Teachers Research their Practice: Developing Methodologies that Reflect Teachers' Perspectives

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In this study eight primary school teachers formed partnerships with researchers to investigate the use of questioning during two numeracy lessons. The teacher researchers were encouraged to act as reflective practitioners (Schön, 1995) and contribute to formulating their own "interpretive frames" (Cochran-Smith & Lytle, 1990). Methods of data-gathering, analysis and interpretation were developed to allow the teacher researchers to have control over the research and contribute to the direction of the project as it evolved. This paper describes some of the challenges faced by both the teacher researchers and the researchers in developing partnerships. It also discusses how the methodologies allowed teachers' views about practice to be made explicit. Teachers gained insights into the complexity of their teaching practices and described ways in which the experience impacted on their views of research as a bridge between theory and practice.

Theoretical Perspectives

The Nature of Teacher Research

Many teachers have the perception that research in teaching is "an esoteric activity having little to do with their practical concerns" (Carr & Kemmis, 1986, p. 8) and regard the creation of a knowledge base for teaching as belonging to the domain of university academic researchers. Recent prevailing concepts of the teacher "as technician, consumer, receiver, transmitter, and implementor of other people's knowledge" (Cochran-Smith & Lytle, 1999, p. 16) have perpetuated this perception, fuelled by the way in which "some consider the kind of knowledge that teacher research produces to be inferior to, and less valuable than, other kinds of academic work" (Roulston, Legette, DeLoach, & Buckhalter Pitman, 2005, p. 182). Cochran-Smith and Lytle (1990) describe the gap that has occurred:

> What is missing from the knowledge base for teaching, therefore, are the voices of the teachers themselves, the questions teachers ask, the ways teachers use writing and intentional talk in their work lives, and the interpretive frames teachers use to understand and improve their own classroom practice. (p. 2)

Gould (2005) has identified the need to reduce the "gap" that exists between research and practice in classrooms. Approaches that encourage teachers to carry out their own research in the context of their own classrooms, with the support of researchers, serve to validate their perspectives and enable greater insights into the complexities of teaching and learning. Teacher research, defined as "a systematic and intentional inquiry carried out by teachers", represents a "significant way of knowing" about teaching (Cochran-Smith & Lytle, 1993, p. 43). Traditional views about the relationships of knowledge and practice, and the roles of teachers in educational change are challenged, "blurring the boundaries between teachers and researchers, knowers and doers, and experts and novices" (Cochran-Smith & Lytle, 1999, p. 22). Such approaches can produce opportunities for a "hybrid discourse" between practitioners and university researchers

based on "democratic research relationships" (Paugh, 2004) resulting in increased learning for both partners, and significant contributions to the knowledge base of teaching.

By participating more substantially in research, teachers develop their own skills as researchers, which are more likely to impact on their practice: "Experienced teacher-researchers become the high risk-takers we need to develop innovative practice" (Mitchell, 2002, p. 253). This may, in turn, encourage other teachers to examine more closely their own pedagogical practice: "Teachers may be influenced to change their practices more readily by reading reports of research by other teachers … rather than university researchers" (van Zee & Minstrell, 1998, p. 792). However, establishing suitable conditions and productive partnerships for effective teacher research is problematic. Difficulties with teacher research are discussed by a variety of writers and include: issues of power and ownership, access to resources, isolation, and possibilities for manipulation and exploitation (Cochran-Smith & Lytle, 1993, 1999; Mitchell, 2002; Paugh, 2004). Dissemination of teacher research has also presented problems. In their investigation of the ways such research had impacted on schools, Berger, Boles, and Troen (2004) found it difficult to find schools where teacher research was making a difference to the teaching and learning culture of an entire school.

Methods of Research into Questioning

Much of the research undertaken to investigate teachers' questioning has been synthesised from data gathered by researchers observing in classrooms, rather than from teachers themselves. A review of comprehensive research syntheses (Houston, Haberman, & Sikula, 1990; Richardson, 2001; Sikula, Buttery, & Guyton, 1996; Wittrock, 1986) did not reveal any studies deeply grounded in teachers' perspectives. The existing knowledge base reflects a looking from the "outside in". A search of the literature located studies that reported teachers' questions and questioning, but few investigations were identified that looked from the "inside out". Up until now, categorisations of teachers' questions in mathematics have predominantly been undertaken by researchers focussing on only a selection of the questions asked by teachers during a lesson. Perry, VanderStoep, and Yu (1993) coded questions about addition and subtraction asked in 311 lessons in Japan, Taiwan, and the United States. They deliberately excluded questions they deemed nonmathematical or questions that were asking for agreement. Vale (2003) devised question categories to accommodate the question types teachers nominated they used most often. Some research has allowed for categorisation of questions by general intention rather than "type" (Morgan & Saxton, 1991), allowing for a focus on the function of a question rather than form (Cazden, 2001). Other researchers have observed "expert" teachers and synthesised how questions can be used in mathematics lessons to develop students' thinking (Fraivillig, Murphy, & Fuson, 1999; Jacobs & Ambrose, 2003). Each of these categorisations was devised by researchers or observers rather than by the teachers from within the lesson.

