SIGNIFYING "STUDENTS", "TEACHERS" AND "MATHEMATICS": A READING OF A SPECIAL ISSUE

This paper examines a Special Issue of *Educational Studies in Mathematics* comprising research reports centred on Peircian semiotics in mathematics education, written by some of the major authors in the area. The paper is targeted at inspecting how subjectivity is understood, or implied, in those reports. It seeks to delineate how the conceptions of subjectivity suggested are defined as a result of their being a function of the domain within which the authors reflexively situate themselves. The paper first considers how such understandings shape concepts of mathematics, students and teachers. It then explores how the research domain is understood by the authors as suggested through their implied positioning in relation to teachers, teacher educators, researchers and other potential readers.

KEY WORDS: subjectivity, semiotics, Peirce, student, teacher, mathematics

Research discourses inevitably create the analytical frames that we use, which in turn create the objects we research; objects that evolve whether we acknowledge this evolution or not. And classroom activities observed within research enterprises and notions like "students", "teachers", "mathematics" and "researchers" cannot escape such filtering, especially those selected for specific analytical purposes. The notions cannot be seen independently of the analytical lens brought to them by the researchers. And such lenses are predicated on supposed associations that are more or less illusory conceptions of who we are, set against the complex backdrop of multiple ideologies shaping the discourses that underpin our actions. These lenses comprise particular choices in terms of the analytic filters that we apply, governed by underlying ideological motivations and trends of which we are not always aware.

This paper focuses on how research discourses shape the objects of research in some specific examples drawn from a Special Issue of *Educational Studies in Mathematics* featuring work written from a semiotic perspective, centred on the work of C. S. Peirce. The central aim of this paper is to examine how subjectivity is variously understood in the Special Issue. Specifically, in the manner of Žižek's "*The Parallax View*" (2006) in which a direct approach to objects is seen as untenable, the paper, through discursive analysis, seeks to examine the productivity of reading the reports from alternative perspectives, and particularly through the filter of how the reports position "mathematics", "student", "teacher" and conceptions of the research domain in the research dissemination processes implied. Here the authors are seen as subjects considered with respect to certain discursive perspectives. This is an intentionally limited focus that does not seek to encapsulate the authors themselves as intentional beings who can be fully attentive to all dimensions of the productivity of their work. My interest is in how subjectivity is produced as a notion in some examples of mathematics education research, not in encapsulating any final meaning that the authors may have intended. This hermeneutical approach to reading leans on philosophical authors such as Ricoeur (1981) for whom the meaning of any text is located in later interpretations, perhaps with respect to other agenda, rather than in any original intended meaning. For example, Foucault (2001/1961) took documents from the eighteenth century to decide how madness was variously understood at the time, even though the documents he consulted were not always centrally about "madness", a term whose meaning has shifted in relation to

symptoms, and understood against evolving frames of reference. Similarly, I am taking the Special Issue as an example of a contemporary historical document and asking how subjectivity has been variously understood or implied by the authors. I have provided extensive discussion of this interpretive approach in relation to children's mathematical learning (Brown, 2001). Later in this paper, following Brown and McNamara (2005), I discuss an example in mathematics teacher education where teachers were examined speaking through the filter of government policy apparatus, not to get at the intention of what the teachers were saying, but rather to understand how the policy was operating through the teachers.

I first consider how we might understand the historical evolution of terms like psychology and subjectivity in relation to the authors' presentations of Peirce's work. I examine how the Special Issue writers variously conceptualise minds in the context of mathematical learning activity by examining the psychologically oriented material they cite. I consider how the research audience is understood as suggested through implied positioning of teachers, teacher educators, researchers and other potential readers. This includes examining the choices of literary resources that have been made and how those choices shape the phenomena being researched. A citation analysis provides an indicator of the authors' perceived research domain.

This response is offered in the spirit of academic debate as an attempt to engage critically and productively with aspects of the Special Issue, a research publication that I admire greatly. I do not see my remarks as a criticism of the individual authors who are pitching their work in to a domain with specific architectonic preferences that define the acceptability of work, a consensus that drives the "context of expectation" (Colebrook, 2007, p. 194) that generates meanings. Rather I am seeking to comment on how this community within the wider mathematics education research community is reflexively defined, and how the objects of research are shaped by these decisions.

