

Mathematics, Myth and Method: the problem of alliteration

Paul Dowling

Institute of Education, University of London

Abstract

This is not really about alliteration at all, but the use of this marketing tactic is familiar in the move from an idea, a story, an argument, to a snappy title designed (though not necessarily destined) to pull in the crowds. This move is a recontextualisation and *that's* what this is about.

In the paper I shall deploy and develop elements of my organisational language—social activity method (SAM)—to establish a departure from Basil Bernstein's restricted concept of recontextualisation to a more general one that places in the same frame the use of probability theory to constitute the activities of a police force as racist (or otherwise), the action of the curriculum, and the practice of educational research. SAM is a language that has been generated in a theoretical-empirical dialogue and this will be in evidence in the presentation here. Predominantly, however, this will be a theoretical exploration, which is to say, a general discourse that invites, but does not in itself provide, local realisation and interrogation.

Stopping police racism in the mathematics classroom

For some time, now, I (and I'm certainly not alone in this) have been arguing that the meanings of utterances and other actions do not carry over between different contexts and that what defines a context as such is the nature of the alliance and/or opposition in respect of which an utterance (or re-utterance) or action (or re-action) stands as a tactic. So utterances and actions are recycled within contexts—sometimes achieving status as slogans—and between contexts as resources for different, often quite different, purposes; the result is a *recontextualising* of the source utterance or action.

School mathematics, as a region of cultural practice, exhibits certain regularities that tend to shape the recontextualisation of utterances and actions that it re-cycles. One aspect of this regularity consists of the objects, precepts and procedures of the official curriculum. A second feature is what I have referred to as the *myth of reference* (Dowling, 1998), the principle that declares that mathematics can refer to practices other than itself and that tends to deny the productivity of recontextualisation and a third is the *myth of certainty* (ibid)—what Paul Ernest (1991) refers to as 'absolutism'—the faith in the infallibility of mathematics. These three features of school mathematics constitute the mathematics curriculum as a powerful and universal tool that potentially allows us to understand and control the world and that, indeed, stands as a necessary condition for our participation in society—the *myth of participation* (Dowling, 1998).

These features pervade school mathematics (ibid), but mathematics educators also form, or attempt to form, other alliances within mathematics education and between mathematics education and other activities. Significant here are alliances with antiracist movements and agendas in which mathematics is presented as a facility in the exposure of ideology leading, potentially, to the emancipation of the oppressed. Ethnomathematics might be seen as participating in this kind of alliance, generating this *myth of emancipation* (ibid). As an example, I'll introduce an example of mathematics teaching presented by Eric Gutstein (2002).

In terms of the curriculum, Gutstein was concerned to get across the idea of expected values. His resources included graphing calculators and data on police traffic stops in Illinois and on the ethnic profile of the state. Gutstein explains:

In mathematics, expected value is based on theoretical probability. If 30 percent of drivers are Latino, we would expect that 30 percent of random stops would be of Latinos—but only in the long run. This does not mean that if police made ten stops and five were of Latinos that something is necessarily out of line, but it does mean that if they made 10,000 stops and 5,000 were of Latinos, that something is definitely wrong. (Gutstein, 2002; no page nos)

In evaluating the lesson, Gutstein reports that:

Students learned important mathematical ideas about probability through considering actual data about “random” traffic stops and compared these to the theoretical probability (what we should “expect.”) Graphing calculators can easily simulate large numbers of random “traffic stops” (since they have a built-in “random” number generator). (ibid)

What was learned is revealed in this ‘fairly typical response’ (ibid):

I learned that police are probably really being racial because there should be Latino people between a range of 1-5 percent, and no, their range is 21 percent Latino people and also I learned that mathematics is useful for many things in life, math is not just something you do, it's something you should use in life. (ibid)

The emancipatory potential—albeit rather slender—was also apparent:

What did emerge was students' sense of justice (“Why do they make random stops? . . . just because of their race and their color?”) and sense of agency, as well as perhaps a sense of naïveté (“And Latinos shouldn't let them [police], they should go to a police department and tell how that person was harassed just because of a racial color”). (ibid)

The curriculum object—expected value—is explicit in Gutstein's text, which shows traces of the myths of reference, certainty, participation and emancipation. Of particular interest, however, is the appearance of the term ‘random’, with and without quotes. In the second extract, the loss of quotes between the first and second instance of the term seems to suggest that the police only pretend at randomness, whilst the graphing calculator is able to reveal what real randomness would look like using pretend ‘traffic stops’. A mathematical and political success, it would seem.

But here's the thing: random traffic stops are illegal in the US, being a breach of Fourth Amendment rights; police have to be able to demonstrate probable cause for their interpretation that an offence has been committed.¹ In fact, one might suppose that police are often not able to estimate the ethnicity of a driver until after they have made the stop. This would seem to suggest that, if there is a correlation between ethnicity and the probability of being stopped, then we might look for the presence of intervening variables for an explanation; a correlation between ethnicity and relative

¹ Decker *et al* (2004) do argue that US courts have been very liberal in respect of what might count as probable cause. However, the principle that there must be a reason for a traffic stop does undermine the assumption in the mathematics lesson that the stops are intended to be random; they are not.

poverty and the association of the latter with the use of elderly and poorly maintained vehicles having visible defects, for example.

Statistics can be used in all sorts of way, of course. One Illinois Department—the Wilmette Police—used their data on traffic stops to demonstrate that stops for different ethnic groups and genders were, in fact, in proportion to their representation in the community, thus demonstrating that ‘Wilmette police officers are engaging in bias free traffic enforcement’ (Carpenter, 2004; p. 66). One possible interpretation might be that, if the stops are non-random (as the law requires), then behaviour that might lead to a stop being made is evenly distributed in terms of ethnicity. Another might be that there has been some quota stopping going on.

My very brief discussion of this issue is intended to illustrate that, whilst statistical methods might usefully be deployed in the investigation and interrogation of the activities of traffic police, both the mathematics lesson and, in this case, the annual reporting of police activities by a police department, have privileged a particular object from probability theory—expected value—and, in doing so, have recontextualised police actions to the point of rendering them illegal! Rather more comprehensive reports are produced annually for the Illinois Department of Transportation (for example, Northwest University Center for Public Safety, 2007), again, though, the presumption that the expected value of stops for each category of driver is presented as the ideal state and any deviation is *prima facie* evidence of bias. We can describe what has happened here using the schema in Figure 1, originally introduced in the early 1990s (but see Dowling, 1998 and in press for developed accounts).

Expression (signifiers)	Content (signifieds)	
	I ⁺	I ⁻
I ⁺	<i>esoteric domain</i>	<i>descriptive domain</i>
I ⁻	<i>expressive domain</i>	<i>public domain</i>

Figure 1
Domains of Action

Mathematics education is conceived of as a loose kind of alliance between mathematics educators that is characterised by a practice—school mathematics—that varies in terms of its strength of institutionalisation of modes of expression and of content (that which expressions signify). Those regions of the practice for which expression and content are most strongly institutionalised (I⁺) form what we might regard as the non-negotiable part of school mathematics. I refer to this as the *esoteric domain* of the practice. Practitioners of school mathematics have been apprenticed into this domain in the sense and to the extent that it regulates what constitutes legitimate mathematical utterances and actions on their part.

