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Discursive Positioning and Emotion in School Mathematics Practices

Jeff Evans
Middlesex University
London, UK

Middlesex University
The Burroughs
London NW4 4BT
United Kingdom
Tel: +44 20 8411 5490
Fax: +44 20 8202 1539
Email: J.Evans@mdx.ac.uk

Candia Morgan
Institute of Education
University of London
London, UK

Anna Tsatsaroni
University of the Peloponnesse
Corinth, Greece

DISCURSIVE POSITIONING AND EMOTION IN SCHOOL MATHEMATICS PRACTICES*

Our approach to emotion in school mathematics draws on social semiotics, pedagogic discourse theory and psychoanalysis. Emotions are considered as socially organised and shaped by power relations; we portray emotion as a charge (of energy) attached to ideas or signifiers. We analyse transcripts from a small group solving problems in mathematics class, and from an individual student. The *structural phase* of analysis identifies positions available to subjects in the specific setting, using Bernstein's sociological approach to pedagogic discourse. The *textual phase* examines the use of language and other signs in interaction and describes the *positionings* taken up by particular pupils. We then focus on indicators of emotion, and find indications of excitement and anxiety, linked to participants' positionings. Finally we consider implications of our approach.

KEYWORDS: affect, defences, discourse, emotion, metaphor, pedagogic discourse, positioning, practice, problem-solving, psychoanalytic, unconscious

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1. Introduction

Our approach is to show that emotions are socially organised phenomena which are constituted in discourse, shaped by relations of power, and implicated in constructing social identity. To avoid individual / social and cognitive / affective dualisms, we adopt an interdisciplinary, critical approach, drawing on discourse theory with sociological, semiotic and psychoanalytic perspectives.

We aim here to discuss the usefulness of this approach for mathematics education research and practice. Section 2 outlines the key concepts in our three perspectives, and how they are brought together in analysing affect and mathematical thinking. Section 3 describes our methodology. Section 4 applies this to a classroom episode. Section 5 discusses its possible use in Frank's case. Finally, Section 6 compares our approach with others in this Special Issue, and assesses the broader relevance of our perspective to mathematics education research, policy and practice.

2. A discursive approach to emotion

Our approach brings together concepts critical for understanding emotion from education, social science, and psychoanalysis (see Introduction and Evans, 2000), in a context described by Critical Discourse Analysis

(Fairclough, 2003; Morgan, 1998), and made relevant to pedagogic settings (Bernstein, 2000).

2.1 Discourse

A discourse is a system of signs that organises and regulates specific social and institutional practices; it provides resources for participants to construct meanings and identities, experience emotions, and account for actions. Discourses specify what objects and concepts are significant and what *positions* are available to participants in the practice – the various roles that may be adopted, together with their possibilities for action and relationships with other participants. They also provide standards of evaluation. These form the basis of social relations of power which regulate how the *positionings* of participants come about – how individuals come to *take up* particular discursive positions from those available (Evans, 2000).

Positioning is particularly relevant to understanding emotion as it affects how individuals' identities are constructed within a power structure of social relationships. Positioning is not permanent; neither is it completely determined, nor freely chosen: participants are constrained and enabled by their personal histories and the discursive resources available to them. These resources may be drawn from discourses other than those underlying the practice(s) in which they are immediately involved. *Interdiscursivity* (drawing on concepts and values of other discourses) and *intertextuality*

(incorporating, even implicitly, signifiers from other texts) are relevant for studying emotion. The conflicts of meanings as different systems of signs interact with one another, substituting for and displacing one another along an unending chain, can mobilise powerful feelings and call "our very identities into question". (Hall, 1997, p. 10).

Discursive psychologists (e.g. Edwards, 1997) conceptualise emotional expression as a means of accounting for actions, seeing emotion as having inter-personal rather than individual origins. In contrast, we locate emotion within social structures, aiming to show how the individual's experience of it emerges from, and is structured by, their participation in discursive practices.

2.2 Emotional experience

Our conceptualisation of emotional experience draws upon psychoanalytic ideas and post-structuralist theories of discourse (Henriques et al., 1984). We speak of emotion as a 'charge' attached to signifiers (Evans, 2000). This metaphor captures the energy and intensity of emotion, and supports a unified approach to cognition and affect, seeing emotion as 'attached' to (chains of) signifiers representing ideas.

