Teacher-research: the benefits and the pitfalls

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Introduction

The aim of this study was to document teacher-research that occurred during a year-long investigation into student writing in science. The focus was on writing skills and how students use them to express their understanding of scientific concepts. It was proposed that a prolonged engagement with a Year 8 science class would lead to a better understanding of how students view and use their writing to demonstrate their knowledge of scientific concepts. This information would then be used to develop teaching strategies that could improve these students’ written expression of their knowledge.

This study was framed around a series of snapshots of self-reflective teaching and learning about writing in junior secondary science in a co-educational, non-denominational, non-government school in the northwest region of Sydney, New South Wales. The students come from a variety of backgrounds and were generally not disadvantaged economically. The Year 8 student participants had been placed in a lower ability science class based on their previous years results.

Theoretical framework

This study attempted to generate knowledge of teaching that Korthagen (2001) called the ‘knowledge of phronesis or practical wisdom’ (p.22) which focuses on knowledge that comes from participatory research involving reflection on action and experience contextually bound within a classroom.

The work of Prain and Hand (1996a, 1996b) also strongly influenced this study in that these authors outlined a framework that is both a pedagogical and theoretical model for improving writing practices in secondary science classrooms. Further guidance
was generated by theories that emphasise the importance of integrating basic technical knowledge with knowledge gained through repeated practice (Boshuizen & Schmidt, 1992; Schank & Abelson, 1977) which are consistent with the cognitive-process theory of writing proposed by Flower and Hayes (1981). These authors described expertise development in writing as a complex interplay between the writer, the task environment and the actual writing processes. That is, when a writer’s long-term memory is activated and updated in a rich and meaningful task environment, the writer will likely achieve greater gains in writing skills than writers who practise their skills in a sparse task environment.

**Qualitative methodology**

An action research framework with the teacher as the researcher was used in this study because the school setting was seen to naturally lend itself more to an informal, interpretive and reflective model of inquiry which allowed the researcher to focus on the complexities of social situations such as those found in classrooms. Qualitative investigations look at the individual’s world view – or ‘insider’ perspective (Allan, 1991; Glesne & Peshkin, 1991) – by the researcher becoming fully involved with the participants about whom the information is being collected and for whom the outcomes become a benefit and justification for the research. The very nature of qualitative research, in terms of its objectives and open-endedness, allows the researcher to observe complex social interactions with respect and without oversimplifying the situation. It has allowed researchers to make meaning of social order by being concerned with the ‘how and why’ questions (Gubrium & Holstein in Denzin & Lincoln, 2000).

The origins of action research are unclear but authors such as Kemmis and McTaggart (1988), Zuber-Skerrit (1992), and Holter and Schwartz-Barcott (1993) suggest that it was initially used by Kurt Lewin in the mid-1940s. It has also been suggested that it began with social reformists such as Collier in 1945 (McKernan, 1991). A variety of forms of action research have evolved but all adopt a methodically iterative approach, typically embracing problem identification, planning, action and evaluation of the
action by reflection. In this cyclic process, the insights gained in one action cycle provide the impetus for the planning for a subsequent cycle in which the action is modified.

The most important aspect of action research is its responsiveness to the problems as they are perceived by the participants in the particular situation (Schon, 1983). Such research is strengthened, not weakened, by focusing on the participants’ needs as they emerge in the practical situation (Hanrahan, 1998). By following the four steps of the action research cycle, the researcher is required to focus carefully on the identified problem and to systematically evaluate the situation, plan and activate an intervention to respond to the identified problem and then evaluate that intervention. This teacher-centered approach can also lead to staff development for teachers through improvement in their observational skills (Wood, 1988, p.146).

**Research in the classroom**

Corey (1949, 1953) was one of the first to promote the use of qualitative research methods in the field of education; action research in particular. Corey’s hypothesis was that schoolteachers could make better-informed decisions and implement more effective practices when the research was part of the normal process of teaching. He added to our understanding of the value of qualitative research with his definition of action research as:

> …the process by which practitioners attempt to study their problems scientifically in order to guide, correct and evaluate their decisions and actions. (Corey, 1953, p.6)