But school mathematics should also be seen as a hybrid activity that articulates the strictly mathematical with what we might loosely describe as pedagogic theory (see Dowling, 2008). The latter will formulate the myths that I have introduced above and, in particular, will require the active subject of school mathematics to cast a gaze beyond mathematics *per se* as has happened in Gutstein’s mathematics lesson involving traffic stops data. The result is a recontextualisation of a police activity that brings it into

alignment with the esoteric domain of school mathematics as mathematics. In fact, in this case, the recontextualisation has occurred in two stages: the first stage has involved the collection of statistical summaries of policing events; the second stage, Gutstein's recontextualising of these as a pedagogic resource. The first stage constitutes an illegal (ie random) ideal traffic stop and the second stage fixes this by its emphasis on its pedagogic objective, the expected value. Now, by and large, the language of the responses to Gutstein's lesson (as reported in his paper and illustrated above) was not couched in esoteric domain language: neither expression nor content are I^+ mathematical language, but look far more like everyday language, albeit rather politically charged. Here, expression and content are weakly institutionalised (I); this is *public domain* language.²

The two other domains presented in Figure 1 are hybrids. The *descriptive domain* employs mathematical language to refer to non-mathematical content. This is the language of mathematical modelling and the prime site of the myth of reference. The *expressive domain* deploys non-mathematical language to refer to mathematical content; this is the domain of pedagogic metaphors, a fraction is a piece of cake, an equation is a balance, and so forth.

Figure 1 allows us to talk in a consistent way about how one practice—here, school mathematics—talks about another. In the case of Gutstein's lesson, the public domain seems to be operating in a janusian kind of way. On the one hand, it is presented as a portal into the esoteric domain, 'Students learned important mathematical ideas about probability ...'. On the other hand, students also got the political message, 'I learned that police are probably really being racial ...', but looking outwards from mathematics. Whilst the esoteric domain objective is mathematically legitimate, the public domain message is suspect, to say the least; policing has been recontextualised to make both a mathematical and a tendentious, political point. You might learn mathematics like this, but you're going to get a naïve view of the non-mathematical world that it recontextualises as its public domain.

Recontextualisation and the pedagogic device

The origin of my use of the term, recontextualisation, lies in the work of Basil Bernstein (1990, 1996, 2000). Bernstein organises educational activity into three fields: the field of knowledge production; the field of recontextualisation; and the field of reproduction. This schema seems to work very well in describing some changes in schooling. The development of 'modern mathematics' in the UK the 1960s, for example, might be described as exhibiting a push into the school curriculum from the field of production of mathematical knowledge—the university—in the form of an organising principle—set theory (Cooper, 1985; Moon, 1986; Dowling, 1998). The inspiration came from the self-styled bourbakiists (field of production) and was taken up by, for example, the School Mathematics Project (recontextualising field) (Howson, 1987), which produced a new series of textbooks. Responses from the classroom (field of production), however,

² In fact, public domain practice does not necessarily imply everyday language, merely language that is not I^+ in terms of mathematics.

resulted in the modification of the textbooks—especially those intended for the 16-18 age range—and the expansion of the range of books (Dowling, 1998, in press). Essentially, the field of reproduction and, ultimately, the field of recontextualisation, effected the recontextualisation of set theory from an organising principle, within the field of production, to what was, in effect, simply another topic on the secondary mathematics curriculum, and a pedagogic resource (realised in activities such as sorting) on the primary curriculum. Another development in the field of recontextualisation was the differentiation of the SMP textbooks on the basis of student ‘ability’ that was ultimately describable in terms of social class (Dowling, 1991a, 1991b, 1998). All of the textbook series contain exercises—with the solutions made available in teachers’ books—and were associated with public examinations.

In the previous paragraph, I have introduced empirical realisations of the effects of what Bernstein (1990, 2000) refers to as the ‘pedagogic device’. Part of the inspiration for this theoretical object comes from Chomsky’s ‘language acquisition device’ and the pedagogic device might be thought of as a kind of social competence. Constituted by the division of labour and principles of control that characterise society, the device consists of three principles: the principle of recontextualisation; the principle of distribution; and the principle of evaluation. Clearly, we can think of the development of ‘modern mathematics’ as products of these principles: the organising principle of set theory is recontextualised as a topic and as a pedagogic resource; the content of the curriculum is distributed between different series of books on the basis of social class; an analysis of the assessment tools that are incorporated in and are in association with the textbooks might reveal the nature of the principles of evaluation that are deployed in and by the device.

Moore and Maton (2001) appropriately, I think, point out that in using Bernstein’s theory, the question to ask is not so much, where is the pedagogic device, but when is it. Quite clearly, the postulation of the device can provide some organisation of data relating to transformations or attempted transformations in schooling, though they are of less help in making sense of more stable periods. Furthermore, Bernstein’s language does give us more tools than I have introduced here. However, firstly, I have problems with Bernstein’s language in general and, in particular, with his grounding categories of classification and framing, which, for example, unless they are directed at different levels of analysis, must always run in tandem, thus rendering one of them redundant (Dowling, in press). In respect of the pedagogic device, it has never been clear to me just what the postulation of this object or of distinct fields of production, recontextualisation and reproduction achieves. Terms such as the division of labour and principles of control have never been well defined within Bernstein’s language, so that the sociological nature of the device is unclear, nor is it clear just what constitutes a field or, for example, how (or when) practices specific to the fields of production, recontextualisation and reproduction might themselves be produced, reproduced, recontextualised, distributed and evaluated. Clearly, it would, in principle, be possible to zoom in, fractal style, to each field and consider production, recontextualisation and reproduction within them by reference to a pedagogic device at this lower level of analysis. The same difficulties with the language would remain, however, and, clearly, Bernstein seems to want to define fields in terms of individual human agents, for example:

... the authors of textbooks in physics are rarely physicists who are practising in the field of the production of physics; they are working in the field of recontextualization. (Bernstein, 1996; p. 47)

This may or may not be the case, in respect of the authors of school physics textbooks. It certainly is not true, however, for university textbooks and the authors of university textbooks frequently use them in their own teaching. How, then, do we theoretically and/or operationally distinguish the fields of production, recontextualisation and reproduction within the field of production? As I have hinted at above in my comment on classification and framing, Bernstein's heavily structuralist language does not easily lend itself to this fractal method, tending to fix levels of analysis in the way in which key terms, such as field, are defined. This leaves us with a theory that constitutes its objects in an unduly simple way. It also leaves us with theoretical white elephants, such as the pedagogic device that do not theorise anything but themselves.

It should be clear that my own conceptualising of recontextualisation is very different from that of Bernstein, even though he was certainly inspirational in respect of its inauguration. Other formative theoretical antecedents include (but certainly not exhaustively) the structural linguistics of Ferdinand de Saussure (1972), Piaget (especially 1995), Foucault (and, in particular, *The Order of Things* (1970) and *The Archaeology of Knowledge* (1972), Barthes (I think especially 1981), Bakhtin (for example, 1981), Baudrillard (especially 1993), Wittgenstein (oddly, perhaps, both 1961 and 1958), Bourdieu (especially 1977), Laclau and Mouffe (1985) and Richard Rorty (1989), as well as from the general area of symbolic interactionism (for example, Goffman, 1990 [1959], Strauss, 1997 [1959]), ethnomethodology (seminally, of course, Garfinkel, 1967) and cybernetics (see Hayles (1999) for an interesting juxtaposition of the history of this field and analyses of science fiction novels). I introduce these citations not to provide support for my own constructions, but to give a sense of where they are coming from. Essentially, Bernstein seems to want to get a God's eye view of the social, so that he can, for example, understand an interaction as a single object. My approach, by contrast, is to try to get inside interactions, so that they must always be constituted as two or more objects, each one constituted from the perspective of a participant. This entails that my categories are, primarily, strategies, whereas Bernstein's are states. Of course, both approaches entail objectification and its attendant problematics (for example, Bourdieu, 1990), though I am content to regard my constructions as the artefacts of my transactions with the theoretical field, on the one hand, and the empirical field, on the other, and to leave it at that for now (though see Dowling, in press; Dowling & Brown, in press).

