CULTURAL CONTINUITY AND CONSENSUS IN MATHEMATICS EDUCATION

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Abstract

How do we develop models of mathematics education that recognise the diversity of the populations that they need to serve? The paper argues that the discourses of mathematics education research often aspire to cultural and historical continuity whilst simultaneously operating on the notion of a consensual ideal dependent on the future achievement of social models with adequate levels of resources. Such discourses, it is argued, rest on oversimplified models of social change that inflate the operative role of individual teachers and of mathematics education researchers in affecting broader teaching and learning cultures. The paper provides model for understanding mathematical work in school as a culturally defined product yet argues that such historically rooted conceptualisations need to be traversed to enable renewal.

Keywords: culture . consensus . change

Given recent tendencies towards international comparisons of performance of students' mathematical achievement in schools is it possible for any sort of consensus to be achieved as regards deciding what mathematics should be taught and how it might be best taught without unbearable cost to specific localities? And how might the activities of mathematics education research be shaped towards supporting the broader development of mathematics learning amidst these trends towards uniformity in a diverse world? In some recent research carried out into children learning mathematics there was a rather startling conclusion that if certain procedures were followed the children's performance in tests could be improved, surely good news if we have clearly defined targets, but unfortunately this was not the whole story. The study also concluded that if these procedures were indeed followed there was also a negative consequence in the form of children being switched off mathematics (Williams, 2008). In another example, there was some evidence that problem solving/ word problem skill declined in assessments in England subsequent to adjustments to policies slightly improving performance in "mathematics" overall, following TIMSS defining mathematical skills more narrowly than had previously been custom in English schools (Brown, Askew, Millett, & Rhodes, 2003). Meanwhile, US "reform" has set key parameters shaping discussion relating to curriculum innovation. It is a conception of improvement often presented as universally beneficial but actually it is culturally specific. For example, according to Sztajn (2003, p.

53): "Based on their concepts of students' needs, teachers select which parts of the reform documents are appropriate for their students" which translates as "children from upper socioeconomic backgrounds get problem solving, those from lower socioeconomic backgrounds undergo rote learning". Clearly it is possible to be governed by a range of priorities that are not necessarily commensurate with each other. Such conflicting priorities can sometimes lead to further resolve to overcome the conflict by producing an ideal solution that pleases everyone. Yet such choices are surely commonplace in mathematics education whilst idealistic solutions that please everyone are rather more difficult to locate. The social activity of learning mathematics, inevitably, can be designed or interpreted in many ways, from school to school, from country to country, where consensus seems unlikely across all interest groups. And further there are many topics and themes within mathematics that will be prioritised differently according to the specific curriculum context, where additionally any given topic can be understood through a variety of more specific pedagogical filters (teaching style, learning scheme, algorithmic preference, etc). Particular choices lead to particular outcomes. Such diversity of approach may seem curiously convoluted in connection to mathematical thinking that is often seen as relating to stable phenomena. Yet the social world clearly does not echo the stability or the harmony sometimes supposed of mathematics. And the various cultural manifestations of mathematics do not always aspire to the same ends.

Within school mathematics any localised form of curriculum definition acquires specific conceptions of "good practice" (such as that which achieves good test results in that locale). More generally, mathematical forms often achieve familiarity through particular pedagogical configurations and this familiarity can become associated with particular forms of social interaction or learning styles. And research ambitions are often centred on the pursuit of identifying and refining good practice or effective pedagogical media for the individual teacher or for populations of teachers. This socially specific pedagogical layer that mediates access to mathematical phenomena clearly has a substantial influence on the learning activity and indeed on how the mathematical phenomena are conceptualised. But to what extent can we see mathematical phenomena as being beyond the specific pedagogical or culturally specific formulations? Much mathematics education research has been predicated on enabling students to experience generalisation to emphasise that mathematics has power beyond mere particularities (e.g. Mason, 1996). However, there are other dimensions to mathematical learning in schools that transcend such mathematical concerns. For example, the packaging of mathematics in particular curriculum contexts may be governed by factors specific to the social arrangements, such as the local assessment regimes requiring more or less quantifiable achievement criteria, or the local economy defining the mathematical needs of its workers. Such concerns may not necessarily be commensurable with producing vivid experiences of generalisation or other motivational aspects of specifically defined mathematical activity. Yet such pedagogical mediation and its hints at other social practices often provide the link between more abstract conceptions of mathematics and their application in specific everyday settings. Consequently pedagogical ambitions often benefit from combining abstraction with the discursive variety that gives mathematics much of its utility in everyday pursuits and in its capacity to provide apparatus for gelling communities of practice. Our thoughts and actions are necessarily rooted in history and shaped by that history. Yet Badiou, "declares that there is no general history, only particular histories, or historical situations. The direct consequence of this thesis is that events (such as the emergence of a new analytical framework) have no ground, there is no one situation that produces events" (quoted by Feltham, 2008, p. 100, my annotation in brackets). Our historical inheritance structures how we both see and make the world. How can conceptions of alternative cultures and histories be supplemented to incorporate a fuller cultural appreciation of mathematical objects embracing more locally specific dimensions of learning, which may transcend properly mathematical considerations? That is, the sedimentation of mathematical objects can arise at the level of broader culture or differently across cultures but also within the confines of more local pedagogical circumstances. How much, for example, is the students' quest to locate mathematical objects previously conceptualised by the teacher, or framed within the pedagogical apparatus? Is the generalisation they seek defined in the assessment regime or is it in any sense left to the student's own formulation? That is, whose generalisation is it? And how do the students experience the demand to reach this generalisation? How is that demand distributed across the specific teacher formulation, the curriculum constraints, school ethos, societal expectations on education or mathematics generally, etc? And if the teacher is culture's custodian how do we understand the cultural formulation of mathematical objects since now the teacher is implicated in that cultural construction, an agent of contemporary cultural dimensions as well as historic aspects?

