Patterns of mediation between students and mathematics in secondary school

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In this paper, I discuss possible mechanisms involved in classroom mediation. I draw from PhD research that examines the observable positive emotions of experienced teachers in action in the classroom to illustrate three patterns of mediation; flipping, chained and distal. Mediation in this context is taken as how teachers actively reconcile two things; in this case students and mathematics such as through modelling engagement. Drawing from Positioning Theory, I examine positioning a mathematics teacher as mediator, in a triangular relationship bridging between students and mathematics. I explore risks inherent in each pattern of mediation in terms of teacher and student affect, and some implications of mediating through play, or temporal mediation between current state and imagined futures of students, both of which act to align students with positive mathematics positions. Teacher patterns that seem supportive of positive student alignment involve continual, rapid, intense, structured and emotionally driven shifting of positions.

Keywords: Modelling; UK Secondary; teacher development; classroom practice; affect

This discussion of mediation uses data drawn from a wider study which investigates the role of positive emotions in secondary mathematics classrooms, through observing the play, modelling and storytelling practices of some experienced teachers applying an Engagement Structures (Goldin et al. 2011) and Positioning Theory (Harré & van Langenhove, 1999) perspective. The data collected from teachers included three phases of pre-observation interview, video of teaching and recording of galvanic skin response (GSR) (discussed elsewhere) and post-observation video-stimulated discussion. The data was analysed in a variety of ways, including examining selected episodes for the changing positions of the teacher and students. This paper focusses on using Positioning Theory with short selected episodes from the classroom, selected by the appearance of positive emotions. Positive emotions are indicated in these illustrations by smiles and laughter from both teacher and students. Arising from the analysis, beyond that presented in the thesis, and that has become the focus for this paper, is how a teacher uses their emotions to mediate between students and mathematics. Mathematics is presented to students in multiple forms, such as existing in textbooks, as new material, as problem solving, or solely as a means to pass exams. Mathematics is not just curriculum, it is 'buying into' a way of doing mathematics that is dependent of the beliefs of a teacher, what the students' goals are, the school context and wider aims. Teachers know that some of what they are teaching does not always have future value for individuals. This discrepancy is hard to reconcile with curriculum and assessment requirements, especially when their first important need is to help the students, and to engage them. Yet teachers still need to mediate between the present and a predictive future for students, so mediation is also a site of irreconcilable differences, which will inevitably evoke emotions (Black et al., 2009).

This difference is one reason why emotions surface as the teacher is juggling and balancing multiple needs on both sides.

Positioning theory

Positioning theory (Harré & van Langenhove, 1999) is used to analyse discourse. In any interaction between people, at any moment, a person takes a position. For example, a teacher might position themselves as instructor, as helper or as a more knowledgeable other. Teacher positioning is continually changing, as others can accept, negotiate or reject both the position of the person speaking or how that person positions them or others. For instance, students could accept an instruction and engage with the task, reject the help proffered by the teacher or negotiate the expected response. Pronoun use is revealing of positions, as is non-verbal communication, whilst video can support identification of assigned positions. If we examine an episode of mathematics teaching where emotions are expressed, then assigning positions reveals how these emotions are used within classroom discourse. In the larger study, there is also collaborative evidence from interviews with the teachers.

Mediation

To mediate is a physiological transitive verb that means to transfer something. To mediate is to act as a medium that transfers something from one place to another in the body, which then needs a mechanism. Mediation is used widely in educational contexts. Here, mediation is the means by which teachers actively reconcile students and mathematics as they are teaching, a means of promoting student access to mathematics. The mediative dimension to the role of a teacher, the skill to modify received information and impart it to others effectively, is why mediation is so important. Not only does mediation influence classroom climate, such as whether and how to listen, manage errors, or attend to what norms are appropriate; mediation also has a temporal dimension, located between how mathematics can be done, is done and should be done. A teacher when mediating is juggling diverse needs and mathematics as it exists in multiple forms, some conflicting, which means emotions inevitably emerge. Further, teachers adapt to the emotions of students, to create a shared 'emotional wave-length', before delivering their message. Yet students can engage in mathematics without the teacher, and teachers engage with students without mathematics (e.g. social and emotional needs) hence the triad model.

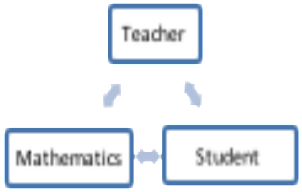

Figure 1: A triad representation of mediation

Patterns of mediation: Flipping, chains and distal mediation

Mediation is integral to the role of a teacher, yet as researchers or teachers, we do not know enough either about how shifting of positions appears for teachers, nor how emotions play a role within mediation. In the teaching episodes studied, there are some patterns that may be common, three of which I propose here for discussion. I argue that experienced teachers mediate by shifting between many forms of mathematics and the many needs of students to achieve classroom balance. Further, that they achieve balance through continual (re)-positioning combined with using positive emotions.