In the remainder of this paper, I want, firstly, to give some consideration to the nature of curriculum—reproduction—and its relation to higher levels of analysis and to other practices within its own level. Then I shall introduce some conceptualising structures relating to the production of practice before returning to reproduction. Before doing so, however, I want to declare two features of my approach, which I refer to as *Social Activity Method* (SAM) (Dowling, in press).

I have claimed that the categories that I develop are, primarily, strategies. This leaves open the question, strategies in pursuit of what. The answer to this question is the degree zero of SAM: the sociocultural is defined by autopoietic, strategic action that is directed towards the formation, maintenance and destabilising of alliances and oppositions and this interpretation can be applied at any level of analysis. Emphasising

strategies clearly removes the focus from the alliances and oppositions that are or might be formed, maintained or destabilised. This is addressed by the second key feature of SAM, which follows from the first and is that social (relations between agents of strategies) and cultural (relations between practices) patterns are to be seen as emergent upon autopoietic strategic action within any given level and not generative of that action. This having been said, of course, emergent patterns (though not necessarily those generated in sociological analysis) are potentially available to strategic agents in respect of strategic decisions, though I am not assuming that all strategies are necessarily the products of rational action. The description of emergent states, then—for example, a description of the esoteric domain of school mathematics or of the construction of the student by curriculum—is produced via the summary analysis of strategies and these states are available only in reproduction of these strategies; simply stated, it is being understood that there is no knowledge as such outside of the actions of strategic agents; textbooks, curricula, policy documents, and so forth, do not so much contain knowledge as, in Barthes' (1981) terms, stand as texts-as-work to be animated as texts-as-texts in specific strategic action. This distinction resonates with Marx's (1976) delineation of dead and living labour. What is being denied, here, is that there are objective social structures that generate cultural practices. What is also being questioned is the value of postulating social devices either as generative structures or, as Bernstein seems to regard the pedagogic device, as stakes in social struggle; in Bernstein's case, the struggles—presumably strategic—are between untheorised social agents.

The reproduction of production

I have described school mathematics as a hybrid activity that articulates curriculum content and pedagogic theory (tacit and/or explicit). The subject of pedagogic theory constitutes a chunking, sequencing and pacing of an implied totality of mathematical knowledge (that is realised nowhere), but this is always already in place and the action of pedagogic theory (like those of the pedagogic device) is available only in terms of transformative strategies that may be operated locally (for example, by a teacher) or on the curriculum more generally (for example, in the negotiation of the official curriculum.³ The subject of pedagogic theory also facilitates the mathematical gaze that establishes the schema in Figure 1. This pedagogic action establishes the evaluation of students in terms of the themed, sequenced and paced curriculum, where theming will be described in terms of the relational space in Figure 1. For example, in Dowling (1998) I revealed the construction, by (my analysis of) the school textbook scheme, *SMP 11-16* (Cambridge University Press) of 'low ability' students as locally competent—having acquired context-specific skills in everyday life (or, rather, its public domain recontextualisation)—but generally incompetent, in that they failed to generalise such skills. 'High ability' students, by contrast, were constructed as generally competent, in that they are in possession of the potential to acquire esoteric domain knowledge, but locally incompetent, in that they inevitably experience temporary difficulties with certain

³ The distinction here corresponds with that made by Bernstein (1990) between the unofficial (enacted) and official curriculum.

aspects of the content. School mathematics is constituted as a necessary condition for successful participation in everyday life for the 'low ability' students; I refer to this as the *myth of participation*.

Clearly, an alliance is visible only in terms of its emergent regularity of practice and, in this sense, reproduces itself to the extent that a degree of continuity (which is not necessarily to say stability) is exhibited in this regularity. In particular, the induction of new participants in an alliance (which may be constituted at any level of analysis) must entail strategies of transmission and acquisition. Again, this is not to say that transmission/acquisition must be effective in terms of the reproduction of a stability of practice. At a very local level, the practice constructed by the 'acquirer' of necessity contrasts with that of the 'transmitter', because 'acquirer' and 'transmitter' must constitute contrasting articulations of alliances and oppositions; they have different histories. Nevertheless, the reproduction and/or expansion of an alliance must be associated with *strategies* of transmission and acquisition. Empirically, we can identify (at least) two dimensions of transmission strategy.

Firstly, transmission may be institutionalised within the context of the production and/or elaboration of the practice. This mode characterises the 'legitimate peripheral participation' of Lave and Wenger (1991) (though not necessarily all of their examples) and also what might be described as traditional apprenticeships (see Coy, 1989a). The craft apprentice—the apprentice Tugen blacksmith, for example (Coy, 1989b), learns his (sic) craft in the forge, alongside the master. Alternatively, transmission strategies may be elaborated by relayers of the practice, who mediate between the mythologised practice (the 'knowledge' of the expert practitioner, experienced member, etc). In this mode, pedagogic theory will tend to take the foreground and the practice to be transmitted will be constituted as a curriculum. This is clearly the mode that is prevalent in schooling, where the emphasis is on the transmission of the mathematical expertise, but not the teaching expertise, of the teacher. On the other hand, if schooling itself is the practice to be reproduced, then it may be more appropriate to think of transmission strategies that are directed at the apprenticing of the newcomer into the community of school students, or school teachers, and so forth, in unmediated mode.

The second dimension of transmission strategy can be introduced by reflecting on two different examples of craft apprenticeship. The first is the apprenticeship of Japanese *mingei* folk potters, described by Singleton (1989b). This looks very much like legitimate peripheral participation. The initial part of the apprenticeship involves minimum risk labouring work and observation around the factory. When the apprentice is permitted to work at the wheel, they are told that they must first make ten thousand sake cups. For the most part, the apprentice's products are thrown into the bin for recycling until, eventually, the cups are rated as satisfactory and are sold in the shop—without the potter's mark—as seconds. Here, the apprentice as acquirer is relatively untheorised; their competence will (or may not) develop in time. Rather, the emphasis in this mode is the production of adequate products, which is to say, on performance, rather than on competence.

The apprenticeship of the mediaeval scribe seems to operate differently. In a 'school for scribes' described by Aliza Cohen-Mushlin (2008), the master (sic) scribe would pen a few lines as an exemplar and then the pupil would take over. When the pupil's performance was inadequate, the master would produce another exemplar. If the pupil progressed, they would be permitted to advance to more challenging tasks, such as

rubrication and eventually take on the role of master. Here, there is clearly a sense of what is an adequate performance. However, a work completed in this mode will contain instances of both adequate and inadequate performances as the pupils' work would not be scrapped; parchment would have been too costly for this and, presumably, such a procedure would have introduced too great a delay into book production. This leaves the emphasis of the apprenticeship far more on the competence of the apprentice than on the quality of the final product, which is always going to be imperfect. The distinction between this mode and that of the pottery apprentice is, as is generally the case, one of emphasis, almost nuance, perhaps, but nevertheless discernible. Pedagogic theory—or what we can know of it—is light, in the scriptorium, seemingly confined to the provision of exemplars, imitation, and correction, nevertheless it is there.

