PROMOTING POWERFUL POSITIVE AFFECT: USING STAGES OF CONCERN AND ACTIVITY THEORY TO UNDERSTAND TEACHERS' PRACTICE IN MATHEMATICS

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This paper describes how one teacher's attempts to promote powerful positive affect in her mathematics classroom gave rise to concerns and tensions related to her practice. The paper shows how using a combination of Activity Theory and the Stages of Concern provides a helpful lens for researchers to understand the challenges of change and professional development. It is argued that the identification and resolution of these tensions is crucial to understand and facilitate the efforts of sustainable pedagogical change.

Introduction

Researchers such as Goldin (2000) and Epstein et al. (2007) have identified a need for teaching strategies that incorporate the affective domain into the mathematics classroom to promote powerful positive affect (PPA), or "patterns of affect and behaviour that foster children's intimate engagement, interest, concentration, persistence and mathematical success" (Alston, Goldin, Jones, McCulloch, Rossman, & Schmeelk, 2007, p. 327). The use of PPA is proposed in response to suggestions that essential affective elements are often considered to be an incidental 'add-on' to mathematics learning (Goldin, 2007).

Affective elements are commonly defined as encompassing feelings, emotions, attitudes, beliefs, and values attached to a subject or object (Leder & Forgasz, 2006). Challenges arise as teachers attempt to implement new teaching strategies and tools that reveal the affective dimensions of students' thinking, perhaps because teachers perceive these to be additions to their existing practice rather than integral aspects of student learning. Currently, tools include student surveys (Fennema & Sherman, 1976) and journaling activities (Jurdak & Zein, 1998; Scott, 2007), but there is a need for professional development (PD) and strategies that involve teachers' own perspectives and experimentation with tools (Flack & Osler, 1999; Smiles & Short, 2006).

This paper argues that developing teaching strategies that promote PPA requires a research approach that is sensitive to the affective dimensions of teachers' perspectives, professional development, and learning. According to Hall and Hord (2006), teachers approach PD and classroom change with many thoughts, feelings, and concerns due to the affective dimensions of change. Change implementers do not simply 'do' the change but are constantly thinking about how the process is unfolding. This research explored

whether it is helpful to refer to stages along a developmental continuum and sought to identify the characteristics of each stage as teachers attempted to modify their practice. The identification of teacher's individual concerns and the resolution of tensions related to the promotion of PPA in their mathematics classroom were fundamental.

This study is part of a doctoral research project that has adopted a critical ethnographic case study approach to examine how teachers promote PPA over a six-month period. While descriptive, ethnography essentially means "learning from people" (Spradley, 1980, p. 3), and was chosen for two reasons: (a) teachers are the key to teaching and learning processes in mathematics; and (b) their perspectives and knowledge are often neglected in education research. In this study, the participants were empowered through valuing their voices in the analysis and presentation of the results (Kincheloe & McLaren, 2005). The researcher explored and acknowledged the "self-other interaction" (Foley & Valenzuela, 2005, p. 218) and was self-aware of her role. Her positioning in the research was upfront and acknowledged (Kincheloe & McLaren, 2005).

This paper highlights the tensions and concerns of one participant as she attempted to promote PPA. The participant worked collaboratively with the researcher over a six month period to contribute to the theorising about her work by focusing on the interaction between her thoughts, affect, and actions and the factors that facilitate and constrain pedagogical change (Mahn & John-Steiner, 1998).

The theoretical framework: Activity Theory and Stages of Concern

This paper specifically reports on the use of Activity Theory (AT) and the Stages of Concern (SoC) to investigate one case study. The essence of these theories is presented below.

Activity Theory. Activity Theory provides a versatile tool to inquire into aspects of mathematics education, and its value is well documented (Daniels, 2001; Fai-Ho, 2006; Hardman, 2006). The main unit of analysis in AT is the activity system (Engeström, 1999). A model of the Third Generation Activity System, which is intended to develop conceptual tools to understand dialogues, multiple perspectives, and networks of interacting activity systems, is represented in Figure 1.