This view has been explored further by Fenstermacher (1994) who looked to the research of those such as Elbaz (1991, 1983), Connelly and Clandinin (1990, 1988, 1985) and Schon (1991, 1987, 1983) to establish a framework for allocating what teachers know into research categories; one that seeks to generate knowledge of teaching that is generated by those who specialize in research on teaching in contrast to the knowledge as a ‘result of their experiences as teachers’ (Fenstermacher, 1994,
These two branches of teacher research have become known as research of the knowledge of *episteme* (scientific understanding) and the knowledge of *phronesis* (practical wisdom) (Korthagen, 2001). The latter focuses on knowledge that comes from participatory research that involves reflection on action and experience that is contextually bound within a classroom. This research ideology arises from teacher dissatisfaction with theories proposed by outsider researchers who take a scientific or technical rationality and try to apply it in everyday classroom practices (Schon, 1983). Phronesis is concerned with scientific understanding of ‘specific, concrete cases and complex or ambiguous situations’ such as a secondary science classroom (Fenstermacher, 1994, p.24) where the researcher is seeking ‘solutions from concrete details rather than from some theoretical domain’ (p.25).

This raises the question of where the most beneficial knowledge about teachers and teaching comes from. To address this issue, Cochran-Smith and Lytle (1999, 1993) established a program called ‘teacher researcher’ that was based on action research and reflective practice which they defined as ‘systematic, intentional inquiry by teachers’ (Cochran-Smith & Lytle, 1993, p.5). These authors proposed that teachers should be the generators of knowledge about their profession and that such knowledge can be just as valuable as that generated by university researchers of teaching. Furthermore this study sought to gain practical knowledge and wisdom about teaching practices for the professional development of the teacher who would research using the methods of teacher-research that have been incorporated into an action research framework as recommended by Silberberg (2002), Tobin (1999) and Northfield (1998).

It is not difficult to see that the teacher–researcher approach is different from traditional ‘researcher outside the experiment’ forms of research, not least because it is largely driven by the teacher’s personal goals, which usually encompass volunteering to help students in addition to their normal teaching duties (Loughran, 2002; Johnson, 1993). Teacher–researchers are often more interested in finding solutions to issues in their own classrooms than researching for the sake of the research and as such show bias that reflects the teacher’s own theories and experiences. (Mitchell, 2002). However, the classroom context has not restricted some
teacher–researchers from generalising their findings across many contexts (Mitchell & Mitchell, 2001) to the advantage of other teachers and students. This study is typical of teacher-research and was concerned with bringing about classroom changes (Cochran-Smith & Lytle, 1999; Belanger, 1992; Copper, 1990; Stenhouse, 1975). Teacher-research starts out with a teacher wondering about an issue and then transforming it into specific questions (Bissex, 1987). In this case, concerns about students’ limited progress in science led to many issues that crystallised into questions on student writing and the opportunities for improvement.

**Research question**

There have been many issues raised about student learning and writing – particularly writing in science – that become of major importance to this study. Writing has a powerful influence on learning and it is apparent that it is not well done in science classes at this school. This action research and teacher research pursues the use of writing in science, in particular, writing of short answer responses similar to those commonly used in science classrooms to address questions from texts and those used in tests and examinations for assessment purposes.

Thus the research question became:

> In what ways can a science teacher assist students to convey their knowledge of science, in writing, more clearly?

**Collection and processing of the data**

Data was collected from the student participants as student work samples including concept maps, homework activities, classroom tests, questionnaires and interviews; from teachers through questionnaires and interviews and through diary notes and journal entries recorded by the teacher-researcher (Gregson).

The data was processed in four main steps that had been adapted from Kumar’s (1996) method of processing data to accommodate the data that was collected in this
study. After the data was collected it was read and loosely placed in categories that were revealed as the data were viewed and reviewed. The editing process allowed separation of unusable data such as non-serious efforts, incomplete or blank questionnaires. This was followed by coding of the data from which summaries were developed. These summaries contained a brief outline of the data, possible theme headings and quotes that would likely be incorporated into the thesis at a later date. During the analysis step the data was read superficially in the first instance to gain a holistic view. This was followed by several deeper readings where ‘like’ material was physically grouped and where emerging themes were identified and refined. The final step was to assess the match or mismatch with the literature.

It is important to note that the data were usually collected, sorted, coded and given a preliminary analysis on the day of collection. Because the study was addressing issues in a real classroom setting new action in the classroom sometimes needed to be taken less than 24 hours after data collection of data. This time constraint was to have a major bearing on the teacher-researcher relationship.

In order to maximise that validity of this study, triangulation of the data was undertaken as recommended by Lincoln and Guba (1989) and Burns (1994). Reliability was achieved through collection of data by:

- prolonged engagement with daily contact with the participant students and regular meetings with interested teachers over a 14-month period;
- collection of data from different sources (teachers and students) via different processes (a questionnaire, surveys and interviews);
- frequent collection of artifacts that helped to build up a picture of how the writing activities were affecting student progress;
- systematic planning, action, observation and reflection using action research as a framework to support the collection and analysis of data;
- frequent meetings with Laird (research site special needs teacher and collaborator) and Aubusson (Doctoral supervisor) where discussions and debates led to clarification of data analyses and findings from the data; and
transcripts of interviews were returned to the teachers and students for member checking.

