

## **THE ANATOMY OF A BID: FROM TTA TO ESRC - looking at the developing algebraic activity in 4 year 7 classrooms**

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**Abstract:** *The starting date of our ESRC small grant project (R000223044)<sup>1</sup> was 1st October, 1999 and is titled: Developing algebraic activity in a 'community of inquirers'. The successful ESRC bid uses an enactivist theoretical framework and methodology. The enactivist framework is discussed, particularly illustrating how our ideas have developed over time, especially from a TTA Teacher Research Grant, and how the theoretical frame links to the methods used. We are developing methodologies for describing the complexity of teaching and consider the research to be transformative for the researchers, but continue to ask ourselves what are the research products for such a framework?*

### **1 What do we believe?**

There are no certainties in teaching and learning. Learners do not have the same experiences from the same lessons. A teacher cannot be presented with the same situation twice in which to act. What we experience through our actions is an interpretation which is a product of the patternings laid down by the whole of our past. Hence two people cannot see the same thing nor share the same awareness.

However, we can communicate because we can talk about the details of common experiences and in doing so the gap between interpretations can be reduced. In this way the possibilities for personal change of habitual behaviours can be raised and alternative perspectives may be appreciated. All we have to work with is what people do, what people say they do and other people's interpretations of what people do and say they do.

How the lack of certainty is handled depends on the individual. As a teacher it is possible to exert sufficient control in a class to make it appear as if lessons are the same. However, we believe that the experience is still different for the individual pupils. Our way of handling this is to let go of the need for theories about the best way to teach and instead learn through the experience of teaching. We tell stories about the classrooms we work in, giving an 'account of' incidents through staying with the detail before 'accounting for' the observations. Although we can often agree the details of a story, it is in the richness of different interpretations that we develop the possibility of new awarenesses in action (Discipline of Noticing, Mason, 1994). These rich interpretations are often informed by the work of others, and we become more aware of those perspectives that we continue to find useful over time within our interpretation of events and which work to develop our practice and refine our observations. Other perspectives used in 'accounting for' events simply atrophy.

### **2 Looking back to look forward**

It was often hard to argue a methodological framework for such research although we were aware that our practices developed and there was little separation of theory and practice. We often questioned why anyone else would be interested in the development

of two individuals, one a teacher (now also a researcher) and one a teacher-educator (now also a researcher and teacher) (Brown (with Coles), 1997, Brown and Coles, 1997a, b). Here we develop a story of how such beginnings have culminated in an ESRC funded small-grant project (Developing algebraic activity in a 'community of inquirers', R000223044, start date 1/10/99).

Laurinda, 1995

I went to a PME conference in Recife, Brazil where there was a discussion group on something called embodied cognition. The phrase enactivism was being used for a theoretical frame where cognition was seen as 'embodied action' (see Varela et al, 1995). Most people in the group did not know much about what all this meant but the discussion group worked with the ideas presented by Raphael Nunez, Laurie Edwards and David A Reid. Although the terms and descriptions were strange there was an underlying comfortableness about enactivism for me and on return to the UK I read *The Embodied Mind* by Varela, et al (1995) and later *Women, Fire and Dangerous Things* by Lakoff (1987). My research before going to Brazil had been about how new teachers articulated their practice making statements (which I called purposes) which helped them to learn through experience. These statements eg how do I know what they know? serve to provide a focus in the student teachers' planning for action which accrues a range of behaviours over time which can be used flexibly and automatically in the classroom. There is a sense of these 'purposes' being between detail (practice) and abstraction (theory, images of mathematics and mathematics teaching). In my reading I came across Rosch's work on colour and basic-level categories which she defines as 'the generally most useful distinctions to make in the world' eg chair, boy (Rosch quoted in Lakoff, 1987, p. 49)) which exist between the abstraction of superordinate categories (furniture, mammal) and the detail of the specifics of particular chairs or people. The basic-level categories are related closely to actions because chair brings specific sensorimotor actions with it (most notably 'sitting!') At a gut level I know what to do with a chair. The student teachers accrue actions to go with 'How do I know what they know?' This resonated strongly with my own beliefs in the importance of working with interpretations of what people do and our previous statement of methodology:

*'We work within what Bruner (1990) called a culturally sensitive psychology: (which) is and must be based not only upon what people actually do but what they say they do and what they say caused them to do what they did. It is also concerned with what people say others did and why ... how curious that there are so few studies that (ask): how does what one does reveal what one thinks and believes (p.16-17)'.*

I returned from Recife having effectively found a theoretical frame and a methodology in one package. But I could not have recognised this without those past experiences which resonated in the meeting.