PEIRCE AND SEMIOTICS TODAY: A SHORT HISTORY OF SELF AND SUBJECTIVITY

How relevant is the work of Peirce writing about signification one century ago to mathematics educators working today? How might we understand how his theory can be utilised in a world rather different to the one in which these theories were conceived? Castoriadis (1987) asks the same questions in relation to Marx's influence with reference to his theories of dialectic materialism, which address how the world reshapes itself in response to analyses made of the world and subsequent actions shaped by those analyses. Specifically Castoriadis asks: Can we really return to Marx's original intentions when the world has been transformed as a result of his influence? Castoriadis argues that the successes and failures, the working through in practice of these theories, impact on our account of Marx's theories today. Similarly, can we return to Peirce's original intentions? Or how might we return to Peirce? Peirce, influential as he is now, was in his day a semiotician whose work extended marginally to concerns of scientific education (Peirce, 1966), yet he engaged little with psychology and predated more contemporary conceptions of human subjectivity (such as, for example, those derived through the work of Foucault, utilised throughout the human sciences, or Lave and Wenger (1991) who are

more familiar in mathematics education research). The inclusion of Peirce in to the historically evolving field of mathematics education research requires some editing or a customised construction of that history to enable Peirce to be integrated successfully into contemporary debates about how students learn mathematics. Accounts of the evolution of mathematics, seen as signifying activity, might benefit from being combined with contemporary views of education, some of which are attentive to various theories of signs, now widely familiar in the social sciences. Contemporary theories of self and/or subjectivity have relevance to applications of Peirce's semiotics on the mathematical learning of present day students. In particular, an understanding of how mathematics understood, as a semiotic enterprise, might connect to contemporary conceptions of pedagogy, could inform learning theories, teacher education strategies and policy development. In short, there have been many theoretical developments that can variously impact on how we understand students and their learning that condition any attempt to introduce Peirce's semiotics in to this arena. Peirce today and the relevance of his work to mathematical learning cannot be understood independently of the deployment of his semiotics in cultural life with the attendant destabilisation that has caused to mathematics through the lives that define and make use of it. For example, the point of contact between student and mathematics can be read in many ways and multiple attempts at such readings provide so much cultural baggage smothering or perhaps transforming the original point, as it were.

In this paper I seek to better understand how conceptions of subjectivity are intentionally or unintentionally produced through the way in which the authors depict research objects such as "students", "teachers" and "mathematics". Yet in using the term "intention" I am cognisant of how this term has faltered as a result of hermeneutic interrogation. To illustrate this, Gallagher (1992) has drawn a useful analogy between teacher-student and author-reader relationships to define four alternative conceptions of hermeneutics (interpretation); spanning conservative hermeneutics where student or reader seek to understand the teacher or author on the latter's terms, to moderate (e.g. Ricoeur), critical (e.g. Habermas) or radical hermeneutics (post-structuralism, e.g. Derrida, Foucault) where new meanings are produced as a result of the interaction between teacher/student or author/reader. In an earlier paper (Brown, 1996), I use this frame to contrast intention of the teacher with significance to the student in some school mathematical examples through moderate and critical perspectives. In short, I argue that the meaning of a mathematical encounter does not have to remain on the teacher's terms. Meanwhile, contemporary literary theory (e.g. Barthes, 1977; Eagleton, 2005; Colebrook, 2007) and political science (e.g. Laclau, 2005; Mouffe, 2005; Harvey, 2006; Nancy, 2007) respectively argue that authors and our political masters produce effects that are not necessarily within the remit of their original intentions. Such concerns are of central importance in the field of qualitative inquiry (e.g. Lather, 2007). Likewise, the authors of the Special Issue through pursuing certain intentions also, perhaps unintentionally, support other moves. And here I argue that one of those moves, which I pick up as a reader, is unwitting support for potentially restrictive conceptions of subjectivity (1).

In this section I am focusing on how notions located by the terms "mind", "psychology" and "subjectivity" have emerged. Piaget and Vygotsky have had considerable impact on how the field understands the psychology of learning. Several of the Special Issue writers cross-fertilise Peircian semiotics with these more contemporary

conceptions of psychology in different ways and this undoubtedly shapes their work, and their interpretation of Peirce. The papers of Radford (2006) and Steinbring (2006) are premised on Vygotsky's notion of cultural tools. Radford's formulation is attentive to potential links between Vygotsky and Peirce in relation to the production of and learning about cultural objects:

> Within this semiotic-cultural approach, an important distinction has to be made between learning and the production of new knowledge. While new cultural concepts arise from communal, reflective, mediated activities in the zone of proximal development of the culture, school learning is the process of activity and creatively transforming these cultural concepts embodied in texts, artefacts language, and beliefs into objects of consciousness. This process, in which subject and object modify each other, is the process of meaning, the process where subjective knowing and objective knowledge merge (p. 60).