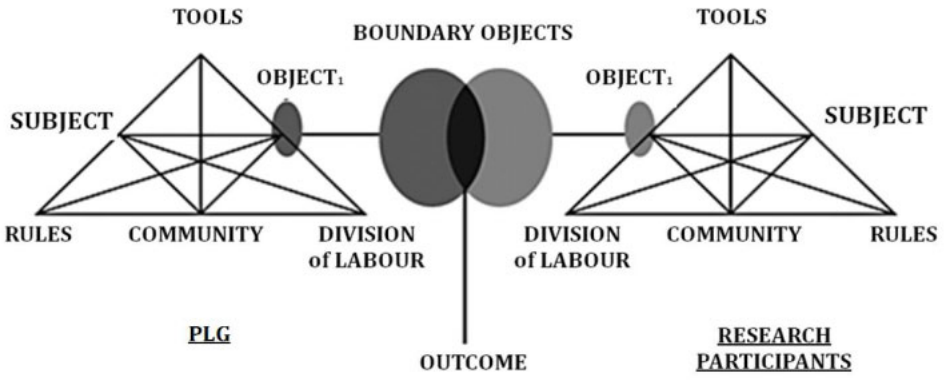

Figure 1. Third generation Activity Theory (Engeström, 1999).

The Subject node refers to the individual or group whose point of view is taken in the analysis of the activity. The identity and activity of the Subject is directed towards the

Object node or goal and is transformed into Outcomes with the help of physical and symbolic external and internal Tools that mediate the Object into an Outcome (Engeström, 1993). Thus, the Object embodies the meaning, motive, and purpose of the system. The base of the triangle represents the contextual characteristics of the activity system. The Community node refers to the participants who share the same general Object with the Subject. The Division of Labour node refers to how tasks are divided between community members. Rules are explicit or implicit regulations, norms and conventions that constrain actions and interactions within the activity system (Centre for Activity Theory and Developmental Work Research, 2003). Boundary Objects operate at the interface of different activity systems. For example, if teachers engage in discussion, debate and reflection whilst participating in professional learning groups, then their learning may be expanded beyond what is possible within their own classroom activity systems (Russell, 2002).

Stages of Concern. The Stages of Concern is a helpful construct to monitor, describe, and quantify the emotional part of change that is often neglected, with resulting arousal of unnecessary resistance to an innovation (Hall, 2010). The SoC describe a predictable pattern of developmental stages that teachers move through as they become increasingly sophisticated and skilled in using new innovations. The seven stages are: (0) Awareness, (1) Informational, (2) Personal, (3) Management, (4) Consequence, (5) Collaboration, and (6) Refocusing (Hall & Hord, 2006). The first stage typifies little concern or involvement in an innovation. The second and third stages involve "self" concerns that focus on teachers' personal feelings of uncertainty and a need to find out more about the innovation such as its general characteristics, effects, and demands. The third stage is "task" oriented, where attention is focused on the processes and tasks of using the innovation and issues related to efficiency, organisation, management, and time. The last three stages are "impact" related concerns that deal with teachers' external concerns about how the innovation may affect students, colleagues, and future work. At the final stage, individuals have definite ideas about major changes or powerful alternatives to the existing form of the innovation (Hall, 2010; Hall & Hord, 2006). It is noteworthy that progress through the stages is not guaranteed and is not necessarily in one direction.

Methodology

Data were collected using two individual interviews at the commencement and one at the conclusion of the study, three to five classroom observations interspersed throughout the six months, reflective journals, and eight group interviews as part of a Professional Learning Group (PLG)—a process of collective and collaborative learning with people "who share a concern or passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2004). The PLG was a safe and supportive environment, meeting approximately every three weeks. It provided participants with opportunities to engage with current literature and to develop and reflect on tools to promote PPA.

Data analysis was a cyclic process involving both AT (Engeström, 1987) and SoC (Hall & Hord, 2006). AT focused on the identification of attempts to change behaviour in the activity system, whilst the SoC focused on identifying the affective aspects of change. All data were transcribed and coded into themes based on the nodes from AT

using NVIVO7, a computer software program. The data were first analysed using AT and then again using the SoC. There was movement back and forth between the two theoretical lenses.

