

A SOCIOLOGICAL DESCRIPTION OF CHANGES IN THE INTELLECTUAL FIELD OF MATHEMATICS EDUCATION RESEARCH: IMPLICATIONS FOR THE IDENTITIES OF ACADEMICS

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AIMS OF THE PROJECT

In this paper we will report on the work of our ESRC funded research project “The production of theories of teaching and learning mathematics and their recontextualisation in teacher education and education research training”.

The aim of our project is to analyse the processes whereby mathematics educational 'theories' are produced and the circumstances whereby they become current in the mathematics education research field. We also examine how these theories are recontextualised and are acquired by teachers and teacher educators.

To talk about changes over time in a field of research in terms of changes in the priorities, understandings and interpretations given by people in positions of power is, at the same time, to acknowledge a number of other aspects:

- the structures and social relations constituting the field as well as, perhaps, the changing strength of the boundary separating this sub-field from other research subfields within education research;
- changes in the relations between education research and other fields within the overall arena of research production;
- the wider picture of power and control relations which affect the (relative) autonomy of the intellectual field of knowledge production, establishing certain forms of social relations between, on the one hand, the official policy agencies and, on the other, agencies and agents in the field (in our case of mathematics education) of knowledge transmission, dissemination, use and reproduction (Bernstein, 1990; Morgan, Tsatsaroni and Lerman, 2002).

It is also crucial to acknowledge that mathematics, and education research more generally, are usually located in departments of education in HE institutions, their principal purpose resulting from the training of future and in-service teachers. This for example is evident today in the competing demands of having to act as a career academic and as a teacher educator.

The study we have carried out of the changing priorities, focuses, styles and values of the mathematics education research community over time has enabled us to examine a range of questions including:

- what have been the changes in the theories used by researchers in mathematics education over the years;
- do researchers draw more on theory than before, or less, and are the theories implicit or explicit;
- what has been the ebb and flow of empirically based studies over the years;
- do research theories manifest in teacher education and in school texts, and if so what transformations or recontextualisations have they gone through; and what are the principles of selection of theory(ies) in such texts and contexts?

Our study consists of an examination of the proceedings of the International Group for the Psychology of Mathematics Education (PME) and the articles in Educational Studies in Mathematics (ESM) (Lerman, Xu & Tsatsaroni, 2003) and Journal for Research in Mathematics Education (JRME) from 1990 to 2001. We have chosen a suitably selected subset of these publications. We have also interviewed the Chief Editors of these two journals.

TOOL DEVELOPING

In the context of this project journal articles and conference papers are seen as instances/representations of the research activity in the field under consideration. We have developed a tool of recording and analysing the specialised texts of the research community, not by using any existing methods of textual analysis, but by drawing broadly on Basil Bernstein's work, using in particular his latest work on intellectual fields and knowledge structures. For example, we have a view about the field as a series of positions, as a horizontal knowledge structure. We would therefore view new theories as, in general, positioned alongside other theories and not replacing them, as we might expect in the development of theories in science. This tool has changed as we interrogated more articles and found our categories inadequate or requiring modification. A key factor has been the development of justifications for judgements, what Bernstein (2000) calls recognition and realisation rules, for what makes us place an aspect of an article in one category or another in an explicit manner. We are concerned that this project should be an empirical, descriptive study and at the same time to generate a language capable of showing the effects of that which it describes.