Radford seeks a form of objectivity in the work of Peirce and Husserl, exploring these authors only to dismiss them with respect to his quest. He provides an example of children mathematising the flow of liquid through a funnel, which at first sight suggests an active role for student conceptualisation that transcends objective pinpointing, yet the children are very much guided towards the teacher's interpretation (Teacher: "Well … no! This is what you have to think about! It's exactly that…" (p. 56)) and not encouraged to pursue their own constructions on their own terms since the specification of the mathematical idea/framework has been set already. Duval (2006) nudges towards Piaget's cognitive psychology in positioning students but where semiotic structures applied to mathematics are very much in focus sidelining a more nuanced conception of the student engaging with them. Meanwhile Otte's (2006) work centres on mathematical epistemologies as understood through semiotic apparatus that places psychological or student concerns on the margins. For example, he reduces people, in almost behavioural terms, to those able to perceive and respond "appropriately" (p. 13) according to the teacher's transformation of symbolic material. In each of these papers, to varying degrees the conception of pupil is somewhat cropped. That is, they are read against registers centred on the interface of student, teacher and mathematics in the classroom setting, as though that were the natural focus.

Ernest (2006) and Saenz-Ludlow (2006) favour semiotic formulations that combine aspects from both Piaget and Vygotsky but centred on individuals defined according to normal behaviour rather than on more socially conceived notions of subjects, where social diversity might open up alternative relations to mathematical objects. Morgan (2006) and Presmeg (2006) react against this by favouring the anti-Piagetian discursive stance of Walkerdine (e.g. 1988) with Presmeg linking to the mid-career semiotic work of Lacan but without mentioning his conception of subjectivity for which the apparatus was designed. (I have discussed Lacan's conception of subjectivity in relation to the work of Peirce, Piaget and Vygotsky in a more recent issue of *Educational Studies in Mathematics* (Brown, 2008a)). In each case however, analysis is centred on interactions in the individual mathematics classroom and how the teacher's role might be adjusted to get a better effect with analysis working out from that rather than being concerned with wider policies such as curriculum construction, teacher education, social definition of mathematics etc. Morgan (2006), for example, whilst opening the door to some other analytical approaches (e.g. Hodge and Kress, 1988; Fairclough, 1995) that "can provide a systematic means of gaining insight into the dynamics of classroom interactions and the

roles of individuals within these" (p. 238), nevertheless centres her conclusion on how such tools "may help mathematics teachers and students to develop more purposeful and hence more effective use of language" (p. 239). That is, whilst providing "some flavour of the extent of the contexts of situation and of culture taken into account in the analyses and of their use in forming interpretations" (p. 239) the analysis privileges relevance to classroom actions at the level of interaction rather than the wider social parameters that govern those actions and define the actuality of classrooms. Ongstad (2006) provides a more fully social model centred on Habermas' opposition to Peirce with links to Bakhtin's conception of dialogical dynamics.

What alternatives might there be in understanding psychology and subjectivity? In her comparison of Lacan and Peirce, Nordtug (2004) points out how in many contemporary theoretical debates preferences for different psychological theories can be explained by the demands of the specific task in hand. Nordtug, for example, argues that poststructuralist accounts of subjectivity so often only apply to groups, or how individuals relate to social trends (she cites Malson (1998) and Lovlie (1992)), which is not so useful to her since she works as a medic with individual patients. She insists that theoretical models need to be fit for purpose. Mathematics education research deals with individuals, social groups and social systems, so consequently needs a variety of apparatus that enables analysis to span variously conceived domains. The choice of apparatus depends on the task being addressed, whether that is trying to support individual teachers or pupils, or alternatively trying to design and implement a policy. Mathematics education research has a choice of positions for itself and its supposed readership, and how it imagines its dissemination might operate. For example, the policy level task of improving particular mathematical capabilities for specific populations of students requires very different apparatus to an individual teacher assessing her own personal capabilities for work with particular individual children. The configuration of student, teacher and mathematics can be understood from many perspectives and the constitution of each is a function of the perspective assumed. Parker (2007) has argued that the conception of psychology as a discipline is generally predicated on a culturally defined perspective, centred on controlling the individual. As alternative perspectives find a voice the notion of psychology has been challenged by emergent conceptions of subjectivity that attend to the discourse-specificity of any assignation and the distribution of the psychological. I have similarly argued that the Piagetian emphasis in mathematics education research echoes a very specific and controversial reading of Freud's theories that saw the task of psychology in terms of nudging individuals towards conventional, that is, state sanctioned modes of behaviour (Brown, in press).

