

METHODS AND FINDINGS IN RESEARCH ON AFFECT AND EMOTION IN MATHEMATICS EDUCATION

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This paper discusses examples of research done in the affective domain, using different types of 'qualitative' methods, here classroom observation and semi-structured interviews. The issue is how a researcher's methodology conditions and constrains the findings that are possible. This issue is investigated by considering the different ways that the two methods / methodologies frame the social interaction between researcher and researched, and that among the various research participants.

Introduction

Social and educational researchers continually question how the research methodology used conditions and constrains the findings that are produced. This may be because different methods allow us to produce different types of data, or because different methods embody different social relations between researcher(s) and researched. This relates to ways in which research methods might be called *reactive*, in eliciting reactions from the subjects that affect the social activity being studied. These issues are obviously important for all types of research that involves human subjects. In particular, they are relevant to claims that methods used by qualitative researchers, such as participant observation and less structured interviews, are more 'natural' and hence produce more 'authentic' data. And also that their methods give them access to 'Deeds' and not just 'Words' (reports of deeds), unlike survey researchers².

Theory and methods in two different projects

This paper considers two studies of emotion on which I have worked recently: a re-reading by Morgan et al. (2002) of a classroom observation transcript of problem-solving activity, and the analysis of a set of semi-structured interviews, reported as part of a wider project on adults' mathematical thinking and the emotions (Evans, 2000). Here I aim to explore the ways in which differences in methods used affect the findings.

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² In particular, it is relevant to the question of the extent to which 'triangulation' is able to establish the credibility of qualitative (or any empirical) research – since if methods substantially condition the results, then we could not expect findings produced by different methods to converge, as triangulation suggests they will (e.g. Oakley, 2000, pp. 67ff.).

Both studies use a version of discursive practice theory. This approach understands the context of thinking or feeling to be constituted by the practices in which the subjects *are positioned*; the passive verb here indicates that each subject must take up a position from those ‘made available’ to him/her, rather than being able to choose completely ‘freely’; however, subjects do have some agency, and are at many moments engaged with more than one discourse / position. Therefore we look for a *positioning*, which is often multiple (see illustrations below). In this approach, the emotions experienced are seen as ‘specific’ to these positionings (i.e. as depending crucially, though not solely, on them). Starting from Critical Discourse Analysis (CDA, Fairclough, 1995), we emphasise the way that such thinking and feeling is socially or ‘structurally’ determined through the development and interplay of discourses:

We start from a notion of *discourse* as the semiotic moment of a practice. A system of signs (or chains of signification), categories and concepts provides resources for participants in practices to construct meanings for their experiences, accounting for their actions, and their identities. At the same time, it regulates specific social and institutional practices. That is, it enables and constrains what it is possible to say, to do, to be – and to feel: discursive practices are understood as ‘places where what is said and what is done, rules imposed and reasons given, the planned and the taken for granted meet and interconnect’ (Foucault, 1991). [Further,] Bernstein discusses the construction of pedagogic discourse, by a ‘recontextualising principle which selectively appropriates, relocates, refocuses and relates other discourses to constitute its own order’ (Bernstein, 1996, pp.46-47). Thus the conceptualisation of the regulation of individual actions and experiences in terms of a pedagogic discourse [...] is based on the integration of macrolevels of analysis with institutional and interactional levels and allows the translation of the ‘distribution of power and principles of control into forms of pedagogic communication and their contextual management’ (Bernstein, 1996, p.3).

(Morgan et al. 2002, p.401)

Morgan et al.’s work suggests two phases in analysis of a transcript. The *structural analysis* provides us with an overall view of the positions available, the spaces within which emotion may arise and the roles that expression of emotion may play within a discourse; Basil Bernstein’s (1996) sociology of education is especially useful here. The *textual analysis* attempts to identify how available positions are *taken up* (for example, by analysing different subjects’ claims to positions, say of knowledge and authority, within discourse, e.g. via rhetorical ploys), how opportunities arise for emotion as a form of meaning and how expression of emotion occurs (Morgan et al., 2002, p.403).