Certain structural features, drawn from a variety of places, have been used to construct the tool. Firstly, we have identified whether the authors drew on any theories or not. If they did, we then look at what theory they drew on, whether they drew on the theory explicitly or implicitly and examine their position in relation to the theory they drew on, such as: how the theory is used, whether it is supported or modified, and whether theories from other fields are used. After this, we make a distinction between an orientation towards the theoretical or towards the empirical. Articles in the first category may move to the empirical to illustrate the theory, but in this category the intention of the article is to present and perhaps to develop theory. Similarly, articles that are orientated towards the empirical may well draw on theory,

but their orientation is towards describing and perhaps informing school practice, policy, or other site of practice. In the second category we look at what is the focus of the empirical, whether school practice, researchers' practice, etc., and what methodology, data collection and analysis have been used. We also look at the relationship between theories and the empirical, in the sense of whether the theory informs the empirical, is informed by the empirical, or there is dialectic between them. Subsequently, we explore the question of whether the author(s) overtly adopt a particular position, such as feminist, post-modern, or other, and we identify the purpose and the addressees of the article.

We then examine which sectors of education formed the subjects of the research, and which mathematics topic was dealt with in the article.

We also analyse the pedagogical model projected/promoted in the paper of the authors, where one has been identified. Here we are looking at Bernstein's classification of performance and competence models. In the former, the model is distinguished to three different modes, namely singular, regions and generic. Within the latter, his distinction is between liberal-progressive, cultural-populist and political-emancipatory modes, and their ideologies (Bernstein, 1996). There are two sub-questions derived from Morgan, *et al* (2002). The first sub-question concerns the strategy, and whether the authors look towards what is present or absent in students' texts and whether they make comments which present mathematics as a specialised or as a localised activity. The second sub-question concerns the nature of the boundary between the everyday and specialised mathematics discourse and whether the boundary is presented as strong or weak.

We should conclude this section by making clear our methodological moves: from theory to the development of the analytical tool, to a descriptive language (external), development of categories, to the descriptive language – internal (model). It is the last one that helps us make sense of our findings (interpret/explain) and help us to connect our findings to wider changes.

ANALYSIS OF DATA

We feel that the work we have done enables us to make some interesting comments in relation to the questions we posed. In what follows, we will report parts of our findings, as we stated previously, only to give a snapshot of our initial analysis of the data. We will focus on just one heading: 'Research Methodologies'.

Research Methodologies

Looking at the data from the point of view of *the methods* used in reports on empirical studies in our sample, we have observed that there is a major emphasis in PME and ESM on qualitative types of inquiry (63.70% and 62.59% respectively), with 16.30% and 15.83% quantitative, and 20% and 21.58% combined methods respectively. JRME places almost equal emphasis on quantitative 43.44% and qualitative 40.98%, while 15.57% in the sample uses combined methods. In order to

discuss the pattern of change over time we have reduced the data to comparing two 6-year time periods, and we have noticed the following:

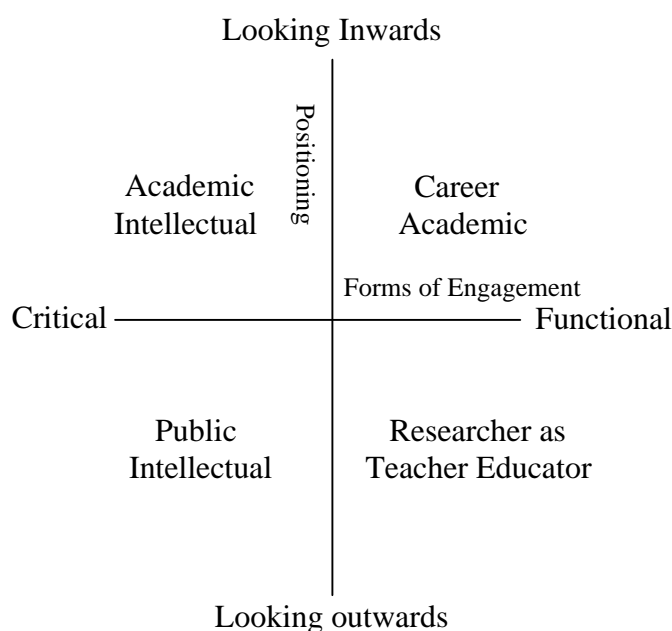
- 1 There is a decrease over time (the two periods) in the number of articles that use quantitative methods in both journals, but an increase in PME.
- 2 There is an increase in the number of articles using qualitative methods in the two journals but not in PME.
- 3 The percentage of articles with quantitative and qualitative methods are the same in JRME, but qualitative methods are higher in both PME and ESM.