Whilst for some authors much the same thing is meant by self and subjectivity a key shift in contemporary social theory has been towards seeing the individual caught up in more or less committed participation in a multitude of discursive activity (Butler, 2005; Žižek, 2006). That is, individuals partake in social languages that more or less fit what they are trying to say but the individual is obliged to use these languages if they are to be included in social exchanges. Their subjectivity is understood, in this paper, as a function of this participation (see Brown, 2008a). Subjectivity is a key analytic term understood variously across fields as diverse as critical psychology, postcolonial studies, film theory, gender studies, social theory, geography, anthropology and cultural studies. Self, meanwhile, has often been understood as the biological entity held together by a

cognitive unity. For example, this is true of Colapietro's book "*Peirce's approach to the self*", which is centred on an individualistic conception of consciousness (Colapietro, 1989). But as Lemke (1995, p. 82) argues, from a "post-modern view this was a massive sleight of hand. Even within the natural sciences there is no guarantee that physical, chemical and biological definitions of an organism coincide for all purposes". The self is not the only centre of coherence. Subjectivity, in this paper and more generally across the fields mentioned above, relates to individuals whose psychological existence is distributed across a multitude of linguistic filters. As subjects individuals identify with and partake in social discourses and through these identifications craft their subjectivity, acting out aspects of previously formed languages, trying them out for size, but never quite fitting (Althusser, 1971). In this model subjects are "alienated" from *their* discourse, an alienation that underpins Lacan's conception of subjectivity, but less prominent in the account of discourse depicted by Vygotsky (1986) and more recent work in cultural psychology (e.g. Cole, 1996). I have discussed the importance of this difference in Brown (2008a). As an example from outside of mathematics education, I was recently on a training course for recruiting staff where a case of alleged unfairness was being considered. Yet unfairness itself is not necessarily against the law and so the victim in the case was obliged to identify racial elements of the unfairness to create a legally viable complaint, since racial discrimination is against the law. He was obliged to express his complaint within the *available* legal discourse of racial discrimination even though this did not match the exact character of his central complaint. Within mathematical learning there are many alternative approaches to demonstrating achievement, yet these may count for little if they do not align themselves with the specific assessment regime in force (e.g. basic skills versus problem solving). A subject is *subject* to the specific discursive framework presently being applied and is recognised according to the degree of compliance. The subject, in his or her alienation, is obliged to express herself and be understood through externally imposed linguistic filters (Brown, 2008b). In Duval's (2006) Piagetian analysis, for example, students fill their assigned space in the appropriate construction of child, seen as being at this or that stage, within the discursive order presented by the research author. Yet this privileges a specific view of students that perhaps marginalises other attributes that would be noticed on different registers.

In this instance of Duval's analysis there appears to be little scope for contestation of places assigned to participants, reduced as they are to "types" (Berger and Luckmann, 1972), responsive in predictable ways according to prevailing discursive frames. The research is conceptualised as adopting a relatively objective eye rather than subjective "I" in positioning teachers and students in roles from which they cannot readily escape. Such a tendency to create "types" promotes an instrumental rationality whereby assessments of mathematics education phenomena are associated with the identification of a control technology to bring about tangible change, perhaps influencing populations seen as homogenous to be more homogenous rather than promoting differences. Yet this contrasts at the same time with some of the individual reports that are predicated on small-scale research understood from the perspective of an individual teacher, teacher educator or researcher. Such perspectives are communicated as if to individual teachers, teacher educators or researchers rather than policy makers or curriculum writers who are more able to influence a broader domain of activity. For example, by focusing on the level of classroom interaction the Special Issue lacks instances of a large-scale policy