Models of mathematics education research have sometimes focused on teachers equipped to shape mathematics in line with some socially approved structure, with children embracing those expectations. Here we would need to assume the existence of experienced teachers able to administer the classroom. This assumes assent from the teachers and also their technical capacity to carry out lessons on this format, or a training course that might be able to produce that capacity in teachers more widely. It similarly presupposes that children will be compliant participants appreciative of the teacher's benevolence and in agreement with this external specification of learning objectives. There is an apparent assumption here that there is some notional model of good teaching that children will recognise and support. We might object, however, that many teachers are alienated from such conceptions at least insofar as their capacity to conceptualise in those terms will be limited, and children may react negatively to externally defined plans for them no matter how ideal their conception. Children, perhaps humans in general, assert their understandings of who they are through a personal exploration of the boundaries they encounter or perceive. For example, Lacan (2006) sees subjective formation resulting through an engagement with the all-encompassing symbolic circuit that shapes thinking, where one's identity is formed through exploring and testing these limits. Brown (2008a) has argued that teachers and students are often alienated from cultural or pedagogical tools and that compliance with them, or accommodation even, is not the only educational choice. Bibby (2008) has provided examples of such alienation. In Vygotsky's developmental framework, for example, students appropriate cultural voices, yet Wegerif (2008, p. 355) argues that it is possible to read this alternatively as the cultural voices appropriating the students. "Vygotsky interprets differences as 'contradictions' that need to be overcome" (ibid, p. 347) yet this is not the only interpretation of an educational interaction; students or teachers may wish, consciously or otherwise, to counter the educational agenda. This paints a sympathetic version of cultural accommodation that disregards "symbolic violence" (Žižek, 2008), such as:

student performance being understood within a pass/fail categorisation; compulsory education fixing choices; differential access to different social groups; insecure teachers reducing the power of student mathematical engagement, perhaps through overly didactic approaches and the closing down of exploration; international curriculum criteria being applied in specific local contexts; the resistance of adolescents to adult guidance; or, the external imposition of perceptual schema (e.g. privileging teacher constructs of social objects; etc). Such symbolic violence cannot be resolved since its existence is consequential to multiple ideologies coexisting in a world that has features that many people may prefer not to reproduce.

These concerns lead me to raise three general questions that the field of mathematics education research may need to consider in to the future as regards how cultural change affects the objects of this research. *Firstly*, *mathematically:* How will the ideologies of scientism (Lather, 2007, 2008), their objects, their control technologies, and their exclusions, evolve in relation to shifts in educational/ working/ social practices? *Secondly, educationally:* How will ideologies of education evolve in relation to situating learners and teachers in different contexts? *Finally methodologically:* What are the theoretical differences between the researcher influencing, a) individual teachers as if through direct communication, and b) the wider population of teachers through policy apparatus.

