interventions become a means by which these ideals are substantiated and realised. These researchers assume one can specify a cause of oppression and have set themselves the task of helping girls to overcome this and to realise their full potential. The very rationale of their work is founded on certain understandings of the 'nature' and 'experience' of women and girls in society, and in their investments in the status of mathematics in society.

After this initial phase of uncovering gender blindness as well as the gender biases of the tradition, the task of feminist theoretical 'reconstruction' began. *Phase Four: Women as Central to Mathematics* focuses on women's concrete experiences across cultures, society and history and asks how the shift in perspective from men's to women's points of view might alter the fundamental categories, the methodology and the self-understandings of mathematics educational theory and practice. This work finds its strongest expression in feminist standpoints. This position is founded on absolute differences. It views women's creativity in mathematics as something different from male approaches to the point where there could be no overlap between the two. Research begins in questions arising from the perspective of women's activities and this perspective is seen as an important part of the data on which the evidence for all knowledge claims is based. Central to theoretical understandings in this feminist reconstruction of mathematics education are the categories of experience and feeling. Both experience and feeling are claimed as a kind of 'inner knowing', a heuristic of a deep truth, shaped by society but simultaneously the basis for oppositional schemes of truth.

What is important to my work is the status that the female subject embodies here in both these projects, and the possibilities that there might be for change. Within the framework of *Phase Three* the subject is seen as a highly rational, self-determining individual with an essential and relatively stable self. It is the individual of the humanist position:

The humanist position tends to see the individual as the agent of all social phenomena and productions, including knowledge. The specific notion of the individual contained in this outlook is one of a unitary, essential non-contradictory and above all rational entity. It is the Cartesian subject in modern form: a notion of the subject

which has been central to the whole of western philosophy founded on the principle of the cogito (Henriques et al., 1984, p93)

She takes the social structure as given but is able to exercise choice and self-determination to empower herself. Essentialism is her motivating text. At the core of her being is an essential self, yet she can liberate herself to achieve justice and independence. She is a reasoning subject capable of exercising individual agency; she says what she means and means what she says. Precisely because she is a biological female she has always been interpreted in gendered terms as dictating a certain identity, always situated in a world of universal roles and expectations. But as Walkerdine (1988) has ably pointed out, with the advent of new theories of the social her universality, her rationality, and her stability turns out to be contested and fictive.

The subject of the woman-centred approach is also circumscribed by essentialism, but for her the roles are reversed. For her, too, essence precedes her and is prior to the social field. Like the subject of *Phase Three* she is also a situated self, constituted by social roles, but for her, identity must be renegotiated. Her occlusion from the discourse of mathematics education is exposed and must be rectified by reversing the hierarchies, in which her experience as the source of knowledge and the focus of learning is central. Certain of her culturally specific qualities have their origins in biological difference and are 'naturally' female. Her feelings or emotions can be summonsed to test accepted claims of what is universally true .

Irigary (1985) has shown that the notion of woman's experience is subject to precisely the same limitations in understanding meaning as the notions that subject of humanism embeds. Underlying the idea of a unique experience of women is the seemingly unproblematic assumption that this experience can be identified and found to yield conclusions generalisable on the basis of gender. At the theoretical level there are difficulties in this claim because it rests on certain assumptions about commonalities in women's lives which have recently been challenged by postmodernism and by women of colour. Moreover, there are contradictions involved in claiming that experience is the source for knowledge while simultaneously arguing, as these theorists do, that these experiences are manipulated, shaped, and even oppressed by dominant discourses in society. What the standpoint 'subject' does in effect is reinstate the binary logic which it sought to deconstruct.

It is these very understandings which pose limitations on the kinds of questions that may be asked, and the kinds of research methods that might be utilised. Posing the question of gender in these terms binds gender research to the concept of binary opposition that is always inscribed in what Judith Butler (1990) calls a masculinist construction of an essentialized self. She argues that putting essentialism to strategic use presents some insurmountable problems for the development of alternative inquiry. The solution is not to replace it by a 'bigendered' conception of the individual in mathematics educational research, by bringing girls so-called 'ways of knowing' into the very definition of meaning. Such a solution remains indebted either to the confirmation or to the reversal of the politics of liberal feminism. It binds the possibilities of feminist research to the very problematic that it wants to challenge.