implementation in which semiotic structures would be an equally valid analytical tool. This choice is not wrong but does have analytical consequences in terms of how a wider map is created. As an example of where an alternative focus has been taken, Brown and McNamara (2005) provide an account of a national policy initiative in which all primary level teachers were obliged to work according to a centralised curriculum with high degrees of specification. The study premised on the perspectives of the teachers themselves sought to better understand how the policy framework was articulated through the teachers' accounts of their own practices. Although not explicitly semiotic the study was premised on understanding how the curriculum (the sign) represented mathematical activity (the object) to the population of teachers in a certain way (the interpretant) (cf. Peirce, CP 2.274). (I discuss the triad of sign, object, and interpretant in Brown, 2008a.) A key element of this study was that it was the government who determined the constitution of mathematics within a legislated curriculum rather than mathematicians or even mathematics teachers. As such the study sought to show how teachers mediated the policy framework, with view to examining how policies might be adjusted towards achieving alternative effects. That is, the study demonstrated how teachers were *subject* to the policy framework and the terminology it employed. Their validity, professionalism and identities as teachers were understood through the filter of their compliance with this regime. The authors however, were not advocates of this regime but sought to examine how the ideology of the regime was processed by teachers. That is, they sought to understand how mathematics, students and teachers were shaped by this policy initiative. I have provided further examples of subjectivity in education in another book (Brown, Atkinson and England, 2006). All mathematics teaching takes place within the context of some curriculum or wider social structure where factors outside of immediate mathematical concerns intervene. Semiotic analysis, drawing on the work of Peirce, lends itself to the investigation of many such contexts yet this potential has not been explored extensively within the reports as a result of emphasising the level of classroom interaction. Whilst this focus is not incorrect there is a consistency of choice of this restrictive field of analysis within the Special Issue. Such a choice, which I argue pervades mathematics education research more widely, emphasises individual teacher action as *the* key variable for change, rather than more structural adjustments for example. That is, the preponderance of mathematics education research reports focus on the interactive level and this naturalises this focus as though it were the preferred point of entry for mathematics education research analysis. This choice defines the field and the architectonic parameters that govern collective points of reference. And a sub-agenda of this present paper is to consider how mathematics education issues might be thought otherwise towards identifying the alternative levels at which we might intervene. Further, our capacity to influence individual teachers across a diverse world is surely limited and moves towards homogenisation (e.g. TIMSS) can suppress the needs of some groups.

POSITIONING OF AUTHOR, READER AND MATHEMATICS EDUCATION RESEARCH COMMUNITY

So having considered aspects of the voices being assumed by the researchers and how this defines their research objects, such as teachers, students and mathematical entities, I

now turn to better understanding how the research audience is understood. Mathematics education research is shaped across a complex network of discourses and authors in the domain are reflected/ produced in these multiple participations. The traditional realm of mathematics education researchers has been anchored theoretically by educational psychology and the philosophy of mathematics, with work targeted on improving teaching techniques. The field is not especially experienced in responding to alternative social paradigms. A survey by Lerman, Xu and Tsatsaroni (2002) of articles in *Educational Studies in Mathematics*, featuring other theoretical fields, depicts a situation in which few alternative theories have sustained interest. The chief exception is constructivism in its many guises but in forms primarily exclusive to mathematics education. Attention to this was initially shaped around the supposed debate between Piagetian and Vygotskian perspectives (e.g. Confrey, 1991). The latter extended to the cultural psychology of Cole (Roth and Lee, 2004), the activity theory of Engestrom (Williams and Wake, 2007) and the situated cognition of Lave and Wenger (e.g. Cobb and Bowers, 1999; Graven, 2004). There have also been some studies building on the sociology of Bourdieu and Bernstein, including some specifically examining school mathematics texts as cultural products (e.g. Dowling, 1998; Cooper and Dunne, 1999; Morgan, 2002). Such moves have characterised the major challenges to cognitive perspectives. There has, meanwhile, been a light sprinkling of reference to other contemporary theory such as post-structuralism and hermeneutics (e.g. Walkerdine, 1988; Brown, 2001; Walshaw, 2004). Yet the influence of such alternative models is less evident than in the broader field of education. Bartolini Bussi and Bazzini (2003) provide a rare recent discussion of how mathematics education research might reach out to other social scientific fields.

I provide below what must be at best an idiosyncratic taxonomy of citations made by the Special Issue authors. My purpose in compiling this was to build some sense of to whom the authors are listening and to whom they might be addressing their work and thus how the literary domain, research community and audience are being conceptualised. I classify and distinguish between some of categories of material that they do cite whilst considering these together with some of areas I assume they might have considered had they been motivated by the issues that I have raised in my oblique reading. The categories I have chosen are: the author's own previous work, work by other mathematics education authors in the area of semiotics, other mathematics education research including the philosophy of mathematics, other philosophical material, non-educational social scientific material, non-mathematics-specific education research, policy oriented material, teacher education research and books or journals aimed directly at teachers. The materials could be classified differently given that each citation is put in just one category, yet the resulting tabulation does provide some evidence of how the authors are positioning themselves in relation to their conceptions of their community and academic domain. In doing this I hope to indicate how the authors variously conceive implementation in respect of their own research, which is not always made explicit in their reports, and how that implementation prescribes roles for students, teachers, teacher educators etc. That is, I seek to understand how the reports could be positioned within a bigger picture where the processes of dissemination are included. In this I seek to pinpoint how the authors understand the building of control technology that would enable the consequences of their research to be realised.