Mediation	Transmitter Focus	
	Competence	Performance
Unmediated	<i>delegating</i>	<i>apprenticing</i>
Mediated	<i>teaching</i>	<i>instructing</i>

Figure 2
Transmission Strategies

The cartesian product of the two dimensions of transmission strategy give rise to the relational space shown in Figure 2. Two of these strategy modes, teaching and apprenticing, are quite familiar and commonly opposed as, indeed, they are here, though in what I think is an original way. The commodity outputs of schooling might be said to be various forms of credentials that attest to competence. We might say, then, that the tools of the school are the curriculum and assessment protocols and its raw materials are its students. The performances produced by the students are generally of little importance once they have been assessed. The commodity outputs of factories are the performances of their staff, so the situation is the reverse of that of the school and it is unsurprising that we find novices confined to low-risk (and probably low paid), peripheral activities until their performances are judged to be satisfactory.

The leading diagonal of Figure 2 opposes delegating and instructing. The mode exhibited in Cohen-Mushlin's scriptorium has been labelled, delegation, which is here being understood as a strategy of transmission rather than a strategy of management (though one might presume that the latter generally entails the former). Here, unlike the situation in teaching, master and pupil performances are the principal products of the activity, yet the emphasis is on the development of a community of competent practitioners, rather than or, at least, as well as, on the quality of any these products. I have no other empirical instances of this mode, though one might look to amateur, hobbyist activities. I have also encountered the sharing of repertoires of skills within informal (ie based in the public house) communities of jobbing builders and delegation might be an appropriate description of transmission strategy here. Consultancy work (the consultant being in the position of the transmitter) might be explored for evidence of this mode as might activities around succession planning in institutions.

Instruction is also frequently opposed to teaching and it constitutes the form of mediated transmission strategy that does not involve any developed pedagogic theory. I suppose sets of instructions accompanying consumer goods would frequently be described in this way. Not all instruction books are exhaustively described like this, however; the users manuals accompanying the professional grade cameras that I use tend to attempt to cater for incompetent users by including some teaching on the basic principles of photography and, in this respect the manuals differ from some of the reviews on websites concerned with photography.

Figures 1 and 2 originate from empirical observation, but have been constituted as logically complete spaces, defined by two, mutually independent, bipolar concepts; the regions of the space can, therefore, legitimately be referred to as ideal types. This is the case with a number of such relational spaces that I have constructed (see Dowling, in press), five more of which will be introduced in this paper. Two issues have been raised by discussants. Firstly, I have been asked whether it is generally appropriate that any given practice should be associated with only one ideal type; might not a craft apprenticeship also involve some teaching? The answers are no and yes respectively. The ideal types are not intended to contain practices, but rather to provide a coherent and consistent language for talking about them, individually and comparatively and at different levels of analysis. It is expected that the analysis of any given practice at any given level of analysis will reveal more than one and possibly all ideal types in any given schema, but that the analysis is capable of describing prevalent strategies or combinations of strategies, regionalisation, trajectories, and so forth. The interpretation that the schemas provide boxes into which particular practices can be dropped possibly arises out of my pedagogic strategies in introducing them, which include the contrasting of practices in order to illustrate the concepts involved. So this is an effect of pedagogic recontextualising, which is to say, a teaching strategy that is directed at the reproduction of these products of academic production—a ploy designed to extend the alliance of those recruiting SAM. In the deployment and development of these schemas in the production of this ‘knowledge’, one would expect to see the description of any given practice to be far more delicately produced and elaborated. This distinction—essentially between the productive development of the domains—Figure 1—of the practice and the pedagogic relaying, or reproduction, of these domains via the strategies identified in Figure 2 might reveal differences between the private action of analysis and the public action of its relaying (in a paper such as this), and, at a higher level of analysis, between the production of ‘knowledge’ in a field—which might include papers such as this—and its reproduction in textbooks.

The second issue that has arisen is related to the first and might be summarised in the question, is it not more appropriate for the concepts that are used to dimension these schema to be continuously scaled rather than bipolar. There are two ways of addressing this question. The first follows on from the previous point: the intensity of any particular strategy that may be said to characterise any given activity at any given level of analysis is a function of the prevalence of that strategy in its analysis or, shall we say, but the saturation of the activity by the strategy. In some instances, it may be considered appropriate to conduct a quantitative analysis in order to measure the relative saturation of the activity by the strategies of a particular schema (see, for example, Dowling, 1998, for quantitative analyses of a textbook series in terms of the schema in Figure 1). Quantification, of course, has a tendency to exchange reliability for

validity (Brown & Dowling, 1998; Dowling & Brown, in press), so this is certainly not to be seen as the end point of 'knowledge' production.

The other way of answering the question about continuities versus polarisation is to re-emphasise the fundamental organising principle of SAM, which is to be concerned with alliances and oppositions. Binary logic is built into the foundations of the approach, which is unsurprising, given its (partial) origins in structuralist linguistics, poststructuralism and cybernetics. The use of binary concepts is also compatible with George Kelly's personal construct psychology (1955; see also Bannister & Fransella, 1971, 1986), which has also been influential. Essentially, the proposition is that any analogue concept may productively be digitised (and I am concerned specifically with the concept and not its operationalisation, so this is not a comment about the relative merits of quantitative and qualitative research). Given that both analogue and digital concepts are being understood within a broadly constructivist frame, movement between them is motivated pragmatically in respect of fitness for purpose; the binary form clearly fits mine.

Production and method

As I have indicated, and in contrast with Bernstein, I cannot conceive of production and reproduction as distinct fields, because the activity of any given field, itself has to be reproduced. Rather, I am concerned with productive and reproductive strategies in any given alliance, though the alliance may privilege (or apparently privilege) reproduction (schooling) or production (for example, academic research). Clearly, however, both productive and reproductive strategies must be involved in all activity. Recontextualisation is also to be associated with both production (the gaze of the esoteric domain subject) and reproduction (by pedagogic theory) and is also not a specialised field; essentially, recontextualisation is a function of all practice, as reflection on the generalisation of Barthes's (1981) distinction between text-as-work and text-as-text illustrates. In previous sections of this paper I have looked at recontextualisation and reproduction; here I want to shift the focus to production.

Earlier, I introduced the myth of participation as the product of a strategy that constitutes (in this case) mathematics as a necessary condition for adequate participation in one or more other practices. However, the public domain, which is the constitution of non-mathematical practice within mathematics, entails the recontextualisation, which is to say the transformation of these practices. By underplaying the effects of recontextualisation, school mathematics tends to naturalise the products of its gaze as discoveries of this gaze. A good deal of metadiscourse in academic research tends to do the same thing. In Dowling (in press) I refer to this mode of activity as *forensics*. Essentially, this kind of approach presents the patterns that it constructs as if they are independent of the method that has been deployed in constructing them, that, somehow, research provides access to fundamental and generative structures that essentially characterise its object. The esoteric domain categories of and public domain descriptions by such work are presented as unmediated representations of the world, they are universalised to the world beyond research. The mode of metadiscourse that stands opposed to this concedes that, in my language, the public domain is always a product of a transaction between the esoteric domain and that which lies beyond the gazing practice, its objects or empirical field; in this mode, the

products of research—its domains of action—are specialised to the particular approach being adopted. Instances of metadiscourse may also vary according to the power of research products, which is to say, they may localise to particular empirical settings or they may generalise to all relevant settings. This brief discussion of metadiscourse establishes the schema in Figure 3.