We draw on Lacan's psychoanalytic ideas. *Desire* permeates the workings of language. Much verbal material may be linked with unconscious (repressed) contents, stored as signs "bound to the earliest experiences of

satisfaction" (Laplanche and Pontalis, 1973, p.481), and involving transformations and transpositions of ideas, words, images and feelings through mechanisms of *condensation* and *displacement*. Lacan links these with the semiotic processes of *metaphor* and *metonymy*, respectively (1977, p.177). Thus, as condensation occurs when multiple meanings 'pile up' on a single signifier, so metaphor superimposes signifiers: an adult interviewee 'Ellen's' idea of being an 'expense', calculable mathematically from a restaurant bill, can be metaphorically linked with the idea of being a burden in a relationship infused with desire, so multiple meanings build up on 'expense' (Evans, 2000).

This emphasis on signification shows how unconscious processes might be implicated in the data used by educational researchers to study emotion, and motivation. However, Lacan's psychoanalytic approach needs supplementing to take account of specific socio-cultural-historical locations (Henriques et al., 1984). An individual's experience of emotion arises from interaction between a personal history of involvement in discursive practices, and present discursive positioning(s) (Evans, 2000). This history is itself structured in ways related to social background, and to forms of pedagogic and other practices in which the individual has participated.

2.3 Pedagogic discourse

We draw on Bernstein's theory of pedagogic discourse, in particular concepts of *classification* and *framing,* to construct systematic descriptions of different practices.

Classification maintains the boundaries between categories, between social groups, discourses (e.g., scientific and everyday) and agents (e.g., researchers and teachers). It thus faces outwards to social order and inwards to order within individuals. The latter involves "a system of psychic defences to maintain the integrity of a category" though these defences are not always effective (Bernstein, 2000, p.7). Where knowledge is weakly classified, the boundary is more permeable, and the discourse more 'vulnerable'.

Classification principles affect students' consciousness through *framing,* the form of control over communication of pedagogic content – including its sequencing, pacing and evaluation criteria, and social relationships. Where framing is strong, the teacher has control over these elements of discourse, and when weak, the learner has 'apparent' control.

Framing matters, since, in classroom contexts, the pedagogic discourse is a major regulator of emotional experience, but other discourses and contingencies of individuals' histories are also important. Unexpected linkages can occur through interdiscursivity and intertextuality, leading to possible flows of

meaning and emotion attached to chains of signification. For example, Walkerdine's (1988) discussion of 'more' in school and home discourses (contrasted with 'less' and 'no more' respectively) shows that, while teachers' attempts to link school to home practices and discourses *can* succeed in aiding understanding, they may fail because 'the same' signifier has different relations of signification in the two discursive practices: this gives rise to various possible emotional/cognitive responses. Thus our discursive approach allows exploration of how meanings are socially organised in pedagogic contexts, yet can flow along different signifying chains, for groups or individuals; psychoanalytic insights show how flows of emotional charge might relate to such flows of meaning.

3. Analysis of emotion in classroom practices – methodological tools

Meaning making occurs in social practices, using language and other semiotic resources. The emotional dimensions of the resulting interaction help to construct and maintain social identity. Thus we focus on fields where school mathematics knowledge is constructed and taught – particularly the classroom. Empirical data is seen as text, the reading of which demands attention to its context(s), entailing a combination of *structural* and *textual* analyses, informing one another. The former seeks to identify the discourses structuring the immediate interaction and the institutional and cultural context – and the forms

of practice and positions *available*. Textual analysis focuses on the exchange of meanings.

3.1 Structural analysis

Structural analysis describes the pedagogic and other discourses which engage participants. Analysis of the *positions* available within discourses displays the ways of meaning, acting and feeling available for participants. Given positions are associated with differing degrees of *power* in relation to others, and with differing *values* within the discourse. The play of values and power creates spaces within which emotion may arise. Often there is more than one available position for an individual, either within one discourse or several competing discourses. Here, potential for *conflict* between positions may also spawn emotionally charged positions. For example, structural analysis identified conflicting positions for a teacher, as examiner within official assessment discourse and as advocate for the student within an alternative child-centred discourse; this explained her problem (cognitive *and* affective) in assessing students' written work (Morgan, 1996; Morgan *et al.*, 2002).