Formulating questions within a lesson is a complex process driven by a range of variables, and analysis of this process requires more than categorising and counting by researchers: "Real insight into questioning needs to take on board contextual factors which are too subtle for the classification systems to handle" (Kerry, 2002, p. 71).

Method

The eight teacher researchers (TRs) gathered data in two cycles, each taking five consecutive days in each of the middle two terms of the four-term school year. In each cycle

they recorded, categorised and analysed their use of questioning within a numeracy lesson. To assist the analysis and interpretation of their findings, the teachers discussed aspects of their findings in individual interviews with a researcher, and then as part of a forum with the other TRs. They also had opportunities to examine current research in this area, reflect on aspects of the research process and contribute to report-writing. Over the course of the project, data were also collected by the researchers who took the role of Research Team Leaders (RTLs). These data related to the TRs' involvement and experience of the research, with the processes for its collection emerging as the project unfolded.

Overall, the data were analysed using the three main stages of data reduction, data display, and drawing and verifying conclusions (Miles & Huberman, 1994). Most of the data collected were qualitative. The qualitative information was considered alongside the quantitative data to identify similarities and differences. The RTLs met following interviews with the TRs to share and compare findings, sorting responses using the same sorting process that the TRs had used in their initial data analysis. This enabled themes to emerge and helped to reduce the collected data to its key elements. The reduced data were then displayed to help identify trends. Responses to various questionnaires given to the TRs throughout the project were compiled to support the identification of key ideas. TRs contributed to the process of interpreting findings at all stages of the project by responding to summaries of emerging ideas presented by the RTLs. The TRs also interpreted their findings in light of current research, which they discussed in a group meeting. The RTLs verified their interpretations of the data with the TRs by feeding speculations back to them at research team meetings for discussion and comment. These methods reflected a grounded theory approach, such as that described by Strauss and Corbin (1998).

Processes for Data-gathering and Analysis

At the introductory meeting of the research team, the roles of team members were clarified, the research aims for the project were shared, and interview questions were negotiated. Processes for data-gathering were discussed by the team, and the "F-sort" (Miller, Wylie, & Wolfe, 1986) data categorisation method was examined. This method allowed teachers freely to generate their own categories for their questions, and provided access to the teachers' ideas and language about categories of questions from the outset of the project.

Within each of the cycles, the TRs recorded two consecutive mathematics lessons, and chose one to analyse. To enable the TRs to have maximum control over the data-gathering process, the TRs themselves were responsible for setting up the technology for the recording procedures. This ensured ownership of the process – no one else was "present" in their classroom. The technology comprised a video camera that remained in one position throughout the lesson, and a "Notetaker" cassette recorder with built-in microphone, which they wore around their necks. After the second lesson the TRs sent the audiotapes of their chosen lessons to be transcribed, which were returned a day later. Only the audio recordings were transcribed and access to these transcripts was restricted to the teachers concerned, the transcriber, and the two RTLs. The TRs were subsequently released from teaching for 2 days to analyse their lesson using their reading of the transcript, assisted by viewing the videotape footage, alongside their recent recollections of the lesson.

The main activity in the analysis phase involved the identification and categorisation of questions within the lesson. This was achieved by extracting the TRs identified questions from hard copies of their transcripts, then sorting them into groups of similar questions for which they devised labels (Miller et al., 1986). At the end of the second day of analysis, the TRs discussed their findings with one of the RTLs in semi-structured, one-to-one interviews (Denscombe,

1999). Summaries of the interviews were later sent to the TRs for verification, and findings were shared in subsequent group meetings.