	PME			ESM			JRME			Total
	90-01 (135)	90-95 (63)	96-01 (72)	90-01 (139)	90-95 (63)	96-01 (76)	90-01 (122)	90-95 (54)	96-01 (68)	90-01 (396)
Qualitative	63.70	69.84	58.33	62.59	49.21	73.68	40.98	29.63	50.00	56.31
Quantitative	16.30	11.11	20.83	15.83	28.57	5.26	43.44	57.41	32.35	24.49
Combined	20.00	19.05	20.83	21.58	22.22	21.05	15.57	12.96	17.65	19.19

To account for this pattern of change we, first, contrast journal articles with the proceedings and on the basis of it we can argue that there appears to be a policy or regulative mechanism in place in the two journals that encourages researchers to move from quantitative to qualitative methods. Such a drive is not evident in PME. By comparing, secondly, the differences/similarities between the proceedings, on the one hand, and each of the journals, on the other, a policy of a balanced use of qualitative and quantitative methods can be hypothesised for PME and JRME, but not for ESM. Thus given the initial emphasis on qualitative methods in PME, the existence of such regulation explains the increase in PME of quantitative, and not of qualitative, research over the two periods. Similarly, given the initial emphasis of JRME on quantitative, such policy explains the increase in qualitative research, and the balance overall over the two six-year time periods. Finally in comparing the similarities and differences between the two journals, the influence of context (USA vs. Europe) must be considered. JRME, as already shown moves from an initial emphasis on quantitative to qualitative with achieving a more balanced use of methods. In contrast ESM's commitment to qualitative research appears to be stable over the two periods. Tradition and fashion in Europe could account for this preference and commitment to qualitative kinds of inquiry. One could also venture the interpretation that this commitment to qualitative research on the part of ESM (e.g. its editors) might also be evidence of the existence of pockets of resistance to external attempts to regulate the field, which are at present witnessed in educational and social research more generally. Thus a balanced use of methods might be but an imposed measure, a social control mechanism that appears as a plea for more realistic or pragmatic approaches to social inquiry.

Discussion and concluding remarks: The mode of regulation of the mathematics education research field

The features of the activity that our data represents can be mapped onto two main axes. The *vertical* axis gives us information on the agents *positioning* as to their overall activity; that is to say, whether the agents in the field are positioned as *looking inwards* or *outwards*, as the two sides of the axis. ‘Inwards’ refers to



either or both the wider intellectual field, or/and their own field, while ‘outwards’ refers to either or both the public sphere or/and the state/school field. The *horizontal* axis gives us information on the *form of the agents’ engagement* with the activity. This again involves either a *critical* or a *functional* stance, as the two sides of the axis. ‘Critical’ presupposes an engagement with intellectual resources (of their own or others) with a view to *developing* their (and other) field(s) resources of research or an engagement in activity seen as *strengthening* the public sphere (including the schools). Functional refers to an engagement with their (or others’) field(s) resources which is *using* the resources to carry out/*describe* what is perceived as their task or an engagement which uses the resources to *prescribe* actions in the field perceived as the field of its application. Accordingly, four positions are derived that constitute the model: *Academic intellectual, career academic, public intellectual* and *(teacher) educator*. Needless to say we cannot expect to find pure positions in our data. They are not ideal types either but they have been generated to assist in the description and explanation of the empirical.

The development of this tentative, as it may be, interpretative model through a back and forth movement from the theory to our empirical material, that also involved a refining of the analytical tool, constitutes our final stage in the development of the methodology in this project (Brown and Dowling, 1998).

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Note The Project is supported by the Economic and Social Research Council project number R000 22 3610