Pedagogic discourse, positioning and emotion: illustrations from school mathematics

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ABSTRACT

Our approach to the study of emotion in school mathematics draws on several theoretical strands, all of which give a central role to the notion of discourse. Thus, emotions are considered as socially organised and shaped by power relations. We see emotion as analytically distinct from cognition, but at the same time as inseparable from it in practice: metaphorically we portray emotion as a charge (of energy) attached to ideas or (chains of) signifiers. To develop these ideas, we analyse a verbal text, based on a video record of a small group of students solving mathematical problems. The structural phase of the analysis identifies the positions available to subjects in this specific field; here we isolate five available pairs of student-positions, which can be inter-related using Bernstein's (2000) 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. Developing the textual phase, we then focus on indicators of emotion, drawing especially on psychoanalytic insights. Here we find indications of a range of emotions such as excitement and anxiety that may be linked to participants' positionings. We conclude by considering some theoretical, methodological and policy implications of our approach.

KEY WORDS

Affect, defenses, discourse, displacement, emotion, metaphor, pedagogic discourse, practice

Résumé

Notre conception de l'émotion en didactique de mathématique entrelace trois fils théoriques qui tous relèvent l'importance de l'idée de discours. Ainsi, les émotions sont considérées par leur organisation sociale et par les enjeux des rapports de pouvoir. Au niveau d'intelligibilité, nous distinguons l'émotion de la cognition, bien qu'en réalité les deux soient inséparables. Et nous décrivons l'émotion par la métaphore d'une «charge» (d'énergie) attachée aux idées ou aux chaînes de signifiants. Pour développer nos propos, nous analysons des séquences audio-visuelles retranscrites, d'un petit groupe d'étudiants qui essaient de résoudre des problèmes mathématiques. Dans la phase structurale de l'analyse, on identifie les positions prises par les sujets dans ce contexte spécifique. A l'issu de cette élaboration, on distingue cinq binômes de positions des étudiants, que l'on analyse en s'appuyant à la sociologie du discours pédagogique de Bernstein (2000). Dans la phase textuelle, on examine le langage utilisé ainsi que d'autres signes dans l'interaction et on décrit les positionnements pris par ces étudiants précis. Nous concluons en considérant certaines implications théoriques, méthodologiques et politiques de notre approche.

Mots clés

Affection, défenses, discours, déplacement, émotion, métaphore, discours pédagogique, pratique

Introduction

There has been a long-term neglect of emotional issues in mathematics education research and the discourses of mathematics teaching and learning. The current extensive literature on emotions in education and in the social sciences, especially social and education policy, justifies identification of an «emotional turn» in research, policy and practice (Tamboukou, 2003; Hartley, 2004). We cannot discuss here the reasons for this «turn», but aim to state clearly the concerns that stimulate our approach, our theoretical resources, and the contribution of this approach to mathematics education research and practice.

Our concern is to show that emotions are socially organized phenomena implicated in constructing and maintaining social identity, avoiding affective/cognitive dualism and the cognitivist paradigm of research. We adopt an interdisciplinary, critical

approach, drawing on discourse theory with sociological, semiotic and psychoanalytic perspectives. Our aim is to discuss the usefulness of this approach for mathematics education research and practice, and to demonstrate how emotions are constituted in discourse and shaped by relations of power. Section «a discursive approach to emotion» outlines the key concepts in the three perspectives we are drawing on, and how they are brought together in analysing affect and mathematical thinking. Section «methodological tools» describses the methodological ideas and tools needed for empirical work. Section «exemplification of the approach» applies these concepts and tools to a classroom episode. Some readers may like to read the latter section first, and then to return to Sections «a discursive approach to emotion» and «methodological tools». Finally, the section «reflections and conclusions», discusses the broader relevance of our perspective to mathematics education research, policy and practice.

A DISCURSIVE APPROACH TO EMOTION

Our approach brings together ideas from discussions of affect in education, social science, and psychoanalysis (see Evans, 2000), in a context described by Critical Discourse Analysis (Chouliaraki & Fairclough, 1999; Morgan, 1998), and made relevant to pedagogic settings (Bernstein, 2000). We highlight the concepts that are critical to our understanding of emotion.

Discourse

A discourse is a system of signs that organises and regulates specific social and institutional practices and provides resources for participants to construct meanings (including meanings for their emotions), accounting for their actions and their identities. The study of discourse «*examines not only how language and representation produce meaning, but how the knowledge which a particular discourse produces connects with power, regulates conduct, makes up or constructs identities and subjectivities, and defines the way certain things are represented, thought about, practised and studied*» (Hall, 1997, p. 6). A discourse specifies what objects and concepts are significant and meaningful, what actions are possible, what *positions* are available to participants in the practice – that is, the various roles that may be adopted, together with their possibilities for action and relationships with other participants. It also provides 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 (Evans, 2000).