Power	Naturalisation	
	Universalising	Specialising
General	<i>generative</i>	<i>emergent</i>
Local	<i>prescriptive</i>	<i>interrogative</i>

Figure 3
Metadiscourse on Structural Value

I want to suggest that a good deal of educational research is presented as if it accessed generative structures that had prescriptive implications for professional educational practice. Here, for example, Chouinard *et al* are clearly suggesting that their research (previous and ongoing) offers direct implications for teaching:

[Our results] suggest that social comparisons exert less influence on engagement in academic tasks than the aspiration to understand and to learn academic content. [...]

On the basis of our results and as underlined by many [...], teachers should avoid eliciting competition among their students and foster competence beliefs, utility value and mastery goals instead. (Chouinard *et al*, 2007; p. 514)

We might understand this as an instance of prescription. Viewed from a specialising metadiscourse, whilst there would be no attempt to deny the potential value of the suggestions offered by the research, what would be denied would be any implication that we are dealing with causal structures, that adopting these suggestions will have the desired effect in the classroom. The interrogative strategy would limit the results of the research to the particular approach that has been taken. This would not entail that the research has nothing to say to teachers, but that what it most usefully says is in the form of an interrogation: how much attention is being paid, in the classroom, to ‘competence beliefs, utility value and mastery goals, how much to competition’? The interrogative strategy would allow for the potential value of apparently contradictory research, such as that by DeVries & Edwards (1973) that found that the combination of using a mathematical learning game in the context of team competition had distinctly positive effects on the classroom environment and an increase in competitiveness was rated amongst these benefits. It’s possibly significant that these two studies were separated by a quarter of a century: the progress of knowledge; or the random walk of fashion?

SAM would constitute educational research and classroom teaching as different activities, because they involve different kinds of alliance from which emerge different principles of evaluation. Both pieces of research cited here are accountable to peer evaluation in respect of their experimental methodological procedures, which, in these cases, is to say, how they create a laboratory out of the classroom. A classroom teacher is accountable in respect to their students, their students’ parents, their line manager

and probably their peers, in terms of, respectively, student satisfaction with and achievement against the enacted and official curriculum. Whilst the prescriptive strategy would tend to universalise findings across these activities, the interrogative strategy would not.

The generative and emergent strategies are the general versions of prescription and interrogation. The generative strategy constitutes the empirical field as subject to generative structures that are potentially available to research; the emergent strategy presents structures that are emergent on the transactions between particular researchers and their respective approaches and their empirical settings, that are also constituted as emergent on the transaction between the researcher and the empirical field. SAM is clearly associated with a specialising metadiscourse: the esoteric and public domains that it produces are constructions of researchers that may be of value to other researchers and to members of other alliances, including classroom teachers. However, I contend that there is nothing intrinsic to SAM that fixes it in relation to the specialising metadiscourse and that it would be possible to establish it as a forensic or universalising practice (though I do not intend to pursue this here); discourse and metadiscourse are, at least relatively, independent of each other.

It is often proposed that one aim of research should be to develop as fully as possible the coherence of what I am calling the esoteric domain of the practice, its conceptual apparatus. Coherence entails self-referentiality and, ultimately, closure. Where the esoteric domain develops to this level, then it is effectively cut off from the empirical world in the sense that it is unable to learn from it; such a practice can see only itself, wherever it looks. Arguably, regions of mathematical practice have developed to this level; certainly, it seems unlikely that school mathematics *per se* will 'learn' via its own public domain. Earlier in this paper, I have associated school mathematics with a gaze that enables it to recontextualise the non-mathematical world. In the case of school mathematics, the gaze would seem not to be explicitly well developed and may be more appropriately considered as a facility that is acquired tacitly. Now I have made two distinctions, here. The first is between the esoteric domain and the gaze. This distinction resonates with Bernstein's description of what he refers to as a language of description:

... a language of description is a translation device whereby one language is transformed into another. We can distinguish between internal and external languages of description. The internal language of description refers to the syntax whereby a conceptual language is created. The external language of description refers to the syntax whereby the internal language can describe something other than itself. (Bernstein, 1996; pp. 135-6)

This would then associate the esoteric domain with the internal language and the gaze with the external language.

The second distinction is between explicit and tacit developments of a practice. I use the category, *discursive saturation* to refer to strategies that tend to make the principles of a practice available within discourse. Such strategies are prevalent in school mathematics, particularly where it is concerned with 'higher ability' students (Dowling, 1998). It is therefore appropriate to refer to school mathematics as, in general, a high discursive saturation (DS^+) practice, though the gaze that enables mathematics teachers to construct public domain texts and utterances is characterised by low discursive saturation (DS^-) strategies.

I want to propose that research activity may also be understood to vary in these

terms and, again, I am going to illustrate this, only, by an apparent (but pedagogic) totalising of some fields of study. If we consider physics, for example—and I discuss an example from astrophysics in chapter 1 of Dowling (in press)—then it seems clear that DS⁺ strategies will be dominant in its esoteric domain, but also in its enabling gaze, which is institutionalised in inscription devices (various forms of telescope, cyclotrons, cloud chambers, and so forth), the principles of operation of which are also quite explicit. Opposed to this would be certain forms of literary criticism, most obviously F.R. Leavis (for example, 1966). Here, there is no explicit pedagogy, either of the esoteric domain—the conceptual apparatus that constitutes criticism in general—or the gaze—that enables criticism in particular; both are dominated by DS⁻ strategies. Other approaches to criticism operate differently. Louis Montrose’s (for example, 1989) New Historicism, for example, clearly does develop its esoteric domain in respect of his recruitment of Marxist discourse. The gaze of New Historicism, however, is, arguably, not developed in the same way. Finally, and in opposition to the New Historicist mode, grounded theory—whether in its original form (Glaser & Strauss, 1967), or as developed by Strauss and Corbin (1998) or, contrastingly, by Glaser (1992)—is highly developed in terms of its gaze apparatus, but grounded theorists are famously silent on the esoteric domain. So, considering esoteric domain and gaze separately in terms of discursive saturation generates the schema in Figure 4.

Gaze	Esoteric Domain	
	DS ⁺	DS ⁻
DS ⁺	<i>metonymic apparatus</i>	<i>method</i>
DS ⁻	<i>metaphoric apparatus</i>	<i>fiction</i>

Figure 4
Grammatical Modes

Now my contention is that Bernstein’s language deploys the strategies of a metaphoric apparatus. The fact that the most fundamental categories of his esoteric domain—classification and framing—are theoretically constructed so as to operate at different levels of analysis yet are frequently recruited as if they operate at the same level (see the discussion in Dowling, in press; chapter 4) seems to confirm this. But, in addition, Bernstein makes frequent use of fictitious data (ibid) and, even more frequently, no data at all, even when making empirical claims (ibid). So the gaze of his theory—his external language—is characterised as DS⁻; the esoteric domain is, I think, quite clearly DS⁺, though is not perhaps quite as coherent as he sometimes tends to make out (for example, in Bernstein, 1995).