In educational contexts, the characteristics of pedagogic discourse (see 2.3), indicate important variables for structural analysis.

3.2 Textual analysis

Structural analysis summarises the positions available, and possible spaces and roles for emotion within a discourse. Textual analysis aims to identify how

positions are occupied, how opportunities arise for emotionally charged meanings, and how emotional expression functions. Here we primarily analyse verbal text, though other semiotic resources may be used.

Our *first stage* focuses on the text itself, identifying *interpersonal aspects* of the text that function to establish participants in particular discursive positions, using tools of functional grammar (Halliday, 1985). We also attend to the 'play of signifiers' in critical incidents, reconstructing chains of signifiers in the text, sensitive to reinforcement or conflict between chains and discourses. Important indicators include:

- reference to self and others
- reference to valued statuses, e.g. claiming understanding or correctness
- modality, indicating degrees of un/certainty
- hidden agency (e.g., passive voice) or repetition
- 'key signifiers', including metaphors, meaningful within more than one discourse and therefore illuminating the play of meanings at the intersection of discourses and subjects' interdiscursive positionings (see Ellen's use of 'expense' above).

The language functions dynamically to *realise* the positions identified structurally. This stage seeks to identify how participants are positioned or seek to position themselves, and how they and their contributions are valued within

the discourse. It thus identifies opportunities for emotions, and their possible linking with certain signifiers, but does not make claims about the presence or nature of participants' emotions.

We therefore need a *second stage of textual analysis*, attending to:

(a) indicators of emotional experience generally understood/used within the (sub)culture :

- direct verbal expression, e.g. 'I feel anxious'
- use of particular metaphors, e.g. claiming to be 'coasting' (Evans, 2000, p214)
- emphasis by words, gesture, intonation, or repetition, indicating strong (or chronic) feelings
- 'body language', facial expression or blushing.

All but the first indicator involve *exhibiting* emotion, of which participants may not be conscious. *All* require careful interpretation.

(b) indicators for the operation of psychic *defences* against strong emotion, e.g. anxiety, or the 'return' of unconscious *repressed* material (Hunt, 1989; Evans, 2000):

- 'Freudian *slips*' or *jokes*. e.g. 'surprising' errors in problem solving
- *denial* (say, of anxiety), e.g. 'protesting too much' about one's confidence in mathematics

- *behaving 'strangely'*, e.g. laughing a lot, talking unusually quietly
- *impatience* to get/know the 'right answer'.

Psychoanalytical insights suggest further themes, including:

- *identification*, whereby pupils seek to take on characteristics / behaviours of a favourite teacher or admired classmate
- *resistance* to authority figures, or to authoritative peers.

4. Illustrative Analysis

The episode analysed involves three boys, Filipe, Mário and Tiago, working together on a mathematical task, within an 8th grade Mathematics class in Lisbon, Portugal. The data include a transcript of one episode, plus the original researcher's description of its context, the classroom, and the national education system. [1]

4.1 Structural analysis

Drawing on relevant documents, here the original researcher's notes, we identify significant concepts and values, and positions available to students in this classroom.

In Portugal at the time, students might fail and have to repeat the year. This official policy creates positions of *failing student* and *'normal' student.* The

technology of marks further creates a visible structure for comparing and valuing students.

But evaluation can be carried out *by different participants*. Besides the teachers, the students are said to evaluate each other as 'good' or 'rather weak' – but apparently using different criteria. Criteria reflect the mathematical or everyday discourses drawn upon, valuing different aspects of mathematical performance – or valuing the person instead.

Further, *classrooms differ*: in this one, students "spontaneously and frequently checked their solutions among themselves, not depending on the teacher's evaluation". This suggests, alongside the official pedagogic discourse, a local 'progressive' form.

Thus the positions made available by these two pedagogic discourses in this classroom include:

evaluator and *evaluated*. Evaluating, especially of other people, is an essentially powerful action. This raises the question of how the power to evaluate is distributed across participants.