The use of AT and SoC complimented each other in two main ways. Firstly, the SoC was useful for refining the analysis of tensions identified using AT in the first round of analysis, by providing further detail about the affective aspect of change related to how participants felt about the implementation of a particular PPA innovation. Secondly, data analysis using the SoC provided more description of the tensions and in many cases highlighted tensions, which had not been revealed by using AT alone. This prompted further analysis using AT to analyse the transcripts and individual nodes related to the new tension to confirm if this tension was associated with attempts to change behaviour and teaching practice.

The SoC lens is used first in the following discussion of the case, to understand and describe the participants' concerns and affective aspects of change. Then AT is used to refine and theorise attempts to change behaviour and teaching practice in the activity system to promote PPA.

Theoretical analysis and discussion

"Leonie" has been teaching for 17 years in various school settings, and at the time of the study was a contract teacher at "Hillsview Primary School" located in Adelaide, South Australia. Leonie taught a Year 3 class in tandem with her colleague, Violet. In her first interview, Leonie portrayed strong images of not being "good at maths" and described that her learning of mathematics "didn't come easy". These negative perceptions and experiences resulted in a lack of confidence, which appeared to contribute to her many concerns as well as tensions within her mathematics teaching practice. Leonie identified the use of concrete materials, reflection and mathematics story books as useful innovative tools for promoting PPA in her mathematics classroom. Leonie appeared enthusiastic about experimenting with different tools to promote PPA. However, she also raised concerns about making changes to her practice: lack of time to accommodate new tools into the school day and a need to maintain classroom order.

Leonie's First Dominant Concern: Lack of time for implementing new tools being shared at PD sessions. Leonie explained this concern at the beginning of the study during her second interview:

> How do we bring it [new tool] in? We've got to let something go and it's making those choices about what we let go in order to fit this into our day because everything we're doing is really important … but this new bit of information is important, really important as well, so how do you make those choices within the time constraints?

This suggested that Leonie is struggling to prioritise the teaching strategies and tools she needs to use, as 'everything is important'. At this stage, Leonie is attempting to promote PPA by using new tools in addition to her existing practice. This is causing a tension related to a perceived lack of time to 'fit' everything in. This aligns with Dennis and O'Hair (2010) who suggest perceived time constraints are a significant concern that influences the use of teaching strategies. However, the results of the study presented in this paper suggest that a PLG can support individual teachers in overcoming concerns about time because the PLG responded to Leonie's concerns about time constraints. The

PLG discussions revealed this concern was not just individual, but collective. Connections across the curriculum were suggested by participants as a potential solution. In particular, the use of mathematics story books and journaling were considered to have strong connections to literacy activities, thus relieving timetabling tensions with a lack of time to fit 'everything' into the school day. The PLG supported Leonie in meeting her individual PD needs according to her concerns.

Leonie's Second Dominant Concern - Maintaining a high level of order within the classroom. During a PLG meeting there was a discussion about the use of dialogue to enhance student learning and reflection in mathematics and the problems Leonie had encountered when implementing this tool. Leonie stated:

> Talking is crucial, but how often do we let them talk about maths and their learning? We often say as teachers that the classroom is too noisy. People are coming into the school and we want to keep the students settled – we don't want them talking. We have that constant struggle with our identity as teachers, you know, we want them to talk but we want them to be quiet, we want them to be hands-on and explore things but we want them to stay in their desks and not to touch or annoy other people. There's always that contradiction in teaching … it's not always easy as a teacher … especially when we have people walking into the room – it looks like total chaos (PLG2).

Leonie seemed concerned about how this tool would affect her personally and her reputation as a teacher. Her use of the pronoun "we" suggests that she believed that others shared her concern. She did not want her classroom to look chaotic even if it was for the benefit of her students. In fact, Leonie's concerns about a perceived need to maintain order remained evident at the conclusion of the study but it appeared that she felt that a lack of order was acceptable at times. Leonie explained in her final interview:

> There's a fair bit of pressure from parents and staff … especially in maths – that it is done in a particular way. … Now having been through this process, it's ok to have lots of noise. … You feel that pressure to have kids quiet because you might walk along the corridors and all the other classes are quiet. I think: Why is my class so noisy? There're other classes that are probably noisy but I just don't walk past them when they are.