The positioning of participants is particularly relevant to our understanding of emotion as it affects how individuals construe and construct their identity and their

place within a power structure of social relationships. Positioning is not permanent; neither is it completely determined, nor freely chosen: participants are constrained 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. In fact, *interdiscursivity* (drawing on the concepts and values of other discourses) and *intertextuality* (incorporating, explicitly or implicitly, words or other signifiers from other texts) are common characteristics of texts (see Fairclough, 2003) and are analytically interesting in the study of emotion. The conflicts and oppositions 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 expressions of emotion as a discursive means of performing narrative accounting and rhetorical action. While this addresses emotion as a phenomenon with inter-personal rather than individual origins, it is not located within social structures and relationships. This is what we attempt to achieve here: to provide a way of understanding how the individual's experience of emotion emerges from and is structured by their participation in discursive practices.

The nature of emotional experience

Our conceptualisation of emotional experience draws upon psychoanalytic ideas and their use in post-structuralist theories of discourse (see Henriques, Hollway, Urwin, Venn & Walkerdine, 1984). We find it useful to speak metaphorically of emotion as a 'charge' attached to (chains of) signifiers (Evans, 2000). The notion of 'charge' is consonant with (but not restricted to) the psychoanalytic tradition; for example, Freud ([1916-17] 1974, p. 443-448) sees anxiety as involving 'motor innervations' or 'discharges'. Without considering the physiological aspects of emotional experience, we can see the metaphor is appropriate. It captures something of the energy and the intensity of emotion, and supports a unified approach to cognition and affect, visualising the 'attachment' of emotion to signifiers representing ideas.

Our approach to psychoanalytic ideas draws on Lacan's account. Here, *desire* (originally, for the mother) permeates the workings of language. Thus the language used in many social interactions provides a rich store of material related to affect, emotion and motivation. Much of this may be linked with unconscious (repressed) contents, stored as «*signs […] bound to the earliest experiences of satisfaction*» (Laplanche & Pontalis, 1973, p. 481-483), and involving transformations and transpositions of ideas, words, images and feelings through the mechanisms of *condensation* and *displacement*. Lacan argues that these can be linked to the semiotic processes of *metaphor* and *metonymy*, respectively (1977, p. 177). Thus, as condensation occurs

when multiple meanings «pile up» on a single signifier in the report of a fantasy, so metaphor superimposes signifiers; for Evans's interviewee «Ellen», the idea of being an «expense» is interpreted as metaphorically linked with that of being a burden in a relationship infused with desire, and multiple meanings build up on «expense» (Evans, 2000, p. 186-191). Similarly, as displacement occurs when energy and feeling are channelled from one object to another (less «threatening») object, metonymy effects a continual «sliding under» of signifiers, each one submerged by a later signifier in the chain; thus, we can say that Ellen displaces her anxiety about being a burden, by moving along the chain of signifiers, from «expense» to a calculation in the interview (of a tip on a meal paid for by another) (*ibid.*).

Lacan's emphasis on signification shows how unconscious processes might be implicated in the sorts of data used by educational researchers. However, his psychoanalytic approach needs supplementing with the discursive approaches discussed below in order to take account of specific socio-cultural-historical locations. An individual's experience of emotion arises from interaction between their personal history of involvement in discursive practices, and their present discursive positioning(s). This history is itself structured in ways related to social class, for example, orientation to context-dependent vs. context-independent meaning (Bernsetin, 1990); and to the forms of pedagogic and other practices in which the individual has participated.

Pedagogic discourse

Adopting a discursive approach requires us to consider the structuring of the context. Bernstein's theory of pedagogic discourse provides us with a systematic means of description and also explanation. A pedagogic discourse is a social construction, which selectively appropriates and refocuses other discourses to constitute its own social order (Bernstein, 2000), thus regulating the pedagogic relation and pupils' forms of experience.

To describe differences in pedagogic discourse and practice, Bernstein uses the basic concepts of *classification* and *framing*, translating relations of power and control respectively. Classification maintains the boundaries between categories, between social groups (e.g., social classes), discourses (e.g., scientific and everyday knowledge) and agents (e.g., researchers and teachers). It thus faces outwards to social order and inwards to order within the individual. For individuals, this involves «*a system of psychic defences to maintain the integrity of a category*» but these psychic defences are not always effective and «*the possibility of the other…the yet to be voiced is…also rarely silenced*» (Bernstein, 2000, p. 7). Where knowledge is weakly classified, the discourse is more «vulnerable» because communications from the outside are less controlled.