In the local pedagogy, 'helping' and co-operation among students are encouraged and valued. This creates further possible positions:

helper and *seeker of help*. Moving around the classroom to seek help is legitimate, though it is not clear how much it is actually valued.

collaborator and *solitary worker*. While the local pedagogic discourse encourages collaboration, the official discourse values individual work: a possible source of conflict for particular students.

leader and follower Normally the teacher initiates and directs activities. During group work, however, students can bid for a *leader's* position within their group. We assume an associated, less powerful, *follower* position.

insider and *outsider*. These positions are inferred from the information that Tiago and Filipe consider Mário as "a little bit rejected" by his peers. These positions are likely associated with discourses originating outside the classroom.

We now use these empirically derived positions to construct a theoretical characterisation of the form of practice, using Bernstein (2000).

In the 'traditional' official discourse, the position of *evaluator* is dominant, and strongly classified relative to the *evaluated*. Strong framing further differentiates *leader* and *follower*.

In the 'progressive' classroom, the position of *evaluator* is downplayed or weakened. *Evaluator* and *evaluated* appear as equally valid positions in the instructional aspects of discourse, as do *leader* and *follower*, because control over sequencing rules and evaluation criteria also remain implicit. Both classification and framing are weak, making the hierarchical nature of the transmitter-acquirer relationship implicit.

However, some regulative aspects of the discourse are more explicit, stressing co-operation and sharing. This creates a division of labour between *helper* and *seeker of help*, apparently equally valued (though not equally powerful). Similarly, social relations between pupils are framed by explicit valuing of *collaboration*, creating a division between *collaborator* and *solitary worker*.

Thus the positions described derive from the specific nature of pedagogic discourse. Contradictory subject positions create potential for conflict, and the experiencing of emotions. These may be precipitated by:

- discrepancies between the implicit values of the instructional discourse and the explicit privileging of certain behaviours by the regulative discourse
- discrepancy between the valuing of collaboration by the local pedagogy and the valuing of solitary work by the official discourse
- discrepancies between teacher and student evaluations, based on differing resources and criteria, suggesting likely differences in positioning of individual students.

4.2 Textual analysis

We now turn to analysis of the transcript of two minutes of video recording of the three boys working on a task introduced by the teacher, with annotations (in italics) drawing upon the video record including (limited) indications of visible non-verbal activity. It is an extract from a longer episode during which the students address the following problem:

Mr. Antonio's lawn is shaped like a rectangular trapezium: the bases are 16 and 24 metres long and the height (PL) is 10 metres. […] (see Figure 1). […] To water the lawn, Mr Antonio has two water 'sprinklers', one next to P, and one beside E. […] How far must the sprinklers throw the water to irrigate the whole lawn?

--- INSERT FIGURE 1 HERE ---

The 'realistic' context of the problem may have influenced the discourses drawn upon by the boys, relating in particular to their choice to use measurement rather than (Pythagorean) calculation and to the meanings derived from everyday discourses which infuse their interactions.

As this extract starts, the boys have been using measurement to answer an earlier part of the problem. Filipe, finishing first, made a strong claim to authority through knowledge and a position as *evaluator* by stating that this was "simple", then claimed the position of *leader* by moving on to the part of the problem stated above. We present the extract in five phases, interspersed with our analysis, identifying (1) the pupils' positionings and (2) indications of emotion (in bold).

45-47 - Definitions of the problem

(45) Tiago - 13 meters it's enough. *[An answer apparently taken from measuring his drawing.]*

(46) Filipe — No... OK... what distance should the taps be... they should throw the... the taps should throw the water to irrigate all the field? *[Filipe reads with some hesitation. There are some attempts from Mário and Tiago to clarify.]*

(47) Tiago – Ah!… in the middle is enough, I think.

T's initial statement (45) with its positive modality can be seen as a claim to authority through knowledge (*evaluator* position), which may be challenged by F's evaluative "no" (46) and further attempt to direct activity. A review of the video suggests F's "no" may be in response to M's interjection – though it is not clear how T understands it. It is worth noting that T's evaluation and later evaluations by F use criteria related to the mathematical problem, in contrast with M's later evaluations (see below and section 6).