Findings

Education research literature suggests that teacher research is very necessary (Louhgran, 2002, Cochran-Smith & Lytle, 1999; Stenhouse, 1975) for the advancement of teacher practices and development of knowledge about teaching. However, researching, while teaching, is not easy. In this study what was implemented to bring about change in classroom practice was not always successful and lead to unexpected findings. However, as Northfield, Mitchell and Mitchell (1997) suggest ‘these failures can and have led to valuable insights’ (p.7). These insights became valuable as they contributed to a personal view of teaching practices that had consequences for day-to day teaching.

Ownership, control and isolation

Maintaining the necessary energy and motivation to research requires that the goal of the research be meaningful and necessary to the classroom researcher. Such was the case in this study. I had the freedom to progress at my own pace and in any direction I chose in response to the data collected and to develop pedagogies that were directed to the needs of my students. However, a consequence of the lack of interest among other members of the science staff was that the planning and reflection was often done in isolation. While Laird (a special needs teacher who was an on-site collaborator) and Aubusson (doctoral thesis supervisor) made themselves readily available for discussion and debate, conferences could not always be held immediately in response to the events on a particular day or when decisions were being made quickly on how to proceed. The work completed in the Year 8 class, at the beginning of the study, was intensive. Monitoring the students needs often required planning and reflection on a daily basis. Therefore the speed with which decisions had to be made limited the opportunity to draw on collaborators and the literature. It is due to this rapid pace that in some cases, for this teacher–researcher, the ‘teacher’ outpaced the ‘researcher’.
Teacher needs vs researcher outcomes

No greater example of this can be seen than in the differences between my initial and final findings at the end of an action cycle in which the Year 8 students focused on writing answers to short answer questions. The students were introduced to a modeling activity in which they assessed a series of answers to one question in terms of how many marks each answer was worth. Each answer was more complex, longer in length and used more scientific terminology than the preceding answer thus suggesting that each subsequent answer was better that the previous answer. The students were then provided with a series of alternate questions and asked to provide answers. These answers were then assessed one-on-one with the teacher. An indication was provided on how the answers scored numerically and the discussion that followed focused on how the answer could be improved.

In ‘teacher’ mode, there was excitement because of the students’ increased use of scientific terms. In every case, as they developed their answers to the set question, the students’ answers became increasingly more technical and incorporated the use of specific terminology that related to the question. These students demonstrated that they were capable of learning scientific concepts that incorporated metalanguage and were capable of responding to questions through writing extended answers.

During a more in-depth review the students’ answers (when in the role of researcher) conflicting evidence unfolded. It was discovered that as their answers got longer they contained more concept knowledge and utilised more scientific terms, however, the answers tended to get worse rather than better. That is, their first answer, though only using common ‘everyday’ language, was more scientifically correct and demonstrated knowledge of the concepts being tested. As the researcher read through subsequent answers the scientific understanding was lost under the confusion and non-sense of scientific terms sequenced into sentences that made no sense and no longer addressed the question being asked.

Had the speed of response to the students’ written work during the class caused the teacher to focus on the quantity of scientific terms rather than the quality of the total answer? Almost certainly. The students had responded positively to this task and had
recounted how they now understood how to answer science questions and to them this supplied the reasons as to why they had been so unsuccessful in past tests when they knew that they had understood the concepts being tested. The teacher had been so swept up in the students’ excitement with the task and the belief that they were finally answering questions to the best of their abilities, that the teacher failed to notice the steady decline in the clarity of what they had written. The teacher had fallen into the subjectivity trap of teacher-research. During the data analysis phase time had allowed for some objectivity to be gained and the researcher realised that the teaching strategy used had resulted in an educational contradiction: students had satisfied the teacher’s requirement for using more scientific terms, but their written expression no longer clearly demonstrated their knowledge and understanding of the concept.

This observation led to deeper and broader analysis of students’ written work. A range of different teachers marking of student written answers in examination papers was analysed and two issues became apparent. Firstly, there appeared to be a variation between what different science teachers expected. Some teachers marked for correctness of answer while others looked for phrases and terminology. So that when reviewing the students’ written work answers were seen that were given full or near full marks even though their work included contradictory statements or incorrect phrases. In three cases students had used relevant scientific terms, but in such a way that what had been written was flawed; yet they received full marks.