To study how classification principles establish consciousness we look at the form

of control of communication in pedagogic relations, using the concept of *framing*. This refers to the nature of control over pedagogical content, its sequencing, pacing and criteria of evaluation, and over social relationships. Where framing is strong, the teacher has control over these elements of discourse, and when framing is weak, the learner has «apparent» control over the discourse. The terms «visible» and «invisible» pedagogical practice indicate these two opposing forms, though in classroom practices the strength of framing regarding *each* element of discourse might vary. Bernstein argues that framing regulates both the classroom social order and the subject content order, and relates these to two distinct aspects of discourse, *regulative* and *instructional*. The former is dominant – the instructional discourse is always embedded in a regulative discourse.

In classroom contexts the pedagogic discourse is the major regulator of emotional experience, but other discourses and contingencies of individuals' histories of experience also play important roles. As emotion is attached to chains of signification, linkages between practices that occur through interdiscursivity and intertextuality can lead to unexpected flows of meaning and emotion. 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 a discursive approach to emotion allows us to explore how meanings are socially organised in the pedagogic context, yet can flow along different signifying chains, while drawing on psychoanalytic insights helps us to understand more deeply how flows of emotional charge might relate to such flows of meaning.

Analysis of emotion in classroom practices – methodological tools

Meaning making occurs in social practices in which language and other semiotic resources play a central role. Furthermore, the emotional dimensions of interaction are implicated in constructing and maintaining social identity, as well as (re)producing and changing a social order (cf. Shilling, 1999). Methodologically, this commits us to focus on fields where school mathematics knowledge is constructed, transmitted, acquired and evaluated – including, but not exclusively, the school mathematics classroom. Empirical data is seen as a text, the reading of which demands attention both to the text itself and to its context(s), entailing a combination of *structural* and *textual* analyses. The former seeks to identify the discourses structuring the immediate interactional context and the broader institutional and cultural context. This identifies

the forms of practice and positions available. Textual analysis focuses on the exchange of meanings within the data itself. These two analyses inform one another. Here we use resources drawn from theoretical perspectives, from the discourses identified in the structural analysis, and from our experience of participation in other discourses, including those of (other) mathematics classrooms (using what Fairclough (1989) calls «members' resources").

Structural analysis

Structural analysis addresses the nature of the pedagogic and other discourses within which participants are situated. Analysis of the *positions* available within the discourse is a prerequisite for understanding the identities, actions and ways of meaning (and feeling) that may be available for individuals. Given positions are associated with various degrees of *power* in relation to the practice and to other participants and are accorded various *values* within the discourse. The play of values and of power creates opportunities or spaces within which emotion is likely to arise. In many cases, there is more than one possible position for an individual, either because of flexible possibilities within a single discourse or because there are several competing discourses available. Here, the potential for *conflict* between positions may also be potential for new, emotionally charged positions. For example, textual analysis of the transcript of a teacher assessing students' written work (Morgan, 1996) identified her experiencing a «problem» – as much affective as cognitive – as she shifted between a position as an examiner within the official assessment discourse and a conflicting position as advocate on behalf of the student within an alternative child-centred discourse (see also Morgan, Tsatsaroni & Lerman, 2002). In educational contexts, the characteristics of pedagogic discourse, outlined in the previous section, indicate important variables to be taken into account in the structural analysis. To identify this structure, we initially work with the empirical characteristics of the context and then represent these in terms of formal definitions of practice provided by the theory.

Textual analysis

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. By turning to the textual we can attempt to identify how positions are occupied, how opportunities arise for emotionally charged meanings, and how expression of emotion occurs and functions. Here, we focus primarily on analysis of verbal text, though a wide range of semiotic resources may be in use.

In our developing approach, textual analysis is conducted in two stages. The first stage focuses on properties of the text itself, identifying, in particular, *interpersonal aspects* of the text that function to establish each participant in particular discursive

positions. The analytic tools include those of functional grammar (Halliday, 1985) as used in Critical Discourse Analysis (e.g. Fairclough, 1989). The analysis also attends to the «play of signifiers» in the critical incidents, trying to reconstruct chains of signifiers in the text, sensitive to the possibilities of relations between chains and discourses being either reinforcing or conflictual. The indicators to which we attend include:

- reference to self and others , e.g. personal pronouns;
- reference to valued aspects of the discourse, e.g. claiming to understand or to be correct;
- the modality of utterances, indicating degrees of certainty and uncertainty;
- other «linguistic danger signals» (Jensen, 1989) such as hidden agency (e.g., using passive voice) or repetition of the same or related semantic terms;
- «key signifiers», including metaphors, that may have meaning within more than one discourse and therefore illuminate the play of meanings at the intersection of discourses and the subject's interdiscursive positioning (see, discussion above of Ellen's use of 'expense').