MATHEMATICS

How are science and mathematics produced as cultural material? School curriculums relate to local priorities, yet more generally the fields of mathematics evolve in relation to specific cultural preferences and social potentialities, almost independently of advances in frontier mathematics. From a contemporary perspective within the domain of school education one might suppose that it is an impossible task to even contemplate reducing mathematical objects to extra-discursive entities since the necessary social aspect of education resists the very idea of mathematical objects being understood as things in themselves. Their implication in social discourses (the very acts of education as it were) necessarily transforms their constitution into cultural forms. Nevertheless, in some mathematical domains, to think object can sometimes mean a suspension of subjectivity, perhaps a necessary aspect of mathematical thinking in some instances, a style of thinking extensively reported or implied within many mathematics education research reports on school level mathematics and the curriculums of many university mathematics courses. But surely consensus cannot be reached on this point for all educational situations. A final truth cannot be achieved within knowledge since ideological divergence will ensure that the task of teaching mathematics in schools cannot be governed by a single rationale, nor interpreted against a consistent agenda. Culturalist and idealists will continue to co-exist, acting according to their respective assessments of any situation. Co-existence does not mean they have to agree.

A key argument that I wish to make is that the social and linguistic conditioning of mathematics is a crucial aspect of the discipline being addressed in school and vocational courses. As a consequence the definition of mathematics needs to be fit for this purpose and fit for multiple other purposes. Any quest for mathematical objectivity, or rather any attempt to map out mathematics against an imposed taxonomy, derives from a specific ideological conception, not necessarily consistent with the pragmatic objectives of school education. For example, precise mathematical proof is a form of argumentation but not the only form if we are concerned with a broader understanding of mathematics supportive of broader problem solving agenda. Probabilistic or interpretive readings may be adequate or fit for purpose in some instances, where choice of model or argument is perhaps part of the pedagogical challenge to be met. Social conditioning is a key element of the educative dimension of mathematical objects; objects that continue to grow in the classroom. Proficiency with concretisations is integral to the broader proficiency of moving between concrete and abstract domains, a proficiency that lies at the heart of mathematical endeavours (at least in schools). For many students and teachers proficiency in specific concretisations forms the backbone and principal motivation of activity pursued within the classroom. Whilst teaching strategies and pedagogical devices are generally seen as subordinate to the culturally-defined mathematical conceptions they seek to engender, these strategies and devices comprise cultural apparatus that importantly links mathematical thinking to practical endeavours. Historical and cultural conceptions of mathematics indeed need to be passed on, but the pedagogical packaging through which this may be achieved perhaps comprise shorter-term phenomena that more explicitly carry the ideology or common sense or cultural baggage of the day. The teaching devices of school mathematics can be understood more as constructed and implicit components of the mathematical ideas our students encounter and of the social activities that entail mathematical dimensions. Mathematical exchanges can be defined in conventional mathematical symbols as if from an individual teacher's perspective on how learning takes place with respect to the activities posed, the curriculums that they serve and according to particular ideological conceptions of how situations can be mathematised. The point of contention here perhaps is whether mathematical generalisation can be understood as a thing in itself and hence be universal. We cannot decide this absolutely, however, since the terms of such a decision would be culturally specific, since generalisation, or objectification, (or any multiple entity "counted as one", Badiou, 2007, p. 23) is a function of the cultural or subjective entities that produce it.

EDUCATION

Much mathematics education research is targeted at understanding how school students grapple with mathematical ideas and perhaps at providing a guide for teachers or teacher educators wishing to develop practice or for researchers focusing on classroom activity. But such quests need to take adequate account of the way in which power circulates and how the status quo operates against the aspirations implied. Such properly mathematical objectives would be difficult to achieve in many schools. How many schools/ countries can supply teachers offering the sensitivities required in so many proposed models of mathematical learning? (cf. Skovsmose, 2005) What teacher education programs would need to be put in place and how would this be achieved? How would the aspirations be made to stick as a policy directive when so often government officials centre assessments on skills based metrics of mathematical performance? Could curriculums be designed to enable the existing or next teaching forces to move closer to such aspirations? Proposed strategies must surely be defined within realistic resource constraints and one size fits all models potentially deny key aspects of diversity. Further past experience of wholesale curriculum change in any particular setting has typically been modest (e.g. Brown et al, 2003). And there is the underlying issue that specific structural models are often seen, through cultural bias, as ones that should be aspired to more generally or internationally, e.g. U.S. oriented liberal individualist constructivist rather than Chinese authoritarian collectivist, or simply regulative U.K. Learners and teachers are not things in themselves but are consequential to educational situations being read against specific discursive frames that shape the political domain and the priorities that domain confers.