Evans (2000) is similarly attentive to two equivalent phases in the process, which he calls analysing the *discourses at play* in a particular setting (and hence the positions *available* to subjects), and analysing the *discourses called up* (thus, the positions *taken up* by subjects). This approach further attempts to read verbal, vocal and bodily signs as ‘indications’ of pupils’ experiencing of emotions generally - and often of particular emotions. Here, two further directions of analysis are emphasised: (i)

alertness to the flows of meaning in language, as highlighted by poststructuralist approaches (Henriques et al., 1984; Hollway, 1989; Walkerdine, 1997), in addition to those of CDA; and

(ii) sensitivity to the ways that aspects of emotional experience can be unconscious and therefore not productive of straightforward observable indicators, as stressed by psychoanalysis (Walkerdine, 1988; Evans and Tsatsaroni, 1996; Evans, 2000; Laplanche and Pontalis, 1988).

Findings

The extract of classroom data that we analysed involved three boys, Filipe, Mário and Tiago, working together on a mathematical task³. Our structural analysis was based on a text written by the original researcher, providing a brief description of the Portuguese education system and of the normal practice in the particular school and classroom. From this, we identify significant concepts, values and technologies and use these to identify positions that may be available to students participating in this classroom.

The evaluation dimension is dominant in the official pedagogic discourse in Portugal: students may be judged to fail a year and must then repeat it. This creates positions, defined by explicit criteria, of *failing student* and successful or '*normal*' student. However, we see that in this classroom the evaluation dimension is recontextualised: the researcher's description of practice here suggests a 'progressive' form of pedagogy in which students are encouraged to work together and concepts such as 'help' and co-operation are valued. This pedagogy creates other possible positions:

- *helper* and *seeker of help* (helper positioned more powerfully)
- *collaborator* and *solitary worker*
- *director of activity* and *follower of directions* (latter less powerful)
- *evaluator* (The researcher's field notes say that the students 'spontaneously and frequently checked their solutions between them, not depending on the teacher evaluation'.)
- *insider* and *outsider*. This pair of positions is deduced from the field note that Tiago and Filipe consider Mário to be 'a little bit "rejected" by most of the colleagues'. It is not clear to what extent these positions are associated with the criteria of the official classroom discourse or with discourses in which the students participate outside the classroom.

It is possible that some conflict arises for individual students between different positions available to them. The classroom discourse is not unitary but may be seen

³ The larger data set from which this is taken was originally collected by Madalena Santos for research with a different focus, and therefore not giving the same emphasis as here to emotional aspects of learning. We are grateful to her for permission to use the data, for her translation of the transcript into English and for her background information about the Portuguese education system and about the history of the class. The lesson from which our extract is taken is discussed in Santos & Matos (1998).

as (at least) two competing discourses, one of which values collaboration while the other values individual performance (since the assessment system allocates marks to individuals). The positions identified above stem from an engagement with the empirical world informed by the discursive approach.⁴

The text to be analysed is a transcript of a video recording of two minutes of work by three boys on a task introduced by the teacher:

Given an irregularly-shaped (trapezoidal) field, with two water taps in fixed positions [*specified in the actual problem used*], to what distance should the taps throw the water to irrigate all the field?

[*The original researcher's notes are in italics; our analysis is interpolated in boxes: the left-hand side focuses on positioning, the right-hand side on indications of emotion.*]

They are all going on with their work. Filipe is the first to finish, puts down his pencil and starts talking again passing to the next question.

(41) Filipe - This is very simple [*reads the question*].

Filipe reads aloud the question number three while the others are finishing their work, Tiago is the first to follow the reading in his sheet, then Mário finishes and he too follows, but by Filipe's sheet. Tiago seems to be trying something in his drawing with the ruler and stops reading.

(42) Filipe - Hum...

(43) Mário - Now what?

(44) Filipe - Hang on a second, the tap of irrigation throws the water up to 11 meters, one is by the post, the other by the stack.

<p>F's statement (41) that it is 'very simple' can be seen as a claim to authority through knowledge and hence 'good student' status. By stating and restating the question and by using the imperative 'Hang on a second' (44) he positions himself as the director of activity in the group. M, by asking for direction (43), is positioned in a subordinate way.</p>	<p>This might <i>also</i> (not necessarily alternatively) be seen as 'protesting too much' – reversal into the opposite, a defence (against anxiety).</p>
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(45) – (48) [Omitted] *They go back to their notebooks*

(49) Filipe - So we now do it like this, with the compass, enlarge it...

⁴ Using the concepts of classification, framing, and regulative and instructional discourse provided by Bernstein's theory, we could proceed to characterise the form of practice, and to derive systematically the positions available to students within it; see Morgan et al. (2002, p.406).

Filipe puts the point of the compass in one of the dots and opens it trying either one side or the other until he gets what he searched for.