This observation of teacher expectations and researcher findings highlighted the conflict that was developing between the role of a teacher and part of the science teaching team and the findings of a researcher. Each of which has consequences for students. If revising answers made their answers worse, encouraging students to check their work becomes counterproductive. As students typically hurry to answer questions to get to the next one, then this study suggests that they will most likely show better understanding of the concepts being taught if they do not take time to consider what they have done, or to revise.

However the dilemma arises as some science teachers appear to value the display of scientific terms as a surrogate for student understanding of science. The students that
used scientific terms, even though used incorrectly gained high marks. Conversely there will be students whose understanding of science will not be valued or rewarded with higher marks because they either fail to use these terms or cannot incorporate them into an answer. If less able students’ understanding of science is best communicated in simple English, it may be time for science teachers to examine both their expectations of these students, and the relevance that the scientific terms have to both parties now and in the future. We are seeing specialist terminology being removed from sections of the wider community as lawyers and insurance companies devise ‘plain English’ forms and documents. Should the teacher’s focus be on science itself or the language of science? If on the language of science, then science teachers need to be taught how to teach science language.

The matter of concern is that these students experienced ‘success’ in assessment simply as a result of inserting scientific terms into their written responses, some of which then became a mixture of phrases and terms that made little scientific sense. By contrast, the use of everyday language to clearly convey students’ understanding was not valued. While teachers–markers continue to reward the use of science terms, there is little incentive to engage in the discourse and deeper analysis that might help students to express their understanding in writing better, as opposed to needing to help failing students pass tests.

**Teacher practices**

The initial responses during the modeling activity were due to the teacher finding students doing what she thought she wanted them to do. Hindsight and later deeper reflection by the teacher-as-a-researcher established that what the teacher saw as desired, were superficial. This raises the question of how often we, as teachers, make quick decisions, based on intuition and fail to analyse thoroughly what has been achieved.

The personal nature of the quest provided impetus for long hours of reading, trialing of teaching practices, discussion and reflection. However, it also came with private theories and bias that were often not recognised or valued by other teachers. While the necessity for collaborators is debated by authors on action research and teacher
research (Loughran, 2002; Kemmis & McTaggart, 1988; Carr & Kemmis, 1986) it is widely accepted that for a study to have value the outcomes must be open to review and discussion by peers both at the site and beyond. However, peers, on the science staff at the research school, while not hostile towards the research, paid little attention to its progress or enthusiasm for developing practices to improve students writing in science. They were busy, wrapped up in the demands of day-to-day school teaching and the complexities of new syllabuses which required all their concentration and effort. When occasions arose, a discussion of an activity or results would spark a comment or a suggestion but more often were responded to with passivity, disinterest and disdain. As Paul (a science teacher with 20 years experience) so firmly declared ‘we did not get a science degree to become English teachers…a lot of science teachers want to get into the science concepts, get them done and that is it’. But as this study has shown there is a great deal more to ‘it’.

The role of the collaborators in this study

Some of the discrepancies between the initial and later findings may have been eliminated if there had been a colleague from the science department who had been interested in taking on the role of collaborator. But, as in this instance, there are times when a researcher is investigating a problem that lies on the periphery of his/her domain and is therefore beyond the interest of those who are directly affected. What Laird and Aubusson bought to this study was expertise in areas that augmented my own and informed the study. Laird’s expertise in language and learning difficulties directed the level and tone of the activities planned and broadened the analysis of the students writing by adding a view from outside the world of science. Aubusson’s experience in science teaching and educational theory promoted deep analysis of the science and the development of explanations and rationale for the content of what they wrote. However, these contributions were not always timed to optimally affect the progress of the research.

Time

The discrepancies that existed in this study, between the initial reflection on practice and data and later deeper analysis of these practices and data, have implications for
both teachers and teacher–researchers. The findings from this study illustrate that there is a need for teachers to have time for reflection about their teaching practices before making decisions about future pedagogy. Yet the very need to proceed may prevent extensive timely reflection. The quandary then exists between planning the steps of the study and allowing for the freedom to respond to what has occurred in the classroom and what has been concluded through the analysis of the findings.

**Benefits of teachers as researchers**

One of the many benefits of teachers researching their own practices is that the teacher has a sense of ownership and control of the research because what is being researched occurs in that teacher’s own classroom. Teachers choose to examine their knowledge and teaching practice for their own benefit and that of their students (Lytle & Cochran-Smith, 1992). By teachers becoming researchers, any gaps between theory and practice may be narrowed (Loughran, 2002). A teacher’s presence in a classroom also makes the collection of data easier and longer-term (Mitchell, 2002). Findings can be acted on immediately, and these actions can lead to innovations that may eventually become standard practice (Mitchell, 2002; Berry & Milroy, 2002; Stenhouse, 1975), at least in that classroom.