F's body seems to stiffen at this point, suggesting resistance or fear/anxiety, possibly in response to T's claim.

The attempts by M and T to intervene as F re-reads the question may be collaborative or may be resistance to F's claim to *leader* positioning.

T's adjusted claim (47) has lower modality ("I think"), suggesting that he is deferring to F's challenge. Alternatively, his use of the first person may indicate withdrawal from the group, positioning himself as a *solitary worker*. T's positioning here, and at several other points, is ambiguous.

This may indicate T's feelings of isolation. However, he appears cool with no overt indicators of emotion.

48-52 – Doing

(48) Filipe – Let's see

They turn to their notebooks. Mário with compass, Tiago with ruler, Filipe watching until Mário gives him the compass.

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

Filipe puts the point of the compass on one of the dots and experiments until he is satisfied with the result.

(50) Mário – And there?

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

(52) Mário – Ah… *[agreeing - or confirming understanding]*

F's use of imperatives and normative statements of what "we" do again indicate his position as leader, while M adopts the complementary position of follower.

At the same time, M's 'agreement' suggests a desire for inclusion.

53 – Challenge

(53) Tiago – But it doesn't get there *[Tiago refers to his own drawing, then looks again to Filipe]* So, where does it have to throw? Ah… they are two!… Now I know… *[He returns to his drawing]*

Filipe is drawing. Mário observes attentively, bent over the table, with similar posture to Filipe and Tiago.

T again claims an *evaluator* position and appears to challenge F's direction with his initial "but". However, he does not follow this up, again withdrawing from collaboration, focusing on his own knowledge "Now I know".

T's "I know" may be an indicator of isolation again, or may be another instance of 'protesting too much', a defence against anxiety.

54-58 – Solution claim and evaluation

(54) Filipe – Quite right! [Certinho! – *subsequent discussion suggests 'Bang on!' as an appropriate colloquial English translation*]

(55) Mário – That's it! [É mesmo!] *[Mário turns his gaze towards Filipe's eyes for a moment, then returns to his drawing]*

(56) Mário – Quite right! [Certinho!] Fantastic! *[Mário turns his gaze again to Filipe, smiles, touches Filipe briefly on his shoulder]*

(57) Mário – You know! *[said almost privately 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 *[turning his gaze to Mário's eyes]*.

Mário is listening to Filipe's explanation, his eyes in contact with Filipe's. He 'says' yes with his eyes, nods, opens and closes his legs in a movement suggesting satisfaction.

Both F and M make positive evaluations of F's solution. However, both form and function of these evaluations differ, giving rise to different positionings. F initiates the evaluation and at (58) provides explicit criteria, establishing himself as evaluator in control of the knowledge. M, in contrast, echoes F's evaluation without indicating criteria, attributing the knowledge explicitly to F (57), evaluating the person rather than the mathematics. His statements serve to reinforce F's powerful position rather than claim his own right to evaluate. Further, M's verbal and body language, suggesting a subordinate position, indicates both acknowledgement of the other's superiority and positioning as a 'fan' (within a youth culture which helps to link members of a group together). This positioning within an everyday discourse also makes available resources from other social discourses and associated feelings.

Here we have evidence of emotion – excitement, indicated by intonation (coded by exclamation marks in turns 54-57), F speaking faster, M's

repetition of 'Certinho!' (56), and his body language (touching F's shoulder, making eye contact, gleeful wiggling of legs). This excitement may be generated merely by the successful solution of the problem. However, there may also be a *transfer* of excitement (Evans, 2000) from youth cultures. Mário might *also* be feeling delight at being *included* in the shared pleasure. We might call this a process of M's *identification* with the group, and with F in particular.

59-63 – Challenge and justification

(59) Tiago - *[Leaves his drawing and looks at Filipe's.]* So how did you do it?

(60) Filipe - I measured from there to there to irrigate for sure this piece over here...

(61) Tiago - Yes...