Yet students are not only recipients of culture but also creators of it insofar as their fresh perspectives on mathematical situations can be voiced, rather than being merely evaluated with respect to an existing register. (Although there is also a pedagogical job to be done of enabling students to recognise how mathematical conceptualisation can be linked to cultural forms so that they can engage with and share culturally preferred approaches to tackling everyday problems.) Further, what mechanism might enable the dissemination of such a perspective and an operational adjustment to practices across a population of teachers. Teachers are not things in themselves as the term “teacher” is constituted with respect to a particular social construction of that term and the expectations that go with it, expectations that differ markedly across schools and countries. As an individual teacher I may have all sorts of personal optimistic aspirations but if I want a government job I have to fit in with the regulative structures, and understand myself through the terms of that regulation (Brown & McNamara, 2005). Teacher and student are *subject* to specific discursive frames, where actions are evaluated with respect to that discursive register (Brown, 2008a). So here a mathematical generalisation would not be seen as a “thing” in itself but something understood with respect to a particular discursive frame, that is, to a specifically ideological way of making sense, defined at the level of the pedagogical layer and the materials that support that, such as curriculum specification or favoured ways of setting algorithms. For example, Cooper & Dunne (1999) report how the formulation of mathematics in to word problems can sometimes penalize working class children less able to engage with the particular form of linguistic subtlety.

RESEARCH METHODOLOGY

The audience of mathematics education research is typically constructed as teachers and teacher educators who might be seen as seeking to adjust their individual practices, or researchers seeking understanding. Less commonly does it address policy makers who set their task in terms of what can be afforded within attainable educational frameworks and infrastructures. Such infrastructure is an obligatory dimension of contemporary culture that dictates how mathematics can be understood and limits the possibilities that are achievable within the given frames. Such outcomes require strategic manoeuvres perhaps not through direct address to individual teachers and teacher educators. Whilst it is often customary to direct findings to teachers and teacher educators within mathematics education research this is not necessarily the best assessment of the audience reading research journals, nor of the best point of leverage. The instrument of influencing teachers and teacher educators to adjust their individual practices following research is a very specific conception of how practices may be encouraged to change more generally. Individual researchers in mathematics education accommodate their theories and research practices both to the socio-cultural environment in which they work and to the constraints of the systems to which they are subjected. Their theories and ideologies change over time according to their personal growth as researchers and teachers. Different researchers at different times and at different geographical locations try to do their best to approach those problems within their socio-cultural constraints and possibilities. They accommodate to the history and evolution of those communities and, most of the time, their approaches are not translated into policies even though they are agents of change. Yet this image of mathematics education researcher as an agent of change is not the only conception of how change happens and there are serious grounds for questioning this orientation to mathematics education research (Brown, 2008b). The culture of mathematics education research as defined by, journal preferences, conceptions of good research, discipline boundaries, etc, police the access of work to the domain. Insofar as research is centred on controlling events in the classroom albeit with liberal/ progressive intent questions are predicated on:

- How children could learn better
- How the teacher could assist them
- How the researcher can alert the teacher to possible strategies

But such perspectives rest on certain assumptions:

- That the child is displaying some deficit in relation to a particular ideological perspective (e.g. “raising standards”, “reform math”, problem solving, performance on standard tests, motivation, etc)
- That the researcher focuses primarily on the local classroom interactive level (rather than on socio-economic factors, policy instruments, structural adjustment, etc)
- That the teacher could understand the research provided and could/ would change their practice (rather than this being done by the school board, local authority, government, etc).

Such assumptions result in a partial perspective on the classroom environment, a clipped account of the cultural context and hence a reductive account of the parameters governing the formation of mathematical practices in the classroom. They promote an idealist attitude in which consensus could be readily achieved and where the resources would be available to bring this about. Yet such an acquisition of the necessary resources would entail a radical shake-up of social arrangements beyond the reach and influence of mathematics education researchers. The charge of overemphasising teacher input could be levelled at many examples of mathematics education research. The cultural parameters governing learning are complex and the common assumption that the best point of access is the teacher being advised on the basis of research seems optimistic to say the least. Meanwhile, the cultural parameters seen as governing the research perspective can favour certain models of change.

Too readily the discourses of mathematics education research aspire to cultural/ historical continuity (Gadamer, 1962; Radford, Furinghetti, & Katz, 2007) whilst simultaneously operating on the notion of a consensual ideal to be achieved in the future

(Habermas, 1972), placing hope more on the achievement of educational infrastructures and social models *to come* (e.g. Derrida, 2005, pp. 71-77). Whilst it may appear culturally acceptable within the domain of mathematics education research to speculate in ideals I have suggested elsewhere (Brown, 1996, 2008b) that this is an ideology that underpins the production of many examples of mathematics education research, an ideology that inflates or at least misrepresents the operative role of individual teachers and of mathematics education researchers in affecting broader teacher cultures. We need an alternative conception of change that recognises that "we move to a future which is unforeseeable from the perspective of what is given or even conceivable within our present conceptual frameworks" (Lather, 2003, p. 262). We thus need to be attentive to how our work is governed by assumptions that may not endure so that we can be alert to renewal and the potential our work might have in triggering such renewal.

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