Group meetings were a key aspect in distilling meaning from findings as they emerged throughout the project. Members of the team brought aspects of their findings to share, and similarities and differences were explored and debated. The Cycle 1 group discussion began the process of establishing common categories with which to analyse the lesson in Cycle 2. The TRs were also asked to record any questions and issues arising from the analysis of their first transcript. Their responses were to be used to inform the future direction of the project. Throughout the project teachers responded to questionnaires that explored their perspectives on aspects of the research process. The TRs were unable to be involved fully in writing the final report of the research project. Instead, they wrote reflective responses to the final questionnaire, and these responses were used to amplify the TR's voice in sections of the report.

Findings

Ownership of the Research and Roles of the Research Team

In the initial stages of data-gathering and analysis, some of the TRs described difficulty with the sorting of questions into categories. At this early stage, the TRs tended to draw on frameworks and language about questioning that were familiar to them. In some cases they struggled to produce efficient descriptors from their own language to label groups of questions. Perhaps this indicated the TRs' doubts that what they had to say would have validity or authority in the research project. The TRs may have seen the research in traditional terms such as those described by Cochran-Smith and Lytle (1993) as "outside-in", or as research that "constructs and pre-determines teachers' roles in the research process" (p. 7). The process of sorting their questions had meant that the TRs were encouraged to take responsibility for generating language and ideas, and the commonly agreed categories developed within the forum reflected their own language, which promoted a sense of ownership.

An important principle of teacher research is that teachers have a "sense of ownership and control of their research" (Mitchell, 2002, p. 250). Current definitions of teacher research describe the selection and development of research questions as emerging from the teachers' own practices (Cochran-Smith & Lytle, 1993). Although each of the TRs joined the team with an awareness of the field they were to research, the requirements for the funding for this research had meant that the research questions and aims were established before they met together as a team. However, the research questions had emerged from close links to teaching practice that the RTLs had developed, both in their current and recent classroom teaching experience, and in the considerable number of mathematics lessons they had observed as numeracy advisers.

The RTLs' sense of ownership was strong at the onset of the proposal process as initiators of the research questions and the methodology. This diminished as the proposal progressed and as the three institutions involved established areas of territory and accountability. Ownership was further dispersed as the RTLs continued to work with the TRs. It became apparent that the RTLs had begun the project expecting significant but limited input from the TRs rather than an authentic partnership. Thus, to ensure the development of research capabilities of the TRs, and to increase validity of findings, it was felt necessary to share aspects of control of the project. This was not easily achieved, as the TRs demonstrated differences in perceptions of their role and the RTLs' role. Perceptions of roles were further complicated by the relationships

previously established by the RTLs as mentors and advisers within the context of in-depth professional development. It would seem that the co-researcher relationship "was infiltrated by the discursive positionings more in common in relationships between academics and teachers, or teachers and students" (Honan, 2007, p. 622).

The Changing Nature of the Methodology

Aspects of the methodology were continually adjusted to allow the TRs to develop a greater sense of control within the project.

> The approach was good because it was flexible and allowed the group to have true ownership. The "organic" nature of the form of our meetings allowed researchers to listen without taking over with pre-determined paths. (Erin, Final questionnaire)

In some respects this flexibility paralleled the way the TRs responded to their students, changing direction and transferring power within their classroom practice:

> One thing I've really enjoyed about the research, is that it's just confirmed for me a lot of good teaching practice … It's made me be a little bit more relaxed about letting the children take control. (Erin, Interview 2)

It was originally intended that the RTLs would conduct an analysis of each lesson at the same time as the TRs, reading the transcript and viewing a video of the lesson. Their analysis would then be compared with the TR's findings. However after the initial trial phase, it was decided that the TRs would be solely in charge of the analysis process. This meant that the TRs' own observations and views on their lessons were paramount. Feedback from the Trial teacher shifted the focus of the interview from a comparison of findings to a vehicle for assisting the TRs' reflective processes.

An important aspect of developing the teachers' capability as researchers was introduced between the two cycles of data gathering. At the suggestion of the research consultant, relevant research readings were sent to the TRs for discussion at the upcoming meeting. The themes for these readings were established in response to ideas emerging throughout the interviews and in the second research team meeting, and were also directly indicated by the TRs in their responses to questions and issues arising from the analysis of Transcript 1. An additional day was allocated to discuss these and other relevant themes, to enable the TRs to see their current research in the context of other research in this area.

Moves to incorporate the TRs' voices more prominently in the writing aspects of the research included the use of a final questionnaire. This allowed them opportunity to review the research outcomes and processes, and contribute reflective and crafted responses that could be incorporated into the report. The style of the report reflected the partnerships developed in the project, by aligning the RTLs' contributions, observations and interpretations alongside those of the TRs'. This made visible the key role the TRs had throughout the project by anchoring interpretations of findings in their statements. A draft of the findings was shared with the TRs for their editorial comment before publication.