	1. Self	2. Semiotics within MER	3.MER/Philosophy of mathematics	4. Other philosophy	5.Soc-sciences non-education	6.Education-non math	7. Policy	8. Math teacher ed	9.Teacher books/jrnls
Duval	15	0	8	7	0	0	3	0	0
Ernest	9	5	45	5	6	0	0	0	4
Morgan	7	7	21	0	13	0	0	0	2
Otte	7	0	14	17	1	1	0	0	0
Ongstad	13	6	4	15	15	4	0	0	0
Presmeg	5	10	6	5	4	0	2	0	0
Radford	7	5	11	27	5	1	0	0	0
Saenz Ludlow	4	13	20	19	1	5	1	0	0
Steinbring	6	8	10	3	1	0	0	0	0

The citations primarily emphasise the domain of mathematics education research, centred on the authors' own work with some reference to other semiotic specialists and others within mathematics education research, to more mathematically oriented philosophical/ theoretical material. Radford, Otte, Steinbring, Ernest and Ongstad are primarily addressing specialists in analytical apparatus and do not appear to be talking directly to teachers or even teacher educators, or at least not in ways that would suggest an immediate impact on practice. The theoreticians they cite are generally no longer with us. Their analysis is centred on structures rather than on people, except when those people have a well-defined role to perform within a structure. Presmeg (2006) and Saenz-Ludlow (2006) both more readily address the integration of their theoretical input into the practices with teachers and children yet issues of dissemination remain understated. For example, Saenz-Ludlow (2006, p. 213) promotes "interpreting games" as potential "teaching-learning tools" and suggests:

> For this to happen, it is necessary to build up classroom environments in which a communicative relationship between teacher and students naturally emerges with immediate and mediated intellectual results. That is, teacher and students should be equally committed to the establishment of a communicative relationship in which sign use, sign interpretation, and inquiry become a continuous state of affairs.

Yet such changes are left to the individual teacher or teacher educator reading this report, which assumes that individual teachers would read this research paper, that they would understand this, and that they might be able or free to adjust their practices in line with it. It is not policy talk. As the author concludes her paper, routes to implementation are not outlined in great detail:

> Because the curriculum in elementary schools tends to be less intense and children tend to be more open to dialogue due to their age, classroom environments in which interpreting games tend to flourish tend to be easier to establish in these schools. It might also be possible to establish this type of classroom environment in secondary schools but more research is needed in this direction (Saenz-Ludlow, 2006, p. 215).

It is not made explicit as to whom this author is talking; a lone teacher, a teacher educator working with groups of new teachers, a school principal choosing staff or a mathematics teaching scheme, a curriculum writer able to include "interpretation games" into the

curriculum, or fellow researchers considering alternative angles? The author appears to be making assumptions about the character of elementary schools and the reader's professional capacity to adjust practices within them. The possible paths to implementation are not conceptualised as part of the research. And the assumptions made about implementation, for unsupported reasons, do not extend to secondary education.

Meanwhile, Presmeg (2006, p. 180), working within an ideological frame spanning *National Council of Teachers of Mathematics* (NCTM) and *Realistic Mathematics Education* (see Brown, Hanley, Darby and Calder, 2007), is also a little vague about implementation by way of teachers: "It seems clear that these theoretical lenses have the potential to cast light on some of the processes involved in attempts to construct connected knowledge in mathematics classrooms." Presmeg is keen to support policies that emphasise how connections can be made between everyday practices and mathematical concepts, where meaning is negotiated through discourse. In his assessment of the Special Issue, Hoffmann (2006, p. 284) possibly fills some gaps in arguing that Presmeg's approach assumes that a teacher could intentionally define learning routes through specific semiotic chains as though they were necessarily the most obvious to follow: "Learning might be much more complex, and different paths could be taken by different students". Unlike Hoffman (ibid.), however, I find Presmeg's combination of Walkerdine and Lacan, with links to linguistics, epistemology and psychoanalysis as entirely feasible within mathematics education (as I have argued elsewhere; e.g. Brown, 2008a). Further, Presmeg (pp. 172-173) acknowledges how mathematical objects are "mutually constituted in the classroom by the participants involved". But she does this without explicitly hitching the process to the subjective constitution of those participants themselves. Also the fluidity of mathematical objects that Presmeg espouses contrasts with her depiction of students acquiring "some mathematical concept that is desirable for the students to learn" (p. 166) through pursuing a specified chain of thinking to a "connection" conceived in advance by the teacher. Such a specification suppresses the conceptions of subjectivity that Walkerdine or Lacan would portray beyond their usage of Saussure's linguistic apparatus. Walkerdine's (1984, 1988) neo-Marxist stance paints the process of learning as being about social regulation and student compliance. Whilst for Lacan (e.g. 2006, pp. 6-48) the human subject is a regressive affair consequential to a multi-layered linguistic making sense of the world, where there are multiple discursive engagements (akin to Peirce's conception of *semiosis*) combining to generate the subjectivity of any individual engaged in producing "meaning" (2). Meanwhile, Hoffman (2006, p. 284) responds to Presmeg (rather normatively, but perhaps fuelled with the same NCTM optimism): "meaning making should be conceived of as a creative process whose outcome can never be determined in a normative way".