Flipping

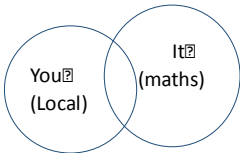

Figure 2: Representing flipping

Flipping is a continual back and forth teacher positioning between students and mathematics. Flipping mediation may be evident through pronoun use, as a stepping in and out of aligning with mathematics. In this pattern, the teacher continually shifts language between 'you' as predominantly local, the students in the room rather than meso-level, (all students) or a global 'you' (all people who do mathematics), and 'it' is objectified mathematics. One teacher in the study, Adam, overtly mediates between his students and himself as a doer of mathematics, a common pattern in his discourse. Adam rapidly switches between aligning with mathematics, taking an active positioning as a doer of mathematics, through to how students should then engage. The extract below illustrates Adam switching between aligning with mathematics as existing, to active modelling of engaging, through to how students should engage. Although a brief illustration, it shows how he rapidly switches position.

SELF/FACT/MATHS	"So what I have written on the board is...."
MEDIATION	"I am going to...."
STUDENTS	"Right, [You] think about this..."

A second example from Adam shows mediation between students and mathematicians as experts as he emphasises the importance of being an expert. The flipping is between himself as expert, student (Amy) as expert and back again. When he returns to the position of teacher, having temporarily passed this position to Amy, he repeats again what Amy has said. His repetition shifts emphasis, realigning with mathematics as exam requirements rather than repeating the procedure as described by Amy. Later when explaining this shift, he says *"So for them to improve, it's often knowing exactly where they get the exam marks from."* This illustration is simultaneously an example of mediation between students and mathematics as an exam. He aligns alternately with mathematics, and then shifts back to aligning with his students (local), telling them what they will be doing in the future. The students accept the future orientated proffered position; *"We've got ages!", "Can we do that again?"*

Chains of mediation

In this pattern, the teacher mediates through formation of 'chains' of positions. In both examples below, as for Adam above, there is a temporal element, a leading forward of students. The 'chains' depend on student responses (acceptance), including an emotional response, so there may be rapid shifts of positions along a chain as continual reacting to student positioning. I illustrate this pattern with an episode from Carol. Carol overtly mediates, there is a physical positioning here as well as she moves from student through task to mathematics in 3 steps; she gathers information by asking questions, intervenes and then directly mediates between students and mathematics (as text) using a textbook example to compare with the student approach. The phases are clearly delineated by pronoun use (Checking – show you – We are looking for – Here is, They've...). Similarly, Edward overtly mediates by shifting position through pronoun use, something revealed using positioning theory. For example, he says in quick succession [added bold emphasis],

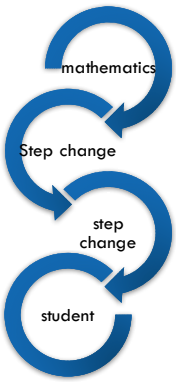

Figure 3: Mediation as chaining

> "Ok. What methods do **we** have for division? What do **you** have for division? **Mark**, what method do **you** have?"

By positioning students as the ones with methods to share or demonstrate, the teacher is facilitator of discussion, the one to be shown the mathematics, and is freed up to comment in relation to both students and mathematics, an ideal meditative role. At the end of the discussion, Edward overtly and explicitly aligns with the requirements of mathematics as exam, as he says,

> "Ok. So you need to be able to do that. You need to be able to divide in order to convert a fraction to a decimal. Ok."

Distal mediation

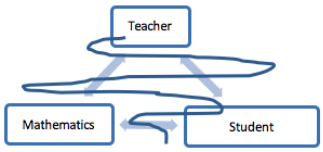

Figure 4: Illustrating distal mediation

This zigzagging form of mediation involves the teacher moving closer to one form of mathematics or other at some points, and closer to student positions at others, less structured than flipping or chaining. A teacher moving away from mathematics, in emotional terms, either draws students closer to engaging or distances the students from the mathematics. Mathematics is both close and distant, experienced and existent and effective mediation provides balance. We have evidence that students value characteristics such as immediacy in their mathematics teachers (Titsworth et al., 2013). Immediacy is the quality of bringing one into direct and instant involvement with something, which gives rise to a sense of urgency or excitement, a quality that makes you feel as though something is happening now and that you are involved in it. A distancing and proximal (immediacy) pattern, here called distal mediation, shifts student engagement closer and further from the mathematics, achieved through a mechanism of teacher positioning and use of positive emotions. The mathematical future for an 11-year-old may be hard for students to visualise, especially that one day they might become a mathematician. Gus uses future imaginative predicting that I think achieves future immediacy in terms of mediation,