Developing Community and Accessing Support

The research team meetings were important in refining the methodology and allowing the research team to discuss and interpret findings. They contributed toward establishing a shared understanding of the research question, served to generate common categories for coding questions, and assisted the TRs to establish a common interpretation of findings. These forums also provided the collaborative support necessary for such projects as described in Mitchell

(2002). Mitchell notes the loneliness often experienced in such studies, which was also identified within our project.

> For the first release days I felt isolated and completely lost. (Ingrid, Final questionnaire)

At times, interactions at the research team meetings caused concern. The fact that three of the teachers were drawn from one school, and knew each other well, may have impacted on the group dynamics. Moves to incorporate the views of all the team members more fully included the provision of extra meetings and the use of strategic groupings and activities within group meetings.

An awareness of the issue for the TRs of managing their research project commitments along with teaching workloads was evident throughout.

> The amount of time involved was underestimated and at times it got stressful with other demands of work. (Stephanie, Final questionnaire)

It was often apparent that the teachers felt a tension between the demands of undertaking the research and being present in their classrooms. Cochran-Smith and Lytle (1993) note that:

> Participation in teacher research requires considerable effort by innovative and dedicated teachers to stay in their classrooms and at the same time carve out opportunities to enquire and reflect on their own practice. (p. 20)

Oliver (2005) found that school support was a significant factor in the success of teacher research projects. Responses to a questionnaire given to the TRs midway through the research described a full range of support from the teachers' schools. External systemic support (Osler & Flack, 2002) was also essential to the project. Money allocated from funding provided through the research funding allowed the teachers to have release time to analyse their lessons in detail, and to attend meetings.

Links to Practice

The research process was seen as providing significant relevance and immediate impact on the TRs' own classroom practice.

> I have developed an awareness of the types of questions that I can use ... the research has helped to identify a specific area of focus and thought and therefore it must have an impact back in the classroom. (Quentin, Final questionnaire)

> This has identified needs and gaps in my questioning and there have been surprises in other areas. (Olivia, Final questionnaire)

The TRs also described possible directions for further research about their own practice.

> Maybe the biggest question for me personally is how to take the information I have now about my questioning and find practical ways to implement change in the class. Maybe I need to do more reading about that. (Olivia, Final questionnaire)

> It would be interesting to look again at the types of questions asked at which part of the lesson. ... Are there any significant shifts in the types of questions asked? (Stephanie, Final questionnaire)

Although early on in the project the TRs recognised that this research should be able to inform the wider teaching community, at the conclusion of the project it was felt that the research process itself, rather than their findings about their use of questioning, was what they considered significant.

> Having the opportunity to micro-analyse within a subject area has heightened my awareness of the strengths and weaknesses of my own classroom practice. This in turn has challenged me to either strengthen those practices that are valuable and to adjust/ improve those practices that are weak. (Erin, Final questionnaire)

The TRs found it difficult to be specific about exactly how the research findings relating to questioning might be applicable to teachers in general. The categories were seen as useful to the teachers involved in the project, as they had created them and "owned" them. There was a lack of confidence that other teachers would find them useful.

> We need to be careful with transferring research to their [other teachers'] situations – qualify it with the fact that it is for "here and now" and may be less relevant when different factors are taken into account. (Ursula, Final questionnaire)

> This research was done by a small group of teachers. What are the implications for other teachers? How would it transfer across to other teachers? (Natalie, Final questionnaire)

Perhaps this reflects findings from Mitchell (2002) who noted: "TRs are more interested, at least initially, in finding what may appear to be context-specific solutions in their own classrooms" and that many aspects of the research process are personal: "in some important ways, the journey is experiential – some parts of the story cannot be told, they must also be experienced" (pp. 262-263).

Changing views of research

Osler and Flack (2002) found that skills to be developed by TRs included: "reflection, articulation, familiarity with research literature, linking their own work to the work of others, writing, and presentations" (p. 243). The development of each of these skills was in evidence in various forms throughout the project. The developing capability of the teachers as researchers was reflected in their changing views about the nature of research. The ability to reflect on and articulate their practice was evident.

> It is a huge learning curve because you see things from a different perspective. (Quentin, Final questionnaire)

Research was seen as a vehicle for sharing, challenging, or confirming existing ideas and introducing new ones. One aspect described by the TRs was the complexity and scale of the research process.