(62) Filipe -Then I looked here and here and it fitted rightly. *[To Tiago pointing at the places "here and here" which seem to be the radii of the two circles.]*

Tiago observes but doesn't seem convinced. Mário continues with his own drawing and Filipe returns quickly to his drawing to remake it more precisely. Tiago returns to his own work and traces with the compass one of the arcs of the circles Filipe referred to and asks:

(63) Tiago - So where did you put it?

T's questions are ambiguous; they may be requests for help or bids to collaborate. Alternatively, they may represent challenges by a would-be *leader*/*evaluator* to F's status conferred in (54-58), checking cogency of arguments and evaluation criteria.

T's questions may be indicators of anxiety – at being left behind, or left out? Or this may be a case of *resistance* – to F's attempts to take the position of leader/evaluator in a hybrid practice characterised by both

cooperative aspirations of the progressive discourse, and competitive relationships valued within official discourse.

“So how did you do it?” is a signifier with different meanings when spoken from different positions. Within the progressive pedagogy of this classroom it may call up the value placed on explaining mathematical activity and collaborating. Within a traditional pedagogy it may represent a challenge by an evaluator (in a superior position) or a request for help from a student with lower status.

5. Frank's case

A discursive analysis of Frank's episode focuses on: discourses at play; available positions; and Frank's positioning(s). However, the lack of information about local educational discourses makes structural analysis difficult. For example, knowing which secondary school track Frank's class belongs to is crucial for any sociocultural approach. From the account of his beliefs (mathematics as a developing field, approached through discovery, and with multiple ways of solving problems), we infer he is familiar with 'progressive' forms of pedagogy. Yet his teacher is "clear" and seems to control evaluative criteria.

The research interview discusses a 'realistic' problem, with context created (a "life-saving" journey). However, the interpretation of realistic problems depends on the pupils' social background and educational experiences (Cooper & Dunne, 2000). Here, boundaries between everyday and school mathematical knowledge

are weakened, as are boundaries among school subjects, such as maths and physics, creating tension with the apparently stronger boundaries of the practice familiar to Frank. The discourse of the research situation thus differs from classroom discourse in the definition of mathematics, but also in values and evaluative criteria. In this context, even a "high achiever", generally confident and motivated, may feel anxious, "nervous" and uncertain that he can find *the* correct solution.

In his school mathematics practice, thinking is highly valued, unlike calculator use, signifying perhaps inferior, trial-and-error practices. However, the ever-present tension between stopping to think and the pacing demands of evaluative classrooms, is heightened in these research conditions. Such tensions generate anxiety, yet are crucial in determining Frank's positioning, and demonstrate the mutual influence of cognitive and affective processes.

Besides indicators of emotion identified through facial expression and explicit evaluations of his feelings, we note further linguistic indicators, including 'hedges' ("I *seem* to have forgotten") and switches between narrative about the current problem (first person, past tense) and more 'distanced' comments (generalised, present tense). Both may be forms of defence against embarrassment, and against possible negative evaluation as *not knowing* – rather than (merely) *having made a slip*.

Psychoanalytic insights prompt questions about whether Frank's explanation of his initial difficulties with the problem – not liking "the physics stuff" – is a *rationalisation* of the anxieties provoked by the tensions in the discourse discussed above. The labelling of the calculator as 'inferior' in school discourse, while it simultaneously functions as a forbidden object of desire at moments of anxiety and dependence, marks it as a 'key signifier', where school mathematics and other social discourses (about youths becoming 'independent') intersect; recall our earlier references to "Certinho!" for 'Mário' and "expenses" for 'Ellen'. More information about Frank's past experiences – his history of positionings in school maths activities, and his social background – would facilitate understanding of how the range of emotions noted, "negative" and "positive", are managed to produce his eventually successful outcome.

6. Reflections And Conclusions

Our analysis shows how ideas, emotions and actions of participants are shaped by the dynamic of interactional practices, and how positions available in discourse can be realised as positionings in practice. It provides evidence of excitement and anxieties felt by these pupils, showing how these are associated with their positionings in different discursive practices. By analysing the positions occupied by each pupil in interaction, we understand how hierarchical

positions are (re)produced, as well as the role that emotions play in adopting, modifying, 'submitting to', or claiming, a position.