I describe the strategies of my own approach, SAM, as constituting the opposite of Bernstein’s language, that is, as method and, in this respect (but not in many others), I share something with Glaser and Strauss. My esoteric domain is substantially limited to the single principle that I have introduced above, that is, the sociocultural is characterised by the strategic formation, maintenance and destabilising of alliances and oppositions and by that which follows from this principle; this is DS⁻. SAM’s gaze, on the other hand, comprises two hundred or so specialised terms that originate empirically and that are defined in ways that bring them comparatively close to their empirical

recognition. This, of course, might be challenged—empirically—but the schema in Figure 4 at least provides a way of thinking about ‘knowledge’ production that, for example, allows a distinction to be made between social theory and sociological method, between varieties of literary criticism, between all of these and the natural sciences, but that does not unduly naturalise these descriptions; this is a strategic move.

Reproduction revisited

All strategies are elaborated in the context of some kind of interaction. As I have indicated earlier, my strategic approach does not constitute an interaction as a single object, but rather we need to consider actions relating to each participant in the interaction and this will include action on action; that’s what an interaction is. So any utterance or action is a move in an interaction; actions may (at least in principle) receive no response, but no action is *sui generis*. Interaction, of course, takes place in the context of some kind of alliance at some level of analysis, in the sense that participants are construed as participants; in this sense, even a war, a fight, an assault, an execution may be interpreted as alliances, though not necessarily at the level of the individual; all alliances are emergent upon and not simply generative of action. So the Japanese father taking a photograph of his wife and children standing in front of the A-Bomb Dome in Hiroshima might be construed as an alliance in the context of dissimilar discourses. The dome stands in heroic defiance of violent interaction in a discourse of peace; the family constitutes a discourse of tourism (we need be here just long enough to take the snap that will stand as a *point de captio*n in our trip); but the elder child, a boy of maybe five, delays the shoot whilst he adopts his pose, aiming a toy rifle directly at his father in celebration of imagined, media violence, perhaps. Unseen by them, another photographer captures the family making their portrait. This photographer is a sociologist concerned with the formation, maintenance and destabilising of alliances and oppositions. Facing the sociologist is his (sic) audience; action on action on action on action and so it goes on in open pastiche.

A group of holiday friends sit in a bar in Mombassa, exchanging narratives of previous vacations. No one passes commentary on any other’s narrative, but sometimes a metonym or two string them together. They all seem to be playing the same game. Until, that is, the sociologist (to whom this game is strange) presents, in lieu of a story, an analysis of the game. It goes very quiet for a while. Finally, one of the others recalls a previous holiday and tells its story.

In a third location, this time in Cape Town, the sociologist is in a car with a colleague. They are returning from a data collection visit to a high school in what was, at the time, referred to as an informal settlement. The two sociologists are exploring their day’s experience, shuffling ideas around, trying to reach some kind of stability. When something does seem to fit—just so—they have to stop for a while, talk about something else, fix the moment, another *point de captio*n, though it may be pulled free on a subsequent occasion.

Alliances may be constituted as alliances of similars, in terms of discourses, or of disimilars and interactions may be targeted at closure or not. This pair of binary-scaled concepts gives rise to the schema in Figure 5.

Alliance	Target of Discursive Action	
	Closure	Openness
Similar	<i>equilibration</i>	<i>exchange of narratives</i>
Disimilar	<i>hegemony</i>	<i>pastiche</i>

Figure 5
Modes of Interactive Social Action

I have already labelled the shooting in Hiroshima (Dowling, in press) as pastiche. The sociologist's intervention in the exchange of narratives in Mombassa is an attempt at hegemony (which failed). The discussion in the car is equilibration. This schema also seems to catch at dominant strategies that we routinely observe in the reproduction of practice. The traditional classroom—students' desks facing the teacher's, teacher facing the students—is set up in hegemonic mode: the teacher transmits; the students acquire. Conventionally, in terms of the institutionalised assessment practices, this situation obtains until the successful completion of the doctoral viva, at which point the former student enters into a peer reviewing field of equilibration; at least, that's official story. In practice, papers presented at conferences are often received in something that seems more an exchange of narratives; hegemonic moves are dangerous.

As to why hegemonic moves may be dangerous, we need to look to acquirer side strategies. Here, I shall introduce a schema that derives partly from observation and partly from a (deliberate) misreading (see Dowling & Chung, in press) of Pierre Bourdieu (1977). The empirical observation concerns interviews with high school students in the Cape Town area of South Africa (Dowling, in press). Essentially, students from a prestigious, predominantly 'white' school and those from a school in a 'coloured' township reported an understanding of the value of the curriculum as purely instrumental in respect of their acquisition of symbolic capital in the form of the matriculation examination. Students at the school in the 'informal settlement', mentioned above, by contrast, were clear that they saw the skills and knowledges to be acquired in school to constitute the 'base' of future knowledge and skills. I want to describe this distinction in orientation to cultural capital (Bourdieu, 1991) as acquirer focus on the objectification of the practice in symbolic form (qualifications) in contrast with a focus on the embodiment of the practice as 'knowledge' or 'skills'.

Now Bourdieu (1991) also distinguishes between cultural and social forms of capital. The latter is 'capital' accruing by virtue of relations between social agents. I want to suggest that we might also consider this form of capital as exhibiting two modes corresponding to the binary, objectification/embodiment. As an individual, I might conceive of myself as standing at the hub of a set of relations that I value for their own sake. Relations with family, friends, lovers, and so forth, might be members of this set. These relations are, in a sense, embodied in my life. On the other hand, I am also implicated in networks of relations (that may or may not include members of the other set) that are valued not in themselves, but for what they may provide access to. Here, the focus is on the objectified network rather than on the embodied hub. I now have the basis for the schema in Figure 6.

Culture	Capital	
	Cultural	Social
Embodied	<i>habitus</i>	<i>hub</i>
Objectified	<i>symbol</i>	<i>network</i>

Figure 6
Acquirer Strategies

I have referred to the categories in Figure 6 as acquirer strategies because I am associating them with that which the audience of a transmission strategy may be aiming to acquire. Now, the speculation that I made earlier, about hegemonic interaction strategies being dangerous is plausible, if the acquirer strategies are directed towards the acquisition of social rather than cultural capital. Either *habitus* or *symbol* strategies may allow hegemonic action by the transmitter, though to the extent that the former excludes or reduces the latter, we might expect that those who are engaging on, say, a doctoral programme might be less willing to pay close attention to their supervisor; this also accords with (at least my) experience.

I want to introduce one more schema in the context of reproduction. This final conceptual space is concerned with the modality of strategy directed at establishing the authority of an utterance or action; such authority would be particularly important in hegemonic interaction. The front page of the paper by Chouinard *et al* that is cited above (clearly a research paper participates in the production of a practice, but at a lower level of analysis it also constitutes a move in the reproduction of a particular research project) shows the crest and name of the British Psychological Society in the top right hand corner; below this is the url of the website for BPS journals; and to the left is the title of this particular journal, *British Journal of Educational Psychology*, the date (2007) and issue number (77) and the page range for this article (501-517) and underneath this is the copyright claim, '© 2007 The British Psychological Society'. This heading asserts the institutional authority of the text that follows. It is used for all of the papers in the journal, so all papers and, indeed, all authors are equivalent, in this respect. The institutional authority marks out a specific area of practice—this is educational psychology and not mathematics—but leaves open the question of just who is authorised to engage in it. This is a *bureaucratic* authority strategy. The authors of the article are, of course, named on this page—below the title—and the first author is named in the header of every second page. So we know who they are. However, we also know that at least two of them have prior credibility as authorities in educational studies, because other publications authored by them (two by the first author and one by the second) are listed in the references at the end of the article. The association of the closed area of practice with these particular authors—we cannot simply substitute other names as authors of the cited works—is a different kind of strategy; it closes not only the practice, but also the author(s); I want to refer to this kind of authority strategy as *traditional*.