> "...and it's... it's making sure you use the vocabulary that maths teachers use. How do you become good at something? You use the right words. You use our language and we [maths teachers] think you know what you are talking about. That's what you do in exams. If you go into a maths exam and use the right words, people assume you are brilliant." (Gus)

Teachers might also position as distant from the mathematics, 'stepping back', which might include a physical distancing by the teacher from the mathematics, a deliberate distancing of self from the mathematics that allows students to take a temporary active position as owner of the mathematical communication. According to Fredrickson (2001), 'stepping back' allows objectivity and the emergence of alternative strategies such as strategic distancing as a skill that develops with experience. 'Stepping back' models for students a deeper form of reflection, one useful for learning. Edward and Adam exemplify distal mediation. In Edward's lesson, he values explaining mathematically. He positions himself at the back of the classroom, whilst the explaining students are positioned at the board encouraging student engagement. Adam achieves 'stepping back' whilst seated at his desk whilst Amy, the explainer, takes her position as expert. Yet in both cases, Adam and Edward achieve a distance from engagement in mathematics that acts to draw students closer to the doing of mathematics and achieves four purposes. Firstly, there is empowerment or ownership. Secondly, the modelling of reflection is enabled. Thirdly, checking of student understanding is facilitated and finally, a potential issue

of leaving out essential information is easily addressed. In both cases the teachers mediate through acceptance of position.

The effectiveness of each pattern

Hardy (2000) identifies three beliefs about the role of a teacher that will inevitably inform mediative actions. These are the expert, as a vehicle for transmission, or immediate arbiter. In terms of mediation, the third implies distal mediation by proximity. I suggest that the most skilful pattern of mediation is distal, as empowering for students and affective. Yet what may be more indicative of effective mediation is exemplified by Adam, who uses all three patterns in just a few minutes. My subjective impression of mediation effectiveness aligns with the fluidity and flexibility of mediation. There is also a future anticipatory sense of pleasure from some patterns of mediation, which assigns value to engaging in mathematics now for future purposes, with an expected future of mathematical engagement appropriate to the student horizons. Valero (in Black et al., 2009) highlights how a teacher's beliefs in mathematics affect the degree of mediation possible. For example, that mediation may function most effectively if mathematics is seen as a 'malleable entity' (p.216).

Risk and the role of emotions in mediation

Assuming affect is a mechanism of mediation, then effective mediation requires emotional effort, and mediation occurs only if emotions are engaged. If we position positive emotions as a mechanism for mediation, then, especially for distal mediation, the question becomes whether there is an ideal positioning, or a limit, past which mediation loses effectiveness and hence entails risk. Similarly, there is further risk in immediacy, as some patterns are more demanding of the emotions of the teachers. For example, proximal positioning that encourages immediacy, may be more stressful for a teacher. Freddie, in an episode from his lesson, positions himself as a student, in passive proximity during an activity. Later he says he felt like a 'plum', suggesting it was internally stressful to take such a position.

There is an expectation of mediation as integral to the teacher role. There are then implications if a teacher does not mediate, and abrogates this element. For example, lack of emotional engagement may interfere with mediation. Bertha, who finds behaviour for learning challenging, mediates relatively simply. In the episodes, between the mathematics and herself as teacher, is the authoritative 'other' of a website. Mediating in this case is between mathematics as existing via an authoritative website via self as overt mediator and students. Bertha positions herself as data recorder in another lesson, so she is not quite positioned as teacher, which limits her mediation. The effect, combined with some negative emotional expression, is to locate mathematics as having to be done, but not enjoyed.

Implications and future development

In the examples above, there are many arrangements of mediation, from I have selected three overlapping patterns of mediation to discuss, that I have called 'flipping': a continual back and forth positioning between students and mathematics in various forms; secondly 'chaining', where a more temporal mediation occurs; and seemingly most common, at least in these illustrations from teaching, a distancing and proximal pattern of mediation here called 'distal', mediation which shifts student engagement closer and further from the mathematics, achieved through a mechanism

of teacher positioning and use of positive emotions. It seems that mediation, through positioning, acts to guide students into structures that are more (or less) supportive of learning mathematics. The evidence is based on short episodes of teaching for each teacher, chosen by the teacher showing emotions. Adam, in a small sample of his teaching, uses all three patterns of flipping, chaining and distal, which implies skilful mediation. Consequently, and subjectively, my impression of teacher effectiveness is based on the degree of fluidity and flexibility of mediation. As a researcher, the use of positioning theory has revealed for me the shifting patterns of mediation, a continual positional juggling undertaken by a teacher. I do not suggest here that the patterns are exhaustive, or apply where emotions are not expressed, but that such examination may be a future research direction. My work with both experienced and trainee teachers suggests that mediation patterns may differ for early career teachers, and that paying attention to mediation may be useful for professional development.

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