Of particular interest is our observation of interplay between discourses of mathematics education and everyday discourses. Thus, for example, Mário's anxiety seems to be less about mathematics and more about being included in the group – while the anxieties of Tiago and Filipe seem to relate to competition and conflicts of values between the official pedagogic discourse and local practice. For Mário, it is through pleasure, associated both with discourses of youth culture and local classroom practice – the latter shaped by the 'progressive' pedagogic discourse of enjoyment in doing mathematics – that submission occurs.

Evaluation – of self and of others – is crucial in establishing an individual's positionings and identity. In our classroom episode, the local pedagogy did not provide the students with explicit criteria to evaluate their work but allowed freedom to determine their approaches to the problem. The contrast between Tiago's and Filipe's use of task-related mathematical criteria to support their evaluations of solutions and Mário's 'fan'-like evaluation of Filipe served to reinforce Mário's outsider position - and hence exacerbated his anxiety to be included. The nature of the mathematics and of the pedagogic discourse (especially evaluation criteria) interact with other discursive resources and personal histories of individual students, enabling certain positions and creating

links and contradictions, thereby opening up spaces within which emotion may occur.

Our approach enables us to notice and understand emotion as part of the social organisation of practice. The structural analysis of positions afforded by the pedagogic and other discourses at play, together with textual analysis of their realisation in participants' positionings, allow a dynamic understanding of the situation, highlighting moments when ambivalence within a discourse or conflicts between discourses come into play. For example, we observe Tiago switching between the positions of *follower* or *collaborator* (made available by the local pedagogy) and that of *solitary worker* (valued by more traditional discourse). The anxiety, isolation and resistance we hypothesised appear associated with the multiplicity and ambiguity of his positionings during the episode.

Observing the sequence of positionings also allows us to see how individuals' identities are produced. For example, we observe Mário in consistently subordinate positions. Even when valued within local practices (e.g. *collaborator*, *seeker of help*), these positions have lower status in the other discourses at play and, along with his shift into everyday discourse when acting as *evaluator*, help (re)produce his low status. This analysis supports interpretation of his verbal and bodily expression of delight at the problem solution as a process of identification with Filipe, while the repeated moves he

makes toward inclusion through submission suggest anxiety about his place in the group, and a desire to be included. Therefore, although he makes bids to be included as 'insider', he is often at risk of being an 'outsider'.

The episode analysed above represents a particular configuration of discourses and positionings as the students work together. Later in the same lesson, the configuration changes as the teacher intervenes, suggesting the students use calculation with Pythagoras's Theorem rather than measurement. This introduces new evaluation criteria and re-establishes traditional pedagogic relations. The teacher's intervention, with its strong instructional discourse – for example, "No, that's finding geometrically, but I say calculating, doing some calculation and finding how much it measures" – elicits obedience from the students, and acceptance of positioning as followers, rather than as directors of their own learning. As could be expected, the traditional pedagogy leaves less space for emotion: neither delight nor anxiety are expressed in this new context.

The teacher's enunciation of alternative criteria affected the direction of the students' activity, and his assertion of authority also affected relationships within the group. Interestingly, following the teacher's intervention, Mário is enabled to adopt more powerful positions (including *evaluator* of mathematics and *helper*) by taking control of the calculator and providing numerical answers for the others. Eventually, once the group has agreed on a solution, Mário even adopts a *leader* position by grabbing the worksheet and reading out the next

question for the group to work on.

Comparing these two episodes shows the effects of the form of pedagogy (e.g. visible or invisible) within the mathematics classroom – not only for cognitive advance (or stasis), but also for the quality of emotional experience. Though it might seem to focus attention on the reproduction of teacher-pupil power relations, we would argue that a crucial feature of this teacher's intervention is his explicit reference to evaluation criteria (Morais et al., 2004). Explicit criteria allow less powerful students to take control of the knowledge and to engage in evaluating their own work and that of others.