The language functions to *realise* the positions (identified structurally) in the dynamics of the situation. This stage of the analysis 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 spaces within which emotions may arise, and their possible linking with certain signifiers, but does not make claims about the presence or nature of emotions for the participants.

We therefore need a *second stage of textual analysis*. This stage attends to:

(a) indicators of emotional experience generally understood/used within the society or subculture, for example:

- verbal expression of feeling, as in «I feel anxious»
- use of particular key signifiers and metaphors, as when a student indicates a feeling of ease by saying that he is «coasting» (Evans, 2000, p. 214)
- emphasis by words, gesture, intonation, or repetition, indicating strong (or chronic) feelings
- behavioural indicators, e.g. «body language», facial expression
- physiological indicators, such as blushing.

Note that, apart from the first indicator that involves direct *expression* of emotion, the others involve *exhibiting* emotion (whether consciously or not). *All* demand careful interpretation.

(b) Using psychoanalytical insights alerts us to new themes, including:

- *defences* against the «return» from the unconscious of *repressed* material;
- *transference* by subjects of feelings (from earlier relationships) onto a teacher – or onto the researcher;
- *identification,* whereby pupils might seek to take on characteristics/behaviours of a favourite teacher or admired classmate; and
- *resistance* to authority figures, or to peers who would be authoritative.

In particular, indicators for the operation of *defences* against strong emotion, such as anxiety, or «intrapsychic conflicts» (Hunt, 1989), include:

- «Freudian *slips*» (*parapraxes*) or *jokes* made by the subject: e.g. a «surprising» error or memory failure in solving a problem;
- *denial* (say, of anxiety): e.g. «protesting too much», making an assertive «statement» that the subject feels exceedingly confident about mathematics;
- *behaving «strangely»*: e.g. laughing a lot, especially «nervously», talking unusually quietly or unusually loudly;
- *impatience* to 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.

For examples of all of these, see Evans (2000).

Exemplification of the approach

The episode we analyse here 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 a classroom episode, plus a description, written by the original researcher, of the context of the episode, including information about the national education system and about the particular classroom[1].

1. The larger data set from which this is taken was originally collected by Madalena Santos for research with a different focus. 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 the history of the class. The lesson from which our extract is taken is discussed in Santos & Matos (1998). See also Morgan, Evans & Tsatsaroni (2002).

Structural analysis

In our structural analysis, based on the text written by the original researcher, we identify significant concepts, values and technologies and use these to identify positions that may be available to students participating in this classroom.

In Portugal at the time, students might fail a year and have to repeat it. This official policy creates positions of *failing student* (with a negative value, we assume) and successful or *«normal» student* (neutral). A finer graduation of positions within the «normal» is suggested by the researcher's comment: «From their marks this year in mathematics we can consider them as *medium students* – Tiago and Filipe are a little better than Mário but none of them is the best (or worst) student within this class». The technology of marks creates a visible structure for comparing students, attaching positive value to higher rankings.

The students themselves appear to use rather different criteria; they are said to evaluate each other as «good» or as «rather weak» students. However, they still make use of the systemically constructed idea that value can be attached to individuals according to academic performance.

Differences between teacher evaluations and student evaluations suggest that positioning of individual students may vary between interactions with teachers and with peers. Such differences in positioning may give rise to conflict for individuals, providing a space for emotion to arise.

Evaluation criteria suggest the nature of the discourses upon which the students are drawing and consequent differences in their positionings. Use of explicitly mathematical criteria may be distinguished from evaluation that values the person rather than the mathematics. The latter may suggest drawing upon everyday discourses in which positive evaluations of a powerful other might be interpreted as flattery or a bid for acceptance. In this particular classroom, the researcher notes that students «spontaneously and frequently checked their solutions between them, not depending on the teacher's evaluation». This suggests, alongside the official pedagogic discourse, a «progressive» form in which evaluation is recontextualised.

We now consider the positions made available by the official and the local pedagogic discourses at play in this classroom:

- *Evaluator and evaluated*. Evaluating is an essentially powerful action, especially when exercised on other people. Thus we must ask: Do all students participate in evaluation in similarly powerful ways? Who is subject to evaluation and by whom?