In no way do I wish to be seen as denying the personal and political importance of past and present feminist inquiry in mathematics education. But it is not good enough to refer unproblematically to experience. Emancipatory intentions and resolutions that are predicated on "essentialized, romanticized subjects" (Lather, p131) cannot engage with the complexity of the girls and mathematics issue. They are not able to consider the way power differentially constitutes people and empowers them to perform particular kinds of tasks, thus constructing specific kinds of subject. They are blind to the constraints of the material world and the various interactions of power and privilege that constitute social reality and in doing so their analytic value is reduced in explaining how subjects come to know.

### **Poststructuralism in gender research**

If the essentializing manoeuvres of the contemporary woman-centred standpoint in this field have turned upon themselves into posturing the subject as fixed, stable and universal, how can we go beyond *Phase Four* politics? How is gender research into mathematics education to proceed when the general subject of essence turns out to be a questionable basis for investigation because it locks inquiry within a powerful fiction - a fiction that posits gendered identity as a construction of masculinist binary thought?

Poststructuralism is an intellectual movement that looks beyond these parameters and simple solutions. Poststructuralism, in developing Nietzsche's ideas of the self as a willed unity masking a chaos of conflicting and contradictory desires, has provided a critique of the unitary individual by uncovering those meanings which are taken-for-granted in the term. This theoretical position transforms the essentialist theory of girls in mathematics education which insists on biological 'givens' as a source of meanings to a more situated theory of subjectivity. It refuses to fix meanings. It works against the stability of identities and experiences associated with current gender research in this field, by presenting a much more ambivalent and less fixed positioning of the subject.

Subjectivity is a central theoretical concept in poststructuralist theorising. In her book *Feminist Practice & Poststructuralist Theory* Chris Weedon (1987) explains the term in this way:

...the terms subject and subjectivity...make a crucial break with humanist conceptions of the individual which are still central to Western philosophy and political and social organization. 'Subjectivity' is used to refer to the conscious and unconscious thoughts and emotions of the individual, her sense of herself and her ways of understanding her relation to the world (p32).

For Michel Foucault the concept of 'discourse' is a key term in understanding subjectivity. Discourses are identified in poststructuralist thought as historically variable ways of specifying knowledge and truth. In other words they function as sets of rules, and constrain and enable what is possible to speak or write about, to think of, or imagine at a given moment. For Foucault discourses are not just representations of reality they actively produce it. They do this through language. Discourses are therefore powerful and provide an understanding of the relationships between subjectivity, language and social institutions. They provide a way of understanding meanings and possibilities of the subject.

Discourses form meanings and possibilities and take on and produce the subject and social change. Foucault argues that categories and concepts are never well-defined. They are implicated in what he calls knowledge/power. The 'girl' is a social self and this social self is *not* essential, but historically variable. I understand from this then that the category 'girl' has meaning only in the power of discursive truths which define and regulate it. To be categorised as 'girl' is to be implicated through discursive practices. The subject 'is' the discursive practices which produce her. She is also produced in power relations. She is constituted as a subject in discourses and practices and also, at the same time knowingly or not, contributes to the process of 'making' herself into particular kinds of subjects. Judith Butler has been at pains to clarify this constitutive relation: "There is no self...who maintains integrity prior to its entrance into this conflicted cultural field. There is only the taking up of tools where they lie, where the very 'taking up' is enabled by the tool lying there" (1990, p145).

Discursive practice is constitutive in both conventional and creative ways: it contributes to reproducing subject positions, yet is also contributes to transforming them. These transformations originate partly through constraints and possibilities for change found in the wider social structure and at all levels. The picture is one of changing configurations as discourses change. The 'girl' is subject to continuous transformations both between discursive formations and with a given discursive formation. She is an effect rather than the origin of particular, historically located practices. The girl in schooling might, on the one hand, be considered still a 'given' but, on the other hand,

she is a 'given' produced in and by discourse. She can never be defined once and for all. She is always on the move, "dynamic and multiple, always positioned in relation to discourse and practices and produced by these" (Henriques et al., 1984, p3).

Her former essentialist identity gives way to a 'plural' and complexly constructed conception of social identity. Usher and Edwards (1994) put it like this: "the 'centred' subject does not exist naturally and pre-formed but is rather a cultural *construct*, inscribed by the meaning system that is language and by discourse, particular and systematic uses of language" (p16). The decentred subject, the 'girl' constructed by language, discourses, desire and the unconscious, has at last been shown to be an *unstable* category but one whose instabilities are of much interest to poststructuralism.