Alf, 1995

In my first year of teaching I was acutely aware of a large gap between my theories and ideals of what a classroom could be and the evidence that was daily in front of me. I made global judgements of lessons (eg that was awful!) and did not have a sense of

learning from these experiences. I started working with Laurinda shortly after she returned from Recife. I found initially that the discipline of holding off judgements of lessons and focusing on moments, on details, allowed me to begin to view what was happening in a different light. Rather than a debilitating awareness of how far what I saw was from what I wanted, I began to work on alternative actions and observed the differing results. As our work developed into co-teaching and co-researching I became aware of some of the theoretical ideas behind the transformations I was experiencing. However, unlike the theoretical ideas and ideals I had when I began teaching, these ideas could not be separated from what I did. For example, in my planning, a question I began to always ask myself was: what purposes do I have in this lesson (eg 'finding ways of sharing responses', 'can you convince me?') and what over-arching purpose can I make explicit to the students (eg 'in four lessons time I will write up the equation of a line and my challenge will be: can you tell me where it goes without having to plot it?').

It was out of these strands that we developed a Teacher Training Agency (TTA) Teacher-Research proposal. The sense of how to work with children using the simplest distinctions in the world so that they could organise their own behaviours in relation to such purposes as 'getting organised' or 'looking at simpler cases' seemed to fit with the TTA's pedagogical focus and our interest in children developing a need for algebraic thinking, which, for us, underpins the whole of mathematics. In the TTA project we offered the pupils the task for the year of 'becoming a mathematician' as a strategy for them entering the 'community of inquiry' (Coles and Brown, 1998). In what follows, we will first state some principles of enactivist research and then illustrate how considering these led us to the outline of our current work on an ESRC small grant project, showing the links between the theoretical frame and the methodology. We are still working on developing cultures in which children themselves find a need for using algebra but as we work our sense of what constitutes algebraic activity and how we recognise 'need' emerges with more connections and lightings. For instance one story which we tell of how a need for algebra arose was when Alf, who had worked with a purpose of 'can you convince me?', recognised in children spontaneously asking 'why does that work?' the motivation to give them a proof (Coles and Brown, 1998). The children saw the algebra doing something they could not do without it and some of the pupils went on to develop their own proofs eg of number tricks, without being led by their teacher because they needed to know 'why?'.

### **3 Being an enactivist**

There are four main principles (adapted from Varela, 1999) that inform what we take to be an enactive position:

- cognition is embodied action; that is, perceptually guided action. We cannot take in the details of everything that is happening around us. We are naturally selective since there is a limited capacity to that which can take our attention. What we notice and the connections we make guide our actions, often implicitly.
- for each individual it is all their past experiences which inform the present complex decision-making

- 'multiple views' are sought of events which in practice implies two major considerations:

- a) taking one incident or 'account of' and interpreting it through different views
- b) deliberately seeking a range of different people's views over time.

What seems important here is that overlapping themes emerge over time.

- From these overlapping and interconnecting themes, theories which are 'good enough for' (Reid, 1996) a purpose emerge. There is no sense of there being a 'best' theory. Having a range of possible ways of acting seems useful at different times: different actions are taken for different reasons.

These four principles have been translated into methods which support a research design which acknowledges that there will not be one correct answer. We are working in the classrooms of 4 teachers (one of whom is Alf Coles who is also a named researcher on the project) to investigate the samenesses and differences of the developing cultures within their classes of year 7 pupils in relation to 'becoming a mathematician' as what mathematics lessons are about. There are 4 researchers on the project (the authors of this paper with Jan Winter and Ros Sutherland). So, there are 7 people who will meet together for 6 day meetings during the year and have e-mail access to each other to keep an interaction with the data emergent. The aims of the project are:

- 1) To create year 7 mathematics classroom cultures which provoke a need for algebra.
- 2) To investigate the similarities and differences developed in each of the teachers' classrooms.
- 3) To investigate the nature and extent of the support needed from the collaborative group of teachers to plan their classroom activities starting from the students' powers of discrimination.
- 4) To develop theories and methodologies to describe the complex process of teaching and learning. <sup>1</sup>

Multiple views of the data are ensured in three ways:

- once each half-term Jan interviews 6 pupils of each teacher; Laurinda interviews the teachers and Ros organises a videotaped lesson.