But what other general points can be made? All of the authors refer extensively to their own work (3), emphasising that they are each engaged in a continuing personal project, rather than as part of some shared or coordinated initiative. In the citation count this personal aspect is in most cases stressed more strongly than their associations with the community of mathematics education writers in the immediate area. This is surprising since members of the group meet regularly and given the small number of authors in the field they would each have a relatively large impact on the specification of the domain. Group identity in the Special Issue papers is defined primarily through *identification* (Laclau, 2005) with Peirce and the theoretical domain he symbolises. The main areas

where other citations occur are in relation to mathematics education research generally, the philosophy of mathematics and philosophy, areas not always easy to sub-classify. A key area of absence is more generalist education material, as if to suggest such material would be marginal to the theme being addressed. Thus in relation to the discipline of "mathematics education", the stress appeared to be more on mathematics than on education, and the greater cultural diversity the latter term brings with it. But similarly, material targeted at mathematics teacher education or teacher education more generally is poorly represented, surely key elements of any proposed dissemination strategy as teacher practices would need to be adjusted. Teacher mediation cannot be regarded as a neutral layer in dissemination as any shift in policy would have major ramifications for how teachers understand and adjust their practices. It is thus not always clear how the authors envisage the suggestions of their work being integrated into the work of classroom teachers, as though their work can be developed without that being a major concern at this stage. The emphasis is on the point of contact between mathematics and students rather than on how this might be transformed through the active participation of teachers, or communities of teachers through the adjustments of broader parameters. There is also a general absence of articulated links to policy-oriented audiences. Yet, in many countries it is not teachers who decide the content of mathematics that they teach, or even the style in which they do it.

So to summarise, according to the citation count, in order of descent, the authors are listening to themselves, dead philosophers, other specialists in semiotic work in mathematics education research, other mathematics education research researchers and then just occasionally to social scientists but almost never to other education researchers, including mathematics teacher education researchers, school teachers and teacher educators. The engagement with Peirce is being understood primarily through personal engagements with the original material rather than as a result of working through the filters of history, including those evidenced within mathematics education research reports in the immediate area. The reports, and the hierarchy of power relations implicit in them, marginalise links to education, policy implementation or the broader social sciences.

CONCLUSION

In their Guest Editorial Saenz-Ludlow and Presmeg (2006, p. 3) acknowledge "that several semiotic systems mediate mathematical communication and the teaching and learning of mathematics". Consequently they organise the papers into three categories, i) semiotic and epistemology (Otte, Radford and Ernest), ii) implications for teachers of mathematics (Duval, Steinbring, Presmeg and Saenz-Ludlow) and iii) classroom communication (Morgan, Ongstad). The authors inevitably do stress some features rather than others and this results in some specific shaping of the research objects (mathematics, learners, teachers etc). And I stress again that I am not making a criticism here but rather seeking to analyse how those choices have analytical consequences. By attending to semiotic systems and the place of mathematical entities within them the first set of authors restrict conceptualisations of mathematical students. Here improvements to mathematics teaching are understood in terms of the teacher providing better definition

of and access to the existing symbolic networks of mathematics. The individual is understood with respect to an externally conceived frame and is given little opportunity to contribute an alternative conception of their role. Little mention is made for example of how teachers, or populations of teachers, might be assisted in acquiring these new frameworks of understanding their task or of making these changes to their practices. That is, the layer of teacher mediation implied is not developed as a teacher education task. Similarly, little or no mention is made of the policy implementation structures that would govern curriculum definitions or scope for teacher agency in defining the content and style of their lessons. These restrictive conceptions of learners and teachers are also true of the second set of authors insofar as the roles of teacher and student are specified in ways that assume particular social arrangements, with pre-supposed learning objectives. What sort of teacher is being addressed for example? How is the teacher positioned in writers' intentions? Teachers could be hero/ leaders innovating new approaches to teaching in response to powerfully argued research or be mere administrators of centralised policy, doing what the school principal or government demands of them. Members of the latter group probably need more activation, yet such teachers, or those managing their work, are not conceived as part of the research audience. Few proposals are made as regards modifications to teacher practice or policy parameters.