In the local pedagogy, students are encouraged to work together and concepts such as 'help' and co-operation are valued. This creates further possible positions:

- *Helper* and *seeker of help*. Moving around the classroom to seek help is a legitimate activity, though it is not clear to what extent it is actually encouraged and valued. It seems likely that the *helper* would be positioned more powerfully.
- *Collaborator* and *solitary worker*. While the local pedagogic discourse values and encourages collaboration, the official discourse values individual performance (the assessment system allocates marks to individuals). Conflict may arise for individual students between these different values.
- *Leader* and *follower* We are told that it is normally the teacher who initiates and directs activities. During group work, however, it is possible for students to bid for such a position within their group. Again, there is an inherent asymmetry, so we can assume an associated, less powerful, *follower* position.
- *Insider* and *outsider*. This pair of positions is inferred from the information that Tiago and Filipe consider Mário to be «a little bit rejected» by his peers. There is ambiguity about the extent to which these positions are associated with the official classroom discourse or with discourses in which the students participate outside the classroom.

The positions identified above stem from engagement with the empirical world. We now proceed theoretically to characterise the form of practice, and the positions available to students.

In the «traditional» official discourse, the position of *evaluator* is dominant and strongly classified from that of *evaluated*. And strong framing further differentiates the positions of *leader* and *follower*. Thus the traditional pedagogic discourse is a *visible* pedagogy. In contrast, in the local 'progressive' classroom activity, the position of *evaluator* is downplayed or weakened. *Evaluator* and *evaluated* appear as equally valid positions in the instructional discourse, as do *leader* and *follower*, because control over the sequencing rules and criteria of evaluation of the activity also remain implicit. This local classroom activity is an *invisible* pedagogy: both classification and framing are weak, making the hierarchical nature of the relationship between transmitter and acquirer implicit.

However, some aspects of the regulative discourse are more explicit, stressing the values of co-operation and sharing. This creates a division of labour between *helper* and *seeker of help*, apparently equally valued and legitimate. Similarly, social relations between pupils are framed by the emphasis on *collaboration*, which is explicitly valued within this form of pedagogic practice, and which creates a division between *collaborator* and *solitary worker*. Thus the systematically described positions are derived from the specific nature of pedagogic discourse.

The discrepancies between the implicit hierarchies and values of the instructional discourse and the explicit privileging of certain forms of conduct by the regulative

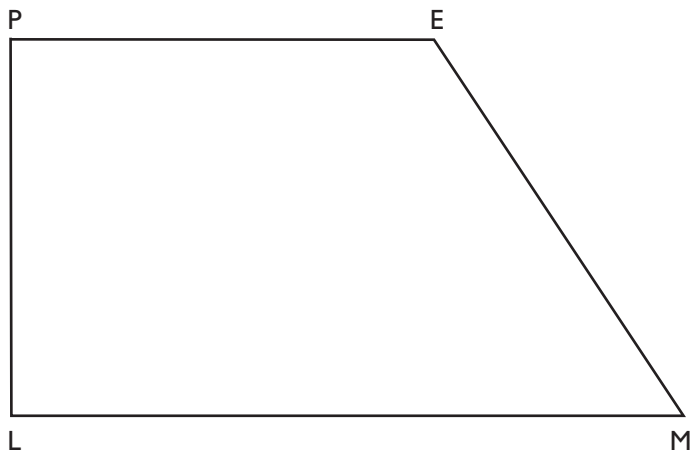
discourse create contradictory subject positions and hence potential for conflict and the experiencing of emotions[2]. Such conflicts can also be precipitated by:

- 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.

Textual analysis

We now turn to analysis of the transcript of two minutes of a video recording of the three boys working on a task introduced by the teacher, with descriptive passages (in italics) drawing upon the video record and annotations by the original researcher including (limited) indications of visible non-verbal activity and gesture. It is an extract from a longer episode during which the students address the following problem: «*Mr. Antonio has a lawn in the shape of a rectangular trapezium, in which the bases are 16 and 24 metres long and the height (PL) is 10 metres. At P there is a pole, and at E a stump […] (see Figure). […] To water the lawn, Mr Antonio has two water "sprinklers", one next to the pole, and one by the stump. […] How far must the sprinklers throw the water to irrigate the whole lawn?*».

FIGURE



The trapezoidal field, Santos & Matos (1998, p. 111)

2. We should note that the pair *insider/outsider*, as student positions, are second order interpretations and presuppose detailed descriptions of subjects' positionings in the practice.

The «realistic»[3] 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. The text is given in Table (see Appendix), together with an overview of the changing positionings of each boy during the episode. This overview allows us to see patterns in the positionings.