(50) Mário – And there?

(51) Filipe – We do like this... Easy, I have done it minding that piece over there...

(52) Mário – Ah... [*Mário agrees with (or confirms that he understood) Filipe.*]

In this section, F's use of imperatives and normative statements of what 'we' do again indicate his position as director of activity, while M adopts the complementary position.	At the same time, M's 'agreement or confirmation of understanding' suggests (a bid for) inclusion.
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(53) Tiago – But it doesn't get there [*Tiago keeps doing it and speaks about what is happening in his drawing looking again to Filipe's*] So, where does it have to throw? Ah... they are two!... Now I know... [*he goes back to his drawing*]

While T appears to challenge F's direction with his initial statement, he does not follow this up but again withdraws himself from collaboration, focusing on his own knowledge 'Now I know'.	A possible indicator of isolation again for T. Alternatively, this may be an indication of motivation to obtain satisfaction from a fuller understanding.
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[*F is drawing. Mário observes very attentively, inclined over the table, like Filipe and Tiago.*]

(54) Filipe – Quite right! [*Certinho!*] [Subsequent discussion has suggested that 'Bang on!' might be an appropriate colloquial English equivalent.]

(55) Mário – That's it! [*É mesmo!*] [*Mário goes with his eyes from his drawing to the eyes of Filipe for a moment and again returns to his drawing*]

(56) Mário – Quite right! Fantastic! [*Mário turns his eyes again to the eyes of Filipe, he begins smiling, with his right arm touches Filipe in his shoulder for a second.*]

(57) Mário – You know! [*said almost in private to Filipe*]

(58) Filipe – No, it's a question of doing here to irrigate there for sure, then you try there and, if needed you enlarge it a little [*going with his eyes from his drawing to Mário's eyes*].

[*Mário is listening to the explanation of Filipe, his eyes in contact to Filipe's eyes, savouring his delight, almost overcome; he 'says' yes with his eyes, agrees with his head; he opens and closes his legs in a movement suggesting satisfaction.*]

Both F and M are making positive evaluations of F's solution. However, both form and function of these	Here we also have some evidence of emotion, evidenced by the intonation coded by exclamation marks on (54
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<p>evaluations differ, giving rise to different positionings. F both initiates the evaluation and at (58) provides explicit criteria for the evaluation, thus establishing himself both as evaluator and as being in control of the knowledge. M, on the other hand, does not indicate any criteria and attributes the knowledge explicitly to F (57). His statements serve to reinforce F's powerful position rather than to claim his own right to evaluate. At the same time, M's body language also suggests a subordinate position.</p>	<p>and 56) 'Quite right!' or 'Bang on!' and (55) 'That's it!', and the positive terms used (perhaps with links to youth and sports culture), indicating satisfaction. Further, we have the body language of M - touching F's shoulder, making eye contact, gleeful wiggling of legs - which denote excitement; this excitement may be generated merely by the successful solution of the problem. However, might this <i>also</i> be delight at being <i>included</i>?</p>
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The findings in this study display the use of the discursive approach to study emotion, including structural and textual phases, to make claims about positions available / positionings taken up and the role of power in these processes, and to display the use of indicators of emotional experience.

The methods and findings of the first study can be compared with those of Evans (2000). One strand of this study was based on semi-structured interviews with a (partly randomly selected, partly voluntary) sample of 25 first year social science students. I set down a general 'reflexive account', that is, an account of the ways in which I was part of the social world I was studying (cf. Hammersley and Atkinson, 1985: 14ff.). The passage below, constructed from the methodological chapter, can be read as data for the structural analysis of the discourses at play in the research setting, and the positions available to those involved.

I was an experienced lecturer in statistics at the Polytechnic. Most of my teaching was with the BA Social Science students, and I was very involved with the First Year 'Maths' course - giving some of the lectures, also as the coordinator. Further, about a third of each student cohort would have had me as a seminar tutor.... The student interviews were done at the end of their first year, conducted in my office. At the beginning of the interview, I offered coffee or tea. I described my work as 'doing research on people's experience with numbers, and on what sorts of things help people feel comfortable with numbers, and what stands in their way [...] So what I would like to do in this interview is to give you some space to talk about your experience with numbers, and your feelings about them'.... I asked the student's agreement to record the interview. I emphasised to the student that he/she did not have to answer any question if they did not want to. I began with the 'life history' questions, and then moved on to the problems to be solved, each preceded by the first *contexting question*, and followed by the second.... The student was given at most only neutral feedback while attempting the problems. Towards the end of the interview, I gave further feedback, if I felt the student needed it, or discussed 'the answers' to the problems, if requested.