We have focused on group work in class, rather than an individual problem solver like Frank. Thus, our findings might seem somewhat restricted: there is little evidence of the pupils *expressing* emotion, though a number of instances where we infer that it is *experienced*. In contrast, Evans (2000), interviewing adults taking mathematics within a social science degree, coded all the women, and most of the men, as clearly expressing emotion. However, we do not suggest that problem solvers in the classroom are actually *experiencing* emotions less than those in interview situations; we explain differences in observed emotional events by differences in discursive practices. Whatever participants may experience, most school mathematics discourses give little opportunity for expression of feelings, or regulate this strictly. In contrast, the discursive constitution of the interview setting designed by Evans allowed students a

position of authority on their life histories, and provided greater space to *express* feelings.

More generally, our approach differs crucially from others described in this Special Issue in its focus on the social nature of school mathematics and its systematic approach to describing its structure and analysing individual participants' interactions within it. While other authors refer to the social contexts of their data and suggest the importance of interactions between individuals and context in producing emotion, this context is in our view not sufficiently specified to provide explanatory power. Our structural analysis of available positions, with textual analysis of the realisation of positionings, provides a way to fully specify the context for thinking and emotion.

Certainly, several other authors suggest indicators for emotion that could be useful at the 'textual' stage of our analysis; in particular, Op't Eynde et al. and Reid & Brown specify a range of non-verbal indicators.

Our main concern in this paper has been with the development and exemplification of an approach to the study of emotion in mathematics classrooms. The strength of our approach entails methodological demands. Its focus on understanding students' social background and experience through their history of positionings in discursive practices requires data on the practices at play in the setting studied, presupposing detailed knowledge about the school setting and the teacher's distinctive objectives and style – and over the student's

lifecourse, requiring life history material from particular students. This may prove a limitation or may lead researchers to make inferences based on possibly insufficient data. This cannot be completely avoided – it is a hazard of doing research, affecting all practitioners of any approach to this challenging area.

Our work also bears on educational practice. Awareness of the positions made available by a particular pedagogy, and of spaces for emotion, may help teachers specifically to consider students' emotional, as well as cognitive, experiences. Further work is needed to support teachers to do this. At the same time, research is needed to identify ways in which students from various socio-economic and cultural backgrounds may become positioned within particular forms of pedagogy, affecting differently their emotional experiences in the classroom and their educational achievements.

Notes

1. The original data set was collected by Madalena Santos for research with a different focus (Santos & Matos, 1998). We thank her for permission to use the data, translation of the transcript, and description of the education system and the particular classroom.

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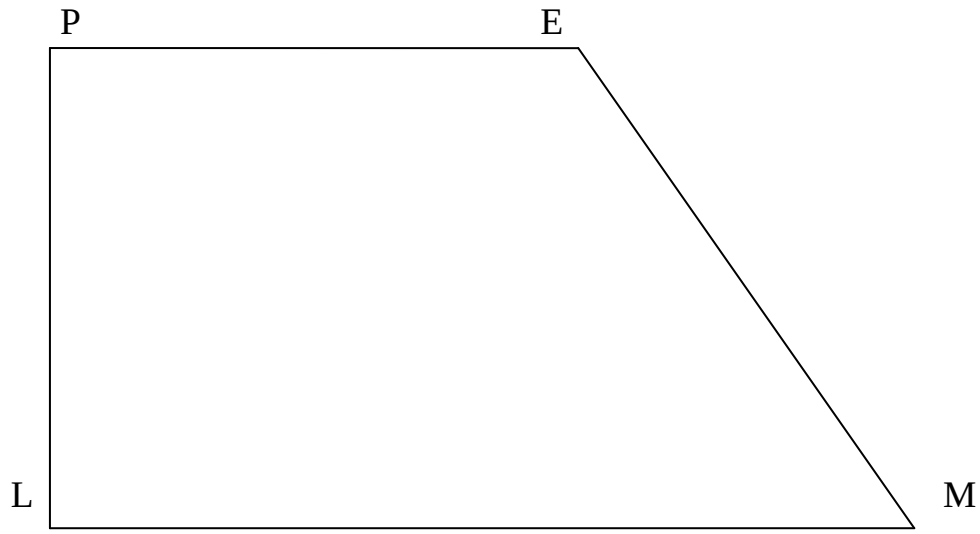

Figure 1. *The Trapezoidal Field*. *Source*: Santos & Matos (1998, p.111)