Our analysis below identifies (1) the pupils' positionings and (2) indications of emotion (in italic type face).

41-44: Opening moves

The modalities of F's contributions function to position him powerfully, as does his body language: mostly turning towards M, he speaks relatively loudly, only turning to T occasionally. His statement (41) that it is «very simple» can be seen as a claim to authority through knowledge and a position as *evaluator*. By stating and restating the question and by using the imperative «Hang on a second» (44) he positions himself as *leader* of activity in the group.

F's statement (41) might also (not necessarily alternatively) be seen as 'protesting too much', a defence (against anxiety).

M is positioned in a subordinate way as a *follower* and, by asking for direction (43), a *seeker of help*.

M's physical positioning, reading F's copy of the question, suggests a desire for inclusion.

T initially collaborates in following F's directions but then adopts a *solitary worker* position. He is thus shifting between potentially conflicting positions arising from the ambivalent nature of the pedagogic discourse.

T's shifting suggests ambivalence, perhaps a response to anxiety caused by the unfamiliar demands of the local pedagogy – or by confusion resulting from conflict between the official and the local pedagogic discourses. He may also be feeling isolated by F's ongoing bodily positioning (see above).

45-47: Definitions of the problem

T's initial statement (45) with its positive modality can be seen as a claim to authority through knowledge (*evaluator* position), which may have been challenged by F's evaluative «no» (46) and further attempt to direct activity. A review of the video suggests F's «no» may have been in response to M – though it is not clear how T may have understood it.

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

3. The interpretation of realistic problems depends on the pupils' social background and educational experiences (Cooper & Dunne, 2000).

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 the *leader* positioning.

T's adjusted claim (47) has a lower modality, modified by «I think», possibly suggesting that he is deferring to F's challenge. Alternatively, his use of the first person may again indicate withdrawal from the group situation, positioning himself as a *solitary worker*.

T's use of the 1st person may be an indicator of feelings of isolation. However, his moves so far appear cool and rational with no overt indicators of emotion.

48-52: Doing

In this section, F's use of imperatives and normative statements of what «we» do again indicate his position as leader of activity, while M adopts the complementary position of follower.

At the same time, M's 'agreement' or 'confirmation of understanding' suggests a desire for inclusion.

53: Challenge

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 a possible indicator of isolation again, or may be another instance of 'protesting too much', as a defence against anxiety.

54-58: Solution claim and evaluation

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 both initiates the evaluation and at (58) provides explicit criteria for the evaluation, establishing himself as evaluator and as being in control of the knowledge. M, in contrast, echoes F's evaluation without indicating any further criteria and attributes the knowledge explicitly to F (57), evaluating the person rather than the mathematics. His statements serve to reinforce F's powerful position rather than to 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» (establishing links to 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 feelings associated with them.

Here we have evidence of emotion – excitement, indicated by F's speaking faster, the intonation of both F and M (coded in the transcript by exclamation marks on (54) «Quite right!» and (55) «That's it!»), 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, 1999) from youth cultures. And Mario 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

T's questions are ambiguous; they may be requests for help or a bid to participate in collaboration. Alternatively, they may represent a challenge by a would-be *leader/evaluator* to the status conferred upon F in the previous episode (54-58), checking procedures for establishing truth claims, revisiting the domain-specific criteria for evaluation in contrast to M's uncritical acclaim.

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, who is attempting to take up the position of leader/evaluator in a hybrid practice characterised both by the cooperative aspirations of the progressive discourse, and by the competitive relationships, valued within the official pedagogic discourse.

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

Reflections and conclusions

In this paper we have been concerned with the study of emotions in school mathematics. Our analysis shows in general how the ideas, emotions and actions of participants are shaped by the dynamic of interactional practices. Table 1 shows how positions available in discourse can be realised as positionings in practice. The analysis provides evidence of anxieties and excitements felt by these pupils, as well as a range of other feelings and emotions – and shows how these are associated with each participant's positioning in different discursive practices. 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. By analysing the positions occupied by each boy in interaction we understand how hierarchical student positions are (re)produced, as well as the role that emotions and feelings play in adopting or modifying, «submitting» to or making a claim to, a position. Of particular interest is our observation of interplay between discourses of mathematics education and everyday discourses. For Mário, it is through pleasure, associated both with discourses of youth culture and the local classroom practice,

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 theoretical and methodological approach enables us to notice and understand emotion as part of the social and discursive organisation of practice. The structural analysis of positions made available by the pedagogic discourse and other discourses at play, together with textual analysis of their realisation in the positionings of participants, allow a dynamic understanding of the situation. It also highlights 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 pedagogic discourse) and that of *solitary worker* (valued by more traditional pedagogic discourse). The multiplicity and ambiguity of his positioning during the episode may be associated with experience of emotion. In Tiago's case we have hypothesised anxiety, isolation and resistance at various points.