(Evans, 2000, Ch.8)

For the structural analysis, we can ask what discourses are at play in this setting. The main practice shared by the tutor and the students is teaching and learning mathematics. This practice is 'regulated' or organised by a set of ideas, rules, values, standards, which we might call the *official discourse* of college mathematics. The positions available in this discourse are *teacher* and *student*. It is of course the former who is positioned to assess, and the latter to be assessed. However, at the same time, the fact that I 'invited' selected students to an interview, addressing them from within a 'research interview' discourse (see second part of reflexive account quoted above), juxtaposes a second sort of practice to the first. Here the positions are of *researcher* and *interviewee*. It might appear that the former is in some ways now positioned as a 'learner', and the latter as an 'authority', concerning her/his own activities at least. But these apparently more equal relations in terms of control of the interview may disguise the ongoing power relations, where the teacher retains an authority based on the recognition of his/her knowledge. Thus we can see that both student-interviewees and teacher-researcher are *multiply positioned*, and the power relations between them are complicated, and very possibly contradictory. This itself may generate emotion.

For the textual phase, the 25 semi-structured interviews were analysed in two ways, a 'hybrid' cross-sectional way ('qualitative' data, quantitative analysis) and as a set of case studies (Evans, 2000, Chs. 9 & 10). The cross-sectional analysis aimed to classify each interviewee on a number of descriptors, such as his/her positioning at key moments of the interview; as to whether they 'expressed emotion' (in general, or a particular emotion) and/or 'exhibited emotion'; as to gender, social class, and so on.

An example of the case study analysis comes from an episode in the interview with 'Ellen' (Evans, 2000: 186-191). When asked to 'choose a meal' from a facsimile menu, and to calculate a 15% tip, she hesitates, then makes a 'slip' (dividing by 15, rather than multiplying). When first addressing the problem, she seems to call up the practice of eating out at restaurants, but reverts to using pencil and paper – indicative of school mathematics (SM) positioning – to calculate the 15% tip. This suggests that more than one practice was called up. In response to a 'contexting question' about how often she does this sort of calculation, she admits that she doesn't usually pay, but nevertheless, she habitually adds up the cost of her meal - since she doesn't 'want to be an expense'.

It is possible to read 'expense' as a signifier on which multiple meanings are *condensed*: it would signify for Ellen both the cost of, say, her meal obtained by summing the individual dishes, and her being a burden within a relationship. Also, in this episode, the anxiety (and guilt and pain) of being an expense would be *displaced* onto the idea of the cost of her meal, and in turn onto any calculations entailed in producing that sum, including that of a tip. Her response may look like 'mathematics anxiety'. But the signifier 'expense' is located at the intersection of two (at least) discourses (discourses on relationships, on eating out and its economics, on school maths), and this linkage allows the strong feelings around her relationship and eating

out, to be displaced onto the calculation problem -which at first seemed so obviously to be simply mathematical!

This allowed me to put forward several findings:

1. Mathematical thinking is ‘hot’, emotional. Diverse forms of emotion can be identified in the interviewee’s talk about previous experiences with mathematics, and experiences actually taking place during the interview.

2. Use of psychoanalytic insights suggests that certain beliefs and behaviours are *defensive* (against anxiety and conflict), and that, in some cases, subjects can be interpreted as ‘*exhibiting*’ anxiety, rather than actually expressing it; such insights also provide possible explanations for sometimes surprising cognitive ‘slips’.

3. Emotions towards mathematics, are sometimes ‘positive’, and often ‘negative’; yet psychoanalysis shows how anxiety or other feelings can be *displaced* to mathematical objects from other objects, via the movement of emotional charge along chains of signifiers, thus showing that what may first appear as, say ‘mathematics anxiety’ may turn out to have bases in other relationships and practices; it also shows how *transference* may invest mathematics teachers as the focus of feelings that may originally relate to other persons and other practices.