> Research is fascinating when you are involved in it!! It is really difficult to do. [There are] heaps of factors to consider. It doesn't always give us answers. (Ursula, Final questionnaire)

> It has been fun, scary, challenging and time consuming... I realise how much work goes into these projects. (Olivia, Final questionnaire)

Throughout the research, areas for future investigation continually arose. At the completion of the study, a range of diverse questions for further research had emerged from the group. Some major shifts in understanding about research were also evident.

> When we first started out I was not sure of what I was getting into and therefore my mind was a bit of a blank slate. I think there is a definite need for teacher research to continue as it informs practice and changes views and brings together your own personal experiences which must be better for your classroom. (Quentin, Final questionnaire)

The TRs have been encouraged to present and discuss the findings and methods of the research with their staff to contribute to developing a culture of inquiry within their schools.

Aspects of the research process were presented by TRs and teacher researchers at one regional and two national conferences. This has further contributed to the development of teacher researcher skills and enabled the research partnerships fostered during the project to be made visible.

Conclusions

> Research doesn't always provide you with answers. It often provides more questions. There isn't always a neat, tidy conclusion that can be drawn. (Natalie, final questionnaire)

Participation in this project impacted on the teacher researchers' views of the relationship between research and practice and provided opportunities to reduce the gap between them. Throughout the project, the teacher researchers encountered authentic research problems regarding methodology, analysis, and interpretation of data as they sought to make meaning from data gathered. The process of researching their own teaching practices served to transform the apparent simplicity of the task of identifying and categorizing questions, to a complex undertaking that confronted the teacher researchers with some of the essential elements implicit in their everyday teaching. This acted to problematise rather than simplify the teaching process.

The unique perspectives of these teacher researchers about questioning provide a valuable contribution to the knowledge base about teaching in this area. The use of the interview and team forums compelled the teacher researchers to articulate their practice more precisely, and to discuss and debate related issues. The process of close analysis and discussion of their teaching practice was an outcome valued by the teacher researchers, which they saw as useful for other teachers. However, it was difficult for them to assess the value of their observations about the questions they asked and the categorisations they devised; they seemed unsure of the validity of their findings, perhaps due to the lack of sufficient time to explore fully patterns and commonalities that may have been present in their questioning practices.

The structure of the initial research design was significant in developing the TRs' confidence and capabilities in research, as it scaffolded the data-gathering and analysis process. This structure allowed the TRs maximum control over the selection of the primary level of data to be analysed, and opportunities for in-depth reflection. Important features that contributed to the success of this process were:

- the use of accessible technology, which the TRs controlled,
- the lesson transcript being made available to them within a short timeframe,
- the interaction between the printed transcript and the video,
- the inductive categorising process used,
- having immediate and concentrated time for analysis, and
- discussing their findings with a RTL in a reflective interview.

A key feature of this study was the ability for the Research Team Leaders to be responsive to the input of the team members as the research progressed. Respecting their contributions and interpretations was imperative, and this was firmly established by making teacher researchers solely responsible for the initial stages of data-gathering and analysis. This ensured their interpretation of data was central to the project and established a sense of trust in the developing research partnerships. The researchers had greater time for reflection and interpretation of findings which meant they initiated much of the direction for the research. Although this was necessary, it created a tension within the project, as the teacher researchers had only a limited time available for these activities. This meant that

the balance of "power" within the partnerships, and the responsibility for the direction and the interpretations of findings were aspects of the project that were constantly negotiated.

Implications

Support for further research that includes the teachers' perspectives in the analysis of teaching practice is vital. To allow teachers to develop the research skills necessary to contribute their perspective in a meaningful and rigorous manner, teacher researchers need to be provided with:

- sufficient release time to examine their practice in depth, and to attend research meetings,
- access to experienced researchers for support and guidance,
- research forums for discussing ideas with other teacher researchers, and
- interest and encouragement from management and colleagues within their schools.

Research questions that originate from teachers themselves can contribute to a closer alignment between research and practice. To enable them to have authentic ownership of research questions, involvement in the earliest stages of a research project needs to be encouraged. Teacher initiation of such proposals could be promoted by the inclusion of a research component into teachers' job descriptions. Consideration also needs to be given to methods that enable teachers to have maximum ownership of processes throughout.

> I had the impression research was often done by a researcher to you, however this has shown that it can be embedded in your practice and the research can be for you. (Natalie, Final questionnaire)

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