The homepage of my website (homepage.mac.com/paulcdowling/ioe) shows a photograph of a sumo wrestler (北桜, Kitazakura) throwing salt, this is juxtaposed with

a photograph of buildings in Ginza, Tokyo, and the words ‘paul dowling’s website’ are written vertically at the left hand side. Now the name closes the category of author (of the website), insofar as subsequent pages identify me unproblematically. However, the practice is now opened up by the use of a non-institutional website as well as by the use of images that have no obvious relationship to the academic practice that is referenced on the next page; this is a *charismatic* strategy.

The terms that I have used for the three authority strategies that I have introduced are taken from Max Weber (1968) and this acknowledges an academic debt, although, quite clearly, my use of the terms constitutes a degree of (again deliberate) misreading of Weber. However, Weber’s threeness is unsettling; where there are three, there must be a fourth. I have, in fact, already introduced two binary categories in the opening/closing of author and practice. The residual strategy is that which closes neither author nor practice, in other words, where authority, in respect of control over the principles for evaluating or legitimating an utterance, are passed from author to audience. This strategy produces what I have referred to as an *exchange* text (Dowling, 2001, in press) and I refer to the authority strategy itself as *liberal*. There is a good deal of deployment of liberal authority strategy in the literature in educational studies, including Piaget’s (1995) denouncement of authoritative pedagogy. The three other strategies are all modes of claiming authority (in respect of control over the principles of evaluation of the text) by or on behalf of the author; these constitute *pedagogic texts*. The whole schema is shown in Figure 7.

Category of author	Field of Practice	
	Open	Closed
Closed	<i>Charismatic</i>	<i>Traditional</i>
Open	<i>Liberal</i>	<i>Bureaucratic</i>

Figure 7
Modes of Authority Action

The schemas that I have introduced in this section allow us to map the reproductive practices of an alliance in terms of: the strategies that are deployed in establishing interaction; acquirer strategies deployed in audience response; and legitimation, or authority claims. They may also be used to explore these strategies in productive action. Ultimately, whether one is talking about production or reproduction is really a matter of level of analysis: insofar as the sociocultural domain is dynamic and not static, the identity of any alliance—or that of any individual, come to that—is always in a state of production and reproduction; we are not and we do not make perpetual motion machines. We had better talk of (re)production (as indeed I have in Dowling, 1998); my apologies for what might be seen as a rather dated, postmodernist strategy.

Mathematics, Myths and Method

I hope that it is clear that this paper is not just about mathematics. However, mathematics is an ideal place to start. It’s highly specialised language makes it very easy to constitute an esoteric domain and also, in the school, generates a need for diversity

in the provision of public domain settings; there must be many ways in and out. The separation of mathematics from the rest of the world and its apparent reinsertion in the rest of the world is also fertile ground for the generation of myths: mathematics can refer to just about anything (reference), indeed, mathematics is a necessary condition for living life properly (participation). But mathematics mathematises everything that it touches, it recontextualises everything with no concern for the identity of the objects of its gaze and does not generally seem capable of learning very much in the process. School mathematics, at least, operates on the basis of mathematical imperialism. Gutstein's traffic stops lesson seems to recruit traditional authority, on the part of the teacher, in hegemonic interaction via the deployment of an esoteric domain as a metaphoric apparatus, and this despite the apparent emancipatory ambitions of the lesson. No one is ever emancipated *from* mathematics (though they may, of course, be alienated from it, which, strangely, perhaps, is not the same thing); resistance is futile. Indeed, what seems to have been widely transmitted is a message about the general facility of school mathematics to get at the truth: the myth of certainty; ideology.

What is needed is a method that gives a steer—it is to be a sociology—but that also develops as a transaction between its developing organisational language and the empirical settings that it regards. The method must also be able to describe itself, for aesthetic reasons, but also because it wants to join in the 'knowledge' party. This is what I have attempted to introduce in SAM. The approach starts out as a general principle: the sociocultural terrain is constituted as and by the formation, maintenance and destabilising of alliances and oppositions that are emergent upon strategic action. This principle can be related to other work in the fields of sociology, social theory, philosophy, psychology, and so forth, but that is (now I'll admit it) primarily a traditional authority strategy (I've read and understood this work, have you?) Essentially SAM's metaphorical apparatus does not need to be elaborated, because SAM is, primarily, to be a method: I consider myself to be a theory engineer, not a philosopher (and I'll have no truck with the philosophical imperialism that declares that everyone is a philosopher, good or bad—eg Collier, 1994).

My response to the need for a method has been to start with Bernstein's theorising of recontextualisation and forge it into an apparatus that gets closer to the empirical, precisely by engaging with the empirical. Bernstein's theory does not transact with the empirical in a way that would allow the empirical to be properly heard. Rather, it constructs a world that can be compartmentalised into simple, functional fields, that possesses an imaginary organ—the pedagogic device—that is brought into play, like a digestive system—only when it is activated by transformative action, that measures the division of labour and principles of control in society in terms the almost content-free categories, classification and framing, and that cannot constitute itself as its own object. I believe that I have given genuine empirical referents in this paper for just about all of the theoretical categories that I have introduced and all of these categories have emerged out of a genuine transaction between theoretical and empirical fields, themselves the products of a strategic partitioning of the empirical (see Brown & Dowling, 1998; Dowling & Brown, in press). The result is a developing language that enables us to talk about things that are different in a consistent way, so as to mark out continuities and discontinuities in cultural practice, in what we might like to call (though I do not) forms of knowledge and its (re)production. At the same time, the analysis may just tell us something about its objects that we hadn't thought of before. Because it is not fixed in

respect of any given practice or any given level of analysis, the method might also constitute a method of interrogation of other practices that we may be involved in, whatever they might be, but, in this context, educational practices in particular. This is most definitely not to claim that the meanings of analysis carry over in moving between contexts. On the contrary, if we are to learn anything about ourselves, then we must first move beyond ourselves and then look back.