### The Method and the Analysis

What is of major significance here for my work is the view of discourse as constitutive - as contributing to the production, transformation, and reproduction of the 'girl' of the mathematics classroom. It opens up a way for me to engage with the category 'girl' yet not be reduced to its essentialism. Rather than looking at 'the' girl in mathematics I want to give an account of how the girl becomes a gendered student in school mathematics. I will not be trying to discover or uncover one 'true self' of the girl but will come upon a multitude of selves found in the different kinds of linguistic practices that she articulates. It will not involve looking for the true nature of the girl in mathematics education but how she is continually being constituted through discourse and what the effects of this are.

In this work I wanted to consider the social positions the 'girl' could occupy and the functions of these positions in the diversity of discourses. I wanted to uncover the way in which she is caught up within discourses and power relations in school mathematics. There were many possible research methods which I could have made use of to do this but most methods would have undermined my original intentions by reducing the phenomena to measurement and/or by trivialising gender. They would not have dealt adequately with the problem of the essentialised subject.

Since I was committed to the application of poststructuralist ideas about the relation between meaning and subjectivity I chose a method that looked at discourse. My method was based on students' accounts of their experiences through their private talk as recorded on audio-tape throughout a series of lessons. I used this as my research data, together with my research journal, with their biographies, with photocopies of their work and with their private conversations with me.

I made use of a method of analysis that synthesises language and social theory. Discourse analysis draws together the work of Foucault and linguistics to consider how discourse constitutes social subjects and social relations. The method considers the role of language in the power relations and power struggles that shape and transform those discourses. It does this in a way that extends Foucault's conceptions of power and resistance which tend to ignore the way in which the subject is an *active* participant in power contestations. Discourse analysis looks instead at practice, at instances of what people actually do and say.

In the extract which follows, there are a multiplicity of discourses constituting the subject, expressed either implicitly or explicitly in the classroom. But my writing up of this transcript is, using Derrida's words, writing 'under erasure'. I am well aware that it is eclipsed by my understanding that gender is a social production. Its representation here, like all representation, is not a neutral process. This idea from poststructuralism suggests that my choice of text is contingent upon my theoretical interests. It also suggests that the meanings that I could generate from it are varied and multiple. No analysis that I could make of it could possibly expect to tell the 'truth'. The chosen text and the tasks I desire of it are fundamental to the questions surrounding my theoretical interests. In this way the extract becomes a production, not an already-there.

The class have been following their teacher through differentiation of functions with negative and fractional exponents. Rachel and Kate are seated in front of Richard and Blair.

(Simultaneous speech is shown as indented words on two or more lines. Pauses are shown as full stops. Capital letters show loud speech. An equality sign indicates one utterance following immediately on from another).

Mrs S: ...and we change that to negative four over three x, to the power of four thirds  
Now this boils down to being able to handle exponents. OK? Any

Rachel: (*whispers*) I can't find it. Oh, shit! Bloody

Mrs S: questions? Just a matter of practising it.

Rachel: book!

(*to Kate, seated next to her*) How many books have they got up there?  
Must be at least two.

Kate: (*whistles softly to get his attention*) Richard we need a book=

Rachel: =A BOOK.

(Blair is not willing to give Rachel and Kate a book)

Rachel: Isn't he MEAN.

(Richard gives his book to Rachel)

Rachel: Even on the right page I think.

It is Rachel who controls the interaction. She does this forcefully. The fact that she does so at all goes against any straightforward cultural myth of female passivity. What is at issue here is the way in which she is implicated in the powerful discourse of the educational process.

As one of the most powerful discourses in society education gives discursive meaning to its world and to its institutional practice by establishing the forms that it can take. Its very constitution as a discursive practice is founded specifically on the principles of progress, rationality and coherence, and these have fixed the possible meanings and functions of the teacher and the student. But this is done to such an extent that one tends to perceive these meanings as pre-formed, as 'ready-made', as natural.