As discussed in the PLG, the importance of social interactions and talking are emphasised in policy documents and mathematics education research: for example, the *Learner Wellbeing Framework for Birth to Year 12* (Department of Education and Children's Services, 2007) and the *Aspects of Working as a Mathematician* model (Grootenboer & Jorgensen, 2009). By the end of the study, Leonie was aware of the value of social interactions and dialogue and this influenced her valuing of these aspects in her classroom, even if this meant that her classroom appeared chaotic at times. The quotation above suggests that Leonie was approaching a resolution to the tension related to the need to maintain order in her classroom by coming to terms with her personal concerns about the expectations of others.

Applying the lens of the SoC (Hall & Hord, 2006) to the case study of Leonie, it appeared that Leonie's concerns were characteristic of Stage 3 Management and Stage 2 Personal concerns. Specifically, Leonie's first dominant concern related to a perceived lack of time to accommodate new tools or strategies to promote PPA into the school day was characteristic of Sage 3 Management concerns from the "task" area, as Leonie focused on implementing a range of tools, teaching strategies and issues related to efficiency, organisation, management, and time to 'fit' them into the school day.

Leonie's second dominant concern suggests a Stage 2 Personal concern that involves personal feelings of uncertainty and a need to find out more about the innovation: the value of social interaction and talking, as identified in policy documents and research. Later, there was evidence that this concern transformed into Stage 3 Management concerns where she was focused on managing the learning environment and accepted a noisy and chaotic classroom at times. Throughout the study, Leonie expressed inconsistent glimpses of Stage 4 Consequence, focused on the effects of new tools or teaching strategies on her students. These Stage 4 Consequence concerns were evident in some PLGs as well as a journal entry where she wrote:

> The impact the PLG meetings are having on my mathematics teaching is significant; especially in the way I view the children in the mathematical process. I reflect on, and try to pick up on, how they are feeling. It has made me realise how important the reflection process is for all students and myself and not only in mathematics but all [learning] areas (Journal 5).

However, higher-level concerns appeared inconsistent and not representative of the majority of concerns evident in her interviews, PLG sessions or classroom observations.

In summary, overlaying the theoretical lens of AT to the case study of Leonie and her two dominant concerns, revealed how Leonie's engagement in discussion, debate, and reflection whilst participating in the PLG supported her to expand her teaching practice in her mathematics classroom. In particular, rather than simply identifying the stage of concern, the use of AT enabled the researcher to analyse and theorise the related tensions that may extend beyond the direct control of teachers in their classroom. From this position, the focus could turn to investigating with participants the possible ways to resolve these tensions and facilitate further insights and improvements to teaching practice. The addition of AT with the SoC was very powerful and valuable during the data analysis and discussion as it revealed new insights into promoting PPA and challenges that would not have been possible without the use of the two lenses in combination. The SoC provided ways to identify concerns that were associated with tensions in teachers' practice and the use of AT enabled the exploration of the nature of these tensions. AT enabled the researcher to customise the PLG meetings to meet the individual needs of the group as a collective.

Tensions in Leonie's Activity System

There are three tensions evident in Leonie's Activity System related to the two dominant concerns identified above.

The first dominant concern has two related tensions in Leonie's Activity System. The first tension in Leonie's Activity System is between Leonie (the Subject of her activity system), the Tools and the Object of promoting PPA (Figure 2, Tension 1). This tension originates from the agreement of the PLG about the shared Boundary Object. As a consequence, Leonie struggled to use different tools in ways that could achieve the Object but 'fit' within the time constraints of the school day. The implications of this tension suggest that Leonie would benefit from support to identify which aspects of the school day and activities need to be her priorities and which aspects she could combine or remove. Alternatively, there may be aspects in her practice that could be better organised and managed to make it more time efficient. For example, time taken for journaling and the use of story books to promote PPA in mathematics could also be

considered literacy activities. This is not an aspect that is currently addressed in the existing range of tools recommended to teachers, however it is a topic well suited to PD and PLG discussions located at the school level.