References

- Bakhtin, M. M. (1981). *The Dialogic Imagination*. Austin, University of Texas Press.
- Bannister, D. and F. Fransella (1971). *Inquiring Man*. Harmondsworth, Penguin.
- Bannister, D. and F. Fransella (1986). *Inquiring Man: The Psychology of Personal Constructs*. London, Croom Helm.
- Barthes, R. (1981). 'Theory of the Text'. *Untying the Text: a poststructuralist reader*. R. Young. London, RKP.
- Baudrillard, J. (1993). *Symbolic Exchange and Death*. London, Sage.
- Bernstein, B. (1990). *Class, Codes and Control Volume IV: The structuring of pedagogic discourse*. London, RKP.
- Bernstein, B. (1995). 'Code Theory and its Positioning: A case study in misrecognition.' *British Journal of Sociology of Education* **16**(2): 3-19.
- Bernstein, B. (2000). *Pedagogy, Symbolic Control and Identity*. Second Edition. New York, Rowman & Littlefield.
- Bernstein, B. B. (1996). *Pedagogy, Symbolic Control and Identity*. London, Taylor & Francis.
- Bourdieu, P. (1977). *Outline of a Theory of Practice*. Cambridge, CUP.
- Bourdieu, P. (1990). *The Logic of Practice*. Cambridge, Polity.
- Bourdieu, P. (1991). *Language and Symbolic Power*. Cambridge, Polity Press.
- Brown, A. J. and P. C. Dowling (1998). *Doing Research/Reading Research: A Mode of Interrogation for Education*. London, Falmer Press.
- Carpenter, G. (2004). *Wilmette Police Department 2004 Annual Report: Traffic stop data collection and analysis*. Wilmette, Wilmette Police Department.
- Chouinard, R., T. Karsenti, et al. (2007). 'Relations among competence beliefs, utility value, achievement goals, and effort in mathematics.' *British Journal of Educational Psychology* **77**: 501-517.
- Cohen-Mushlin, A. 'A School for Scribes'. Presented at Comité International de Paléographie Latine XVIth Colloquium: Teaching Writing, Learning to Write. University of London. 2-5th September 2008.
- Collier, A. (1994). *Critical Realism: An introduction to the Philosophy of Roy Bhaskar*. London, Verso.
- Cooper, B. (1985). *Renegotiating Secondary School Mathematics*. Lewes, Falmer.
- Coy, M. W. (1989b). Being What We Pretend To Be: the usefulness of apprenticeship as a field method. *Apprenticeship: from theory to method and back again*. M. W. Coy. Albany, State University of New York Press.
- Coy, M.W. (1989a). *Apprenticeship: From theory to method and back again*. Albany: State University of New York Press.
- Decker, J.F., Kopacz, C. & Toto, C. (2004). 'Curbing Aggressive Police Tactics During Routine Traffic Stops in Illinois'. *Loyola University Chicago Law Journal*. 36. Pp. 819-892.
- DeVries, D. L. and K. J. Edwards (1973). 'Learning Games and Student Teams: Their effects on

- classroom process.' *American Educational Research Journal* **10**(4): 307-318.
- Dowling, P. C. (1991). 'Gender, Class and Subjectivity in Mathematics: a critique of Humpty Dumpty.' *For the Learning of Mathematics* **11**(1): pp 2-8.
- Dowling, P. C. (1991). A Touch of Class: ability, social class and intertext in SMP 11-16. *Teaching and Learning School Mathematics*. D. Pimm and E. Love. London, Hodder & Stoughton.
- Dowling, P. C. (1998). *The Sociology of Mathematics Education: Mathematical Myths/Pedagogic Texts*. London, Falmer.
- Dowling, P. C. (2001). School mathematics in late modernity: Beyond myths and fragmentation. *Socio-Cultural Research on Mathematics Education: An International Perspective*. B. Atweh, H. Forgasz and B. Nebres. Mahwah, Lawrence Erlbaum.
- Dowling, P.C. & Brown, A.J. (in press). *Doing Research/Reading Research: Re-interrogating education*. Second Edition. London: Routledge.
- Dowling, P.C. & Chung, S-y. (in press). 'Knower's Ark/A Ship of Fools?' in Dowling, P.C. *Sociology as Method: Departures from the forensics of culture, text and knowledge*. Rotterdam: Sense.
- Dowling, P.C. (2008). 'Curriculum (as) Theory: Nine non-exclusionary principles and some brief commentary.' Presented at the inaugural meeting of the Understanding and Theorising Curriculum Special Interest Group, 12th May 2008. London. Institute of Education, University of London. Available at homepage.mac.com/paulcdowling/ioe/publications/dowling2008.pdf
- Dowling, P.C. (in press). *Sociology as Method: Departures from the forensics of culture, text and knowledge*. Rotterdam: Sense.
- Ernest, P. (1991). *The Philosophy of Mathematics Education*. London, Falmer.
- Foucault, M. (1970). *The Order of Things: an archaeology of the human sciences*. London, Tavistock.
- Foucault, M. (1972). *The Archaeology of Knowledge*. London, Tavistock.
- Garfinkel, H. (1967). *Studies in Ethnomethodology*. Englewood Cliffs, Prentice-Hall.
- Glaser, B. G. (1992). *Basics of Grounded Theory Analysis: Emergence versus forcing*. Mill Valley, Sociology Press.
- Glaser, B. G. and A. Strauss, L. (1967). *The Discovery of Grounded Theory: Strategies for qualitative research*. Chicago, Aldine Publishing Company.
- Goffman, E. (1990). *The Presentation of Self in Everyday Life*. Harmondsworth, Penguin.
- Gutstein, E. (2002). Math, SATs, and Racial Profiling. *Rethinking Schools Online*. 16(4) (no page numbers). www.rethinkingschools.org/archive/16_04/Math164.shtml
- Hayles, N. K. (1999). *How We Became Posthuman: Virtual bodies in cybernetics, literature and informatics*. Chicago, University of Chicago Press.
- Howson, A. G., Ed. (1987). *Challenges and Responses: essays to celebrate the twenty-fifth anniversary of the School Mathematics Project*. Cambridge, CUP.
- Kelly, G. (1955). *The Psychology of Personal Constructs (2 volumes)*. New York, Norton.
- Laclau, E. and C. Mouffe (1985). *Hegemony and Socialist Strategy: towards a radical democratic politics*. London, Verso.
- Lave, J. and E. Wenger (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge, CUP.
- Leavis, F. R. (1966). *The Common Pursuit*. Harmondsworth, Penguin.
- Marx, K. (1976). *Capital*. Harmondsworth, Penguin.
- Montrose, L. A. (1989). Professing the Renaissance: the poetics and politics of culture. *The New Historicism*. H. A. Veenser. New York, Routledge: 15-36.

- Moon, B. (1986). *The 'New Maths' Controversy: an international story*. Lewes, Falmer.
- Moore, R. and K. Maton (2001). Founding the Sociology of Knowledge: Basil Bernstein, Intellectual Fields, and the Epistemic Device. *Towards a Sociology of Pedagogy: The contribution of Basil Bernstein to Research*. A. Morais, M., I. Neves, P., B. Davies and H. Daniels. New York, Peter Lang: 153-182.
- Northwest University Center for Public Safety. (2007). *Illinois Traffic Stops Statistics Study 2007 Annual Report*. Evanston: NUCPS
- Piaget, J. (1995). *Sociological Studies*. London, RKP.
- Rorty, R. (1989). *Contingency, Irony and Solidarity*. Cambridge, Cambridge University Press.
- Saussure, F. d. (1972). *Course in General Linguistics*. London, Duckworth.
- Strauss, A. (1997). *Mirrors and Masks: The search for identity*. London: Transaction Publishers.
- Strauss, A. and J. Corbin (1998). *Basics of Qualitative Research: Second Edition: Techniques for Developing Grounded Theory*. London, Sage.
- Weber, M. (1968). *Economy and Society*. New York, Bedminster Press.
- Wittgenstein, L. (1958). *Philosophical Investigations*. Oxford, Blackwell.
- Wittgenstein, L. (1961). *Tractatus Logico-Philosophicus*. New York, Humanities Press.