- Alf, Jan and Laurinda are responsible for tracking (lesson observations at most once every fortnight) particular teachers and so, through their observations of lessons and reading of the interview transcripts, they will be building up stories about their teacher and will find connections from such a perspective when there are interacting strands.

- all the written work is collected for the 6 pupils who are interviewed and also all pupils write about 'what have I learnt?' at the end of each activity and all these writings are collected

- the researchers are responsible for interrogating the data under particular strands: ie Laurinda, metacommenting (Coles and Brown, 1999), Jan, pupil perspectives, Alf, teaching strategies, Ros, algebraic activity and comparing and contrasting the developing cultures in the classrooms and Laurinda and Alf, use by the teachers of 'samenesses and differences' in planning lessons to use the children's powers of discrimination.

As theories which are 'good enough for' emerge they are themselves tracked for their continued existence and use within the developing cultures eg during the TTA project we started to be aware of same/difference in lesson planning which has become a theory which is 'good enough for' at the start of the ESRC project. Similarly the concept of metacommenting emerged from the TTA work and proved an organising principle for the ESRC bid. As Alf became aware of the strategies he was using which were effective in supporting his purposes of 'sharing responses' say or 'asking why or convince me', we became aware that some of the children were starting to have such organising principles themselves as evidenced in their writing on 'what have I learnt?'. We called the comments which Alf used to draw the students' attention to a particular strategy being used to good effect, a metacomment, and were interested in collecting instances of their use.

In the ESRC project we are investigating a range of issues with more people and, since the data will be interrogated by 4 people, observers write field notes of lessons which, as much as possible, stay with the detail - the 'account of' (Mason, 1994) - ready for later interpretation. The videotaped lessons are used for individual viewing and, in shorter extracts, for group viewing and themes emerge through interaction. These themes feedback into our practice, as researchers and teachers.

The data is a journey which we interact with over time, there are no events as such, simply patternings.

#### **4 Where we are**

The research design fitted in with our conceptual need to stay with the complexity of the teaching and learning of mathematics and develop our methodological approaches as we do the project. We are not expecting any absolute theories to emerge. We are, however, interested in how the teaching strategies and approaches to developing a community of inquirers in a mathematics classroom through the purpose of becoming a mathematician, develop different cultures in the four classrooms. This sense of history is important to the work. The teachers involved emerged from being on the steering group of the TTA research. We see the research as being transformative for us all, teachers and researchers, but continue to ask ourselves questions about the products of such research.

In the second whole day meeting of the group of teachers and researchers, having watched two contrasting videotape extracts and worked on discussing the samenesses and differences between them we started to talk about the two teachers being 'fuelled by the kids' and worked on observing teaching strategies which supported this. In this way a teaching 'theory', developed out of same/different, allowing the possibility for extending our range of practices as teachers, which then feeds back into how we think about the 'theory'. The purpose of 'theorising' in this way, developing a common language, is so that we can develop our teaching practices in a way that supports pupils' algebraic activity. It is also clear that the language we are developing is only useful for the group of us who went on this particular journey and the process of creating these shared meanings is what is important.

As we struggle with what the products of research such as this are it becomes clearer that they cannot be such awarenesses as these teachers being 'fuelled by the kids' and related strategies because the connections which we make with such statements are too complex to report since they are lived. It does, however, seem important to document the process and then other groups can develop the ideas through their own contexts and perspectives. At the day meeting of BSRLM we asked for feedback on what participants thought products might be and a comment was made which we have asked ourselves 'Why isn't this just anything goes?' If we are making distinctions in our world about pupils learning mathematics and engaging in algebraic activity then we will notice those things which we believe makes this more effective. We cannot take our own beliefs about mathematics and the effective learning of it out of the frame. This is part of being an enactivist researcher. However, even though this is the case we are also being influenced by each other as teachers and researchers and by the pupils themselves from their written and oral work in the videotapes. When we are asked to report the distinctions we are making in our world (basic-level categories, Rosch, quoted in Lakoff, 1987), to see what is the same and what is different, whether we are pupils observing the structure of a problem or adults involved in a research project, we do not engage with or discuss the arbitrary.

We hope to give regular reports to BSRLM as this project emerges over the year.

1 'Developing algebraic activity in a 'community of inquirers'' Economic and Social Research Council (ESRC) project reference R000223044, Laurinda Brown, Ros Sutherland, Jan Winter, Alf Coles. Contact: Laurinda.Brown@bris.ac.uk or Laurinda Brown, University of Bristol, Graduate School of Education, 35 Berkeley Square, Bristol BS8 1JA, UK

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