Observing the sequence of positionings of various participants (see Table) also allows us to see how individuals' *identities* are produced. For example, we observe Mário in consistently subordinate positions. Even when some of these positions are valued within local practices (e.g. *collaborator*, *seeker of help*) they have lower status in the other discourses at play and, along with his shift into everyday discourse when acting as *evaluator*, contribute to (re)produce his low status within the group and others' perception of him as a «weak student». This analysis of his positioning supports the interpretation of his overt verbal and bodily expression of delight at the solution of the problem as a process of identification with Filipe, while the repeated moves he makes toward inclusion through submission may suggest some anxiety about his place in the group, and a desire to be included. We therefore suggest that, although he makes bids to be included as «insider», he is always at risk of being an «outsider».

Our analysis of the episode 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: a crucial feature of this is his suggestion that 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 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: the transcript shows that neither delight nor anxiety is expressed in this new context.

There are several notable effects of the teacher's intervention. His enunciation of alternative criteria affects the direction of the students' activity, and his assertion of authority also affects relationships within the group. Interestingly, 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 differing effects of visible and invisible forms of pedagogy 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, Neves & Pires, 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.

At the beginning, we emphasised the relationship between cognitive and affective. The discursive practices in which subjects are positioned shape both the ideas and the anxieties, excitements, resistances, and other feelings that arise. We do not argue that affect can be assimilated to the cognitive. Rather, conceptualising affect and emotion as charges attached to the ideas and the terms in which they are expressed, conveys the notion that emotion is both in principle distinct from cognition and at the same time attached to it, though in fluid and temporary ways.

In this paper we have focused on a classroom situation, rather than the efforts of an individual problem solver. As a result, the findings might seem somewhat restricted: there is little evidence of the pupils e*xpressing* emotion, though a fair number of instances where we argue that it is being *exhibited*. In contrast, Evans (2000), interviewing adults taking mathematics as part of a social science degree, coded all the women, and most of the men, as clearly expressing emotion. After allowing for disparities in age, gender, etc., we would not suggest that participants solving problems in the classroom are actually *experiencing* emotions less than those in interview situations, but would explain differences in observed emotional events in terms of the different discursive practices at play in the two situations. Whatever participants may be experiencing, most school mathematics discourses give little opportunity for

expression of feelings, or else regulate this strictly. This was the case for both the official and the local pedagogic discourses discussed above. In contrast, Evans, as interviewer, attempted to shift the discourse from «college mathematics» to research interviewing, and thereby to position the student as authoritative – about their outside-College activities and their feelings – and to soften fears of being evaluated. The discursive constitution of such a setting appears to provide greater space to *express* feelings.

Our main concern in this paper has been with the development and exemplification of a theoretical and methodological approach to the study of emotion in the mathematics classroom. 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.

This work may also have implications for educational policy and practice. Conflicts between the values of different discourses are familiar to those involved in attempts to reform curriculum and pedagogic practices. Principled structural analysis, as illustrated here, provides a systematic means of identifying the sets of positions available and hence of predicting where ambivalences and conflicts within and between discourses are likely to arise. These can be taken into account in the guidance provided for teachers.

The complexity of relations between the cognitive and the affective points to the problematic nature of attempts by education policy makers to intervene to control emotions in schools and classrooms, and to require teachers to develop the emotional competencies of the students. Such attempts can currently be tracked through terms such as «emotional intelligence», «emotional literacy», etc., which theorise emotions as something that can be taught, learned, and assessed[4]. So while, for example, school leadership literature and policy discourse tends to hold up ever more of the «person» – the emotions – for skilling, recording, and even evaluation against «targets», our concern is rather to further understanding of the role of emotions in teaching and learning. Nevertheless, awareness of the positions made available by a particular form

4. Such structural analysis, including attention to values of classification and framing, can help to identify not only which cognitive contents, but also what norms of social conduct and socio-affective competencies (such as sharing, respect, expressing joy) are privileged by the pedagogic practice that dominant discourse(s) construct (see e.g. Morais & Rocha, 1999).

of pedagogy, and of the spaces within which emotions may arise , opens up possibilities for teachers to consider how to attempt to take account of their students' emotional, as well as cognitive, experiences. Further work is needed to support teachers to do this. , furthermore, 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. For example, in a classroom where «emotional literacy» is emphasised, which different social categories of student (in terms of gender, social class, ethnicity) would stand to gain or to lose?