The discourse of the educational process is powerful in the sense of normalising and regulating the practices of the student and those of the teacher that constitute them as particular kind of subjects. It does this through hierarchy, surveillance and regulation. Classroom practice plays a crucial role in its expression. The classroom becomes a site of normalising practices and positions the student as an object of disciplinary gaze of the teacher. It is here where discursive rules and relations are at work which regulate, make possible, and yet delimit who can speak, under which conditions, about what kinds of problems, and determines standards of acceptability. The authority that these rules and relations embody construct the versions of the student in the mathematics classroom that we know today. Yet this is not to claim that these normalising practices are necessarily a matter of overt control. Rather they work pervasively and often invisibly so that every student and every teacher becomes naturalised within the system.

Rachel like any other student has come to take them for granted. She has learned long ago the classroom's ways of doing things and which practices are valorised and which are not. Among other things she has learned to bring her books to class.

Later on in this lesson she says:

Rachel: But I don't know how to do number three.

Kate: Well ask. ASK.

Rachel: No. Cos I'm SCARED of that woman.

Power is exercised both through its visibility and its invisibility. Why does Rachel ask the boys for a book? Why not ask girls? There are other matters at work here. It is too simplistic to make a claim for role reversal. In our conversations she has told me that the four of them (Rachel, Kate, Blair, and Richard) have all been together in classes for two years and have all been promoted a class in mathematics. My research journal records the

seating plans for each lesson and I note that they always sit near each other. Being together presents a confident and consolidated force to the other students in the class who are both older and unknown to them. Borrowing from the boys has a lot more to do with familiarity than subversion of gender roles.

Gender relations have historically structured women's absence from the active production of mathematical knowledge. At Rachel's school almost all of the mathematics teachers are women. As a group they claim an allegiance to liberal feminism. They stress the rights of female students to self-determination and their foremost objective is to create the material conditions at school so that this student potential might be realised.

As a female student in mathematics Rachel has a range of possibilities open to her. But these other possibilities involve accepting, negotiating or rejecting what is currently mediated through a variety of sources to which she has direct access: movies, television, advertising, the magazine which she buys (*Girlfriend*), her family, her involvement in Girls Brigade, and her friends.

All of these construct gendered subject positions in their own particular ways. They are not all compatible. Rachel has learned to make choices between them. She expresses her choice through actively participating in the creation of knowledge in the following extract, taken from the same lesson :

- Rachel: So, number three. Two over square root of x.  
What?  
Two square root of x. I don't know how to do this  
(to Richard, seated behind her) How do you do this?  
How do you do the square root ones?  
Didn't mean that to be RUDE right?  
(classroom becomes momentarily quiet)  
Shhhhit! SO EVERYONE GOES QUIET  
So what do you do?
- Richard: I don't know.
- Rachel: (to Kate) How do you do number, oh, number three?  
What's the answer for number three?
- Kate: You've got the wrong number. Isn't it one over x?  
How come you've got two over x?
- Rachel: Should watch what I'm doing.  
You go one over square x or something like that.
- Kate: One over x to the half. The square root it's a half, isn't it?  
Oh, I don't know.  
Yea. It's the square root.
- Rachel: I don't know  
(sounding cheerful) Well, try it, TRY it.  
Pick a number and square root it and then pick a number and put it to the power of a half and see if you get the same answer.  
OK. Well I'LL DO IT THEN.  
Just pretend to be useful.  
Root nine equals. OK. Nine power one over two . YEP!  
You're right! Beautiful!

What does being a student mean to Rachel? For that matter, what does being a student mean to any of the students. All have different meanings and each one is positioned in relation to these meanings. Each meaning is produced for a specific time and within particular relations and discourses. These meanings have much to do with personal history, culture, unconscious processes and social differences. But above all they have a lot to do with networks of power. If this is so, then meanings that people produce not only maintain these subjectivities they also have the capacity to transform them.

## Conclusion

This piece of research, in both the method that it describes and the theoretical assumptions it presumes, makes a beginning step towards a theory and practice capable of grasping the complexities of what it means to be a gendered student in the mathematics classroom. It marks a theoretical move outside the binary logics of increasingly inadequate category systems into the world of the mathematics student. It also represents my attempt to analyse some of tensions, confusions and dilemmas that make this world so seemingly problematic. Through its production I have come to an understanding of students' classroom experience not as orderly and organised as often portrayed in the research literature, but lived as contradictions, conflicts and comprises.

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