4. Fantasies may invest mathematics and mathematical objects with strong emotional meaning.

Comparing methods and findings

It must be acknowledged that these two studies differ on several dimensions besides their differences in methodology, for example, in the centrality of emotion to the original problem formulation, in the age of the research subjects, in the cultural and linguistic context. Thus any conclusions about the effects of the methods used on the findings must be considered cautiously. Certainly the classroom observation findings seem much more restricted: there is little evidence of the pupils expressing emotion in this classroom, though a fair number of instances where we might argue that emotion is being *exhibited* (if not expressly acknowledged). In contrast, Evans (2000) coded all the women interviewed and at least three quarters of the men as clearly *expressing* emotion.

This evidence might suggest that the participants in classroom problem solving are actually *experiencing* emotion less than those solving problems, in interviews, where there is also space to discuss their ‘mathematics autobiographies’. Yet this is not necessarily the case: there are other possible interpretations. First, I would argue that the difference lies in the way the interaction in each case is framed by the different range of discursive practices in play in the two settings. In the classroom, the social interaction is framed by the official school mathematics discourses, as well as by relatively consistent (though partially competing) discourses, such as the progressive ones at play in this school. (Also relevant are the outside discourses relating to family and leisure pursuits, such as football.) Most versions of classroom discourses, and

related modes of classroom regulation by teachers, do not give much space to the expression of feelings, whatever participants may be experiencing. However, in the interview setting, the interaction was formed within an interdiscursive space where, as interviewer, I attempted to shift the discourse from college maths to research interviewing, and to position the student as authoritative – about their ‘outside-college’ practices and their feelings – and to soften fears of being evaluated. Here there is greater space to express feelings. Further, the interplay of college maths and the research interview discourses might lead to more ambiguity in the positionings – and perhaps to conflicts for interviewee, and interviewer, itself leading to experiencing or expressing of emotion.

Second, both researcher and interviewee seem to have more freedom in the interviewing situation. The interviewee seems to be generally much freer – to decline to attend the interview, to refuse to answer (or to evade) questions, and so on. The researcher / interviewer seems to have more scope to pursue their agenda of questions. However, in so doing, the research becomes more intrusive, and is likely to produce *reactive effects*. Thus the interview may elicit from subjects responses to the interviewer or to interview conditions, or expressions of views or feelings that might not be produced, in another context. The aim of reducing reactive effects, or at least of assessing their effects, is one of the reasons why qualitative researchers use reflexive accounts (see above).

This brings us back to the different *types of data* produced in the two sorts of studies. Again this relates to the fact that the ‘research interview’ discourse creates some different positions and allows subjects the space to say much more about the way they see the action in the setting, as well as their feelings about it. In addition, since each participant brings their particular history of positioning, discursive resources and ongoing emotional commitments to any setting, the interview may create spaces in which these can be more visible. Such opportunities are not necessarily unavailable in classroom observation: debriefing interviews (cf. Morgan et al., 2002a) of teachers and students could be used to follow up participants’ interpretations and emotions around specific episodes, and this would be helpful for any research aiming to study emotion. In any case, a space for dialogue with at least a sample of the relevant actors is important for most studies of affect and emotion – and even more crucial for research aiming to draw on psychoanalytical insights.

Conclusions and further questions for research

The turn to a view of emotion as socially organised, and away from a purely individual approach, is supported by the concepts of *discourse* and *positioning*. Both of the approaches described here are reliant on these concepts. I also aim to avoid the opposite extreme of a too ‘structural’ approach, one form of which is ‘discourse determinism’ (Henriques et al., 1984). This is so as to keep a space in our theorising for the particular subject’s history of positioning, and their ongoing emotional commitments (Hollway, 1989). Another of my aims in using a discursive approach is to allow for the way that the charge of emotionality can be displaced along a chain of

signifiers, crossing boundaries and making meanings in a way that will certainly often be unexpected, and which may be ‘original’, or ‘creative’.

It might be tempting to say that observation in classrooms is based in more ‘natural’ settings, is less intrusive than interviewing, and hence is likely to be less reactive and more ‘authentic’. My argument is that no context is ‘natural’: all are social and are regulated by discourses and social relations, as captured in the idea of positioning. One must go beyond these contexts labelled in ‘everyday’ terms, to consider the discourses and practices at play in the research setting, and the space given to emotional experience and expression, in each.

The bounds of the analysis here indicate areas into which the discussion could be expanded. We could bring 'quantitative methods' into this analysis; for example, by producing data via structured observation of classroom activity (or videotapes), or by using hybrid cross-sectional methods of data analysis (see above). We could enquire about the effects of the two cultural contexts. We could ask what might be the effects of the differences in the ages of the subjects in the different studies.

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