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* This is a later and more elaborated version of Evans, Morgan and Tsatsaroni (2006). Some of the work for this paper was done as part of the project *Teaching and Learning – Mathematical Thinking*, supported by Portugal's Fundação para Ciência e Tecnologia, grant no. PRAXIS/P/CED/130135/98. Our cooperation with project colleagues, João Filipe Matos, Susana Carreira, Steve Lerman and Madalena Santos, has helped enormously to develop our thinking about this topic (and others).

APPENDIX

TABLE. *Transcript and outline of positionings of the three students through the episode*

		Filipe	Mário	Tiago
Opening moves	*All are working on the first part of the task. Filipe finishes first, puts down his pencil and starts talking, passing to the next question.* (41) Filipe – This is very simple. To what distance should the taps throw the water to irrigate all the field?	Evaluator (Maths) Leader		
	Filipe reads the question aloud while the others are finishing their work, Tiago is the first to follow the reading on his own sheet, then Mário finishes and he too follows on Filipe's sheet. Tiago seems to test something in his drawing with the ruler and stops reading. (42) Filipe – Hum…	Leader	Follower Insider (bid (bid for position)[1] (sharing F's sheet)	Follower *switch to* Solitary worker
	(43) Mário – Now what?		Seeker of help	
	(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.	Leader	Follower	
of the problem	(45) *Tiago – 13 meters it's enough. [This is not a correction of the reading but an answer which seems to have been taken from measuring his drawing.]*			Evaluator (Maths)
	(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 the question with some hesitation. There are some attempts from Mário and Tiago to clarify his reading or to speak.*]	Evaluator (Maths) Leader	Collaborator?	Collaborator?
Definitions	(47) Tiago – Ah!… in the middle is enough, I think. [*Tiago seems to have understood the question in a new way.*]			Evaluator (Maths) Solitary

Doing	(48) Filipe – Let's see *They go back to their notebooks. Mário with the compass, Tiago with the ruler and Filipe looking while he waits for Mário to give him the compass.*	Leader	Collaborator	Solitary worker/ Collaborator?[2]
	(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 opens it, trying one side or the other until he is satisfied with the result.	Leader Helper Evaluator (Maths)		
	(50) *Mário* – And there?		Collaborator/ Seeker of help?	
	(51) Filipe – We do like this… Easy, I have done it minding that piece over there…	Leader Helper Evaluator (Maths)		
	(52) Mário – Ah… [*Mário agrees with Filipe – or confirms that he understood*]	Follower/ Collaborator? Insider (bid for position)		
Challenge	(53) Tiago – But it doesn't get there [*Tiago keeps drawing 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*]			Evaluator (Maths) Solitary worker
	Filipe is drawing. Mário observes very attentively, inclined over the table, with similar posture to Filipe and Tiago.		Insider	

Solution claim and evaluation	(54) Filipe – Quite right! [*Certinho! – subsequent discussion of the translation has suggested that 'Bang on!' might be an appropriate colloquial English equivalent*]	Evaluator (Maths)		
	(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*]		Evaluator (Maths), echoing F Insider (bid)	
	(56) Mário – Quite right! [Certinho!] Fantastic! [*Mário turns his eyes again to Filipe's eyes; he begins smiling, with his right arm touches Filipe on his shoulder for a second*]		*Evaluator (Maths/Person)* Insider	
	(57) Mário – You know! [*said almost in private to Filipe*]		Evaluator (Person)	
	(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*].	Evaluator (Maths) Helper	Submitted to evaluation	
	Mário is listening to Filipe's explanation, his eyes in contact to Filipe's eyes, savouring, delight, submitted? He 'says' yes with his eyes, agrees with his head; he opens and closes his legs in a movement denoting satisfaction.		Seeker of help Submitted to evaluation	
	(59) Tiago – [Leaves his drawing and looks at Filipe's.] So how did you do it?			Seeker of help /Collaborator/ Evaluator (Maths)?
	(60) Filipe – I measured from there to there to irrigate for sure this piece over here...	Helper Subject to evaluation		
	(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.*]	Evaluator (Maths)		
Challenge and justification	*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:*			Evaluator (Maths) Collaborator Seeker of help
	(63) Tiago – So where did you put it? [*There is no answer to Tiago's question.*]			Seeker of help /Evaluator (Maths)?

1. Identifications of Mário's positioning as «Insider» are based throughout on the evidence of his own behaviour rather than any behaviour towards him by the other boys. These instances may thus be interpreted as bids for inclusion.
2. Positioning is ambiguous – as are many instances of T's positioning in this transcript.