The second tension in Leonie's Activity System related to the same concern is between the Subject, Tools and Boundary Objects for both Leonie and the PLG (Figure 2, Tension 2). The PLG discussions were often guided and informed by teaching strategies or tools recommended in the literature. This tension suggests that the tools identified in the literature to reach the Object of promoting PPA (including surveys and journals), were designed by researchers for teachers, resulting in teachers being consumers of the tools. This resulted in some teachers feeling uncomfortable in their use of the tool resulting in some resistance to adopt and 'fit' the tools designed by others into their classroom teaching or their individual activity system. This suggests that further research is needed to investigate if PPA tools created by teachers for teachers would be more readily adopted in classroom practice.

The third tension in Leonie's Activity System relates to the second dominant concern, and it is between the Subject and the Community (Figure 2, Tension 3). As Leonie attempted to change her mathematics teaching practice, this tension appeared to have originated from outside of her classroom. Specifically, Leonie (Subject) was aware of expectations from parents and staff (Community) for mathematics to be "done in a particular way" and for the classroom to appear well managed with students seated quietly at their desks. Yet Leonie explained that in her view, there is benefit for students to make "noise" because dialogue and talking are important affective elements to include in the mathematics classroom. The identification of this tension suggests there is an opportunity for parents and staff in general to review and challenge the perceptions of the characteristics of learning environments that promote PPA. Again, this aspect is not currently addressed by the tools recommended to teachers. It is a well suited topic for investigation as part of teacher PD and PLG discussions at the school level.

The three tensions in Leonie's Activity System are represented in a Third Generation Activity System in Figure 2. The first tension is labelled with a number 1, the second tension is labelled with a number 2 and the third tension is labelled with a number 3.

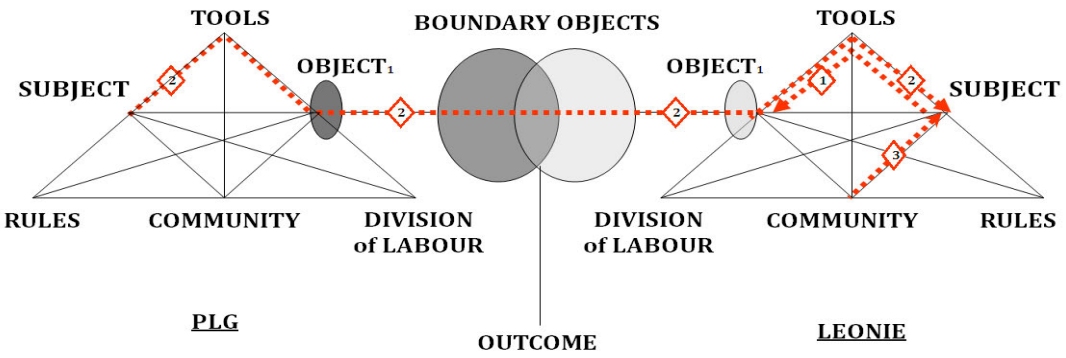

Figure 2. Leonie's activity system and tensions.

In combination, the use of the theoretical lens of AT and SoC reveals how Leonie's engagement and participation in the PLG supported her to address her concerns and expand her teaching practice in her classroom. In particular, the SoC provided a lens to

understand where these concerns were situated in the change process when attempting to implement a new innovation and make a change in practice. The use of AT focused the researchers' attention on tensions within and beyond the direct control of the research participant in their classroom.

Implications and conclusion

The addition of the SoC with AT proved to be a powerful and valuable combination during the data analysis and discussion stage of this research as it revealed unexpected insights and challenges related to the promotion of PPA that may not have been possible with the use of only one theoretical construct. Specifically, the SoC served as a valuable construct to monitor, describe, and quantify the affective part of teachers' implementation of tools for promoting PPA while AT facilitated the examination of the promotion of PPA in terms of a complex system. Together, these constructs supported the researcher to look beyond a narrow focus on tools used by teachers in classrooms and to value teachers' voices to theorise the dialectical relationship between teachers' perceptions, affective responses, motives and actions that support and constrain pedagogical change. This paper has drawn attention to the value of the SoC and AT as a combination of theoretical tools with which to understand and analyse teachers' concerns and tensions in relation to the promotion of PPA in mathematics classrooms.

The use of the SoC and AT in combination together with PLGs has potential use in further research as a means of investigating and understanding teachers' tensions and concerns related to teachers implementation of tools and innovations towards the promotion of powerful positive affect in the mathematics classroom.

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