Meanwhile, the third set of authors focused on communication. Morgan stresses interpersonal and social discourses without a specific structuring of the mathematical content. This provides a flip side to the world offered by Otte, Duval and Steinbring. In Morgan's formulation it is mathematics that is left to fit in around the social world that she depicts. Ongstad most explicitly at a theoretical level creates a more holistic framework. Within this he cites Habermas who questions Peirce's disinclination to engage with subjectivity. Ongstad (2006, p. 251) argues: "inter-subjective aspects ('society', 'you' and 'act') should be brought into a real triadic relation". Whilst applauding Ongstad's complex formulation, his Habermasian supposition that we could achieve consensus through rational means suggests a quest for locating the "best way" that echoes the ambitions of some of the other Special Issue papers. And this issue perhaps provides the best point of exit for this present paper.

Ongstad (p. 271) asserts: "One will, according to Habermas, have to relate respectively, *simultaneously* and triadically to truthfulness/ veracity, truth, and fairness/ usefulness". Habermas is motivated by a quest for "Ideal" communication governed by such absolutes through "rationalization" (e.g. Habermas, 1991, pp. 119-120). His reflecting subject has a conception of Universal principles agreed through consensus and of how any antagonisms could be overcome. The human subject was thus trying to find ways of making things better from some supposed deficit position. A caricature that is commonly made of Habermas' work is that this points to a supposed "emancipatory cognitive interest" (Habermas, 1972, p. 308) whereby the subject assumes a critical distance in confronting these antagonisms and then her action is designed to remove them. Such absolute notions (truth, fairness, usefulness, or we may add mathematical objectivity, or supposed "best practice" in mathematics teaching) require a degree of consensus that may not be achievable in many formulations of life. Neo Marxist writers such as Ranciere (1998), Laclau (2005), Mouffe (2005) and Žižek (2008) specifically argue that it is not possible to remove these antagonisms and that consensus ultimately

promotes the will of the most powerful. For example, conceptions of mathematics and the centralised apparatus designed to promote styles of teaching differ between the USA and the UK. Such notions are time and culture dependent. You cannot step outside of time and culture to offer a point of view. Thus Duval's (2006, p. 107) strict distinction of "the represented object from the semiotic representation" is an analytical choice that downplays the cultural/semiotic dimensions of mathematical formation. This is an issue I have discussed at length in my earlier work (see Brown, 2001, pp. 174-191; Brown and McNamara, 2005, pp. 133-147; Bradford and Brown, 2005; Brown, 2008a).

In summary, without doubt mathematical activity lends itself to being considered as signifying activity spanning multiple discursive domains (mathematical, social, philosophical, etc). Any specific focus within this, however, can exclude some discursive aspects. Particular reductions considered have related to how students, teachers and mathematics are variously implied by the report authors. The foci of papers have predicated specific social worlds, variously delineating the domain of mathematical activity. For example, the individual student/teacher is reduced in formulations predicated on getting the mathematical structure straight. Yet the positioning of subjects more generally can assume somewhat restrictive possibilities within such work, perhaps characterised by suppositions that all subjects would witness equivalent events in given circumstances. This applies to all people implicated in research processes, whether they are the teachers and students being researched or the researchers themselves, as well as the audience predicated within the research design. In concluding her paper, Morgan (2006, p. 239) suggests: "a fuller articulation of social theory is needed in order to characterise the context more systematically". Yet context can be understood in many ways. It is not amenable to singular encapsulation, or to being systematised without cost. Any attempt to produce a system will always result in exclusions. And by focusing on the case of a teacher working with a pupil on mathematics the heterogeneity of the parameters that define such relations may be lost.

NOTES

1. A reviewer of an earlier draft argued that in responding to the Special Issue authors on my agenda rather than theirs I am committing an "ethical violation" in distorting their original meanings. I would respond by arguing that some accounts of contemporary ethics (e.g. Badiou, 2001; Butler 2005) are centred on subjects being obliged to operate within oppressive discursive domains rather than on individuals doing their own thing. And such obligations, it has been suggested (Žižek, 2008), bring with them support for the agenda built into those domains, which can result in symbolic violence to those disadvantaged in those modes of depiction (e.g. would be problem solvers in a basic competency ethos, collectivists in an individualistic world or vice versa). Thus I see my analysis as an interrogation of the discursive domains that shape the Special Issue authors' work and my own, as well as school practices, rather than of the individual authors and their intentions. My target is the practices of mathematics teaching in school where ethical violations are held in place by the custom and practice of discursive operations.

2. I have attempted parodies of this aspect of Lacan's work in an African mathematics education context (Bradford and Brown, 2005), and in relation to teacher subjectivity (Brown, Atkinson and England, 2006, pp. 244-254).

3. I am also guilty of this!

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