Research on teacher-research has identified that when teachers and students work together to solve classroom problems, a product of this interaction has been an increase in student confidence, student willingness to take responsibility for some aspects of what they do in class, and increased levels of student-teacher and student-student collaboration outside of the research domain (Baird & Mitchell, 1986).

**Limitations of teachers as researchers**

The work of a teacher who is researching can easily be construed by colleagues as an unnecessary burden on already overworked teachers or threatening to them in terms of challenging firmly entrenched teaching theories and practices (Mitchell, 2002). This threat could be overcome by having more than one teacher from the research site as part of the research team, and this is seen as essential in Kemmis and MacTaggert’s model form of action research (Kemmis & McTaggart, 1988). The
research process in this study has also shown such research to be difficult and isolating for a lone teacher (Mitchell, 2002). Experience at this research site reflects what has been experienced by others in that colleagues showed a range of reactions: some did not value the research, others chose not to find the time to become involved, and a few were openly antagonistic or critical of the effort being ‘wasted’ on research when science teachers were ‘busy enough just doing our jobs’ (Osler & Flack, 2002; Cohen & Manion, 1989).

The findings from this study confirm Mitchell’s (2002) suggestion that teacher-research is often messy and logically non-linear, with the outcomes of the research not always immediately obvious, but taking some time to unfold (p.252). He gave two reasons for this: the complex nature of the projects, and that the data and responses to them must be collected, collated and reviewed on top of the teacher’s normal teaching duties. Finding the time to collect data and to write in journals while performing normal teaching duties has become recognised as one of the persistent trials of teacher-research (Baird & Northfield, 1992). Mitchell (2002) countered this, however, by suggesting that data are ‘deeper and richer’ (p.252) because the teacher is always present. Mitchell also claimed that the results of the research can sometimes lead the researcher away from the original goals. This effect may be beneficial because it shows that the researcher is approaching the research without prejudices or, conversely, may be undesirable because the findings are not addressing the original intent of the research.

Teachers all too often undervalue the work they are doing, an attitude which acts as a deterrent for disseminating significant ideas that generate from teacher-research. As Munby and Russell (1994) stated, teacher–researchers often fail to acknowledge that their research findings have a certain authority, and that their own experiences have an objective and positive value to other teachers. This argument is taken further by Baumann (1996) who said that teacher-research should be thought of as its own genre, and the next step in the evolutionary trend of research.

The comments made by the teachers and the complex nature of these findings make it difficult to decide what should be done in terms of sharing the outcomes of this study.
with fellow teachers. There are implications in terms of teaching practice that challenge teaching and assessment strategies and the importance of scientific literacy skills. There are also implications for teacher–researcher decisions that may have been made in response to a student’s immediate need, hence based on a quick analysis or reflection rather than on later and deeper reflection, due to the real-time nature of teaching.

Conclusions

There is no doubt that the ‘insider’ view (Allan, 1991) provided by teacher research has been appropriate and beneficial to this study. The process was largely driven by my personal goal to help my students which is typical according to Loughran (2002) and Johnson (1993) and the findings had immediate impact on my practices, as a teacher, which have now been incorporated into my philosophy as a teacher educator. Some of the limitations of this method, suggested in the literature such as ‘messiness of the findings’ and colleague ‘disinterest’ (Mitchell, 2002; Cohen & Manion, 1989) came to fruition in this study. However action research provided the scaffold to systematically trial practices to improve student writing, to reflect and analyse the effects of the practices. The findings to some degree remain interconnected and inconclusive, but can be judged on the ethical procedures used to collect the data, the prolonged engagement, use of multiple methods of data collection and member checks which all provide methodological trustworthiness.

Overall the findings of this study demonstrate how complex yet how powerful teacher-research is in the classroom and highlight the need for teachers to be aware of the potential that researching their own pedagogy has in influencing student learning and motivation, pedagogy and assessment practices. The process of researching students’ scientific literacy has led to the gathering of information about an area of study that was beyond the boundaries of any previous study. During my teacher training, some fifteen years ago, students’ literacy needs were not pursued. The analysis of the data has clarified the value of some strategies I use in the classroom and has led to the questioning of others with the consequence that regular review is made of the outcomes of my teaching through personal reflection and data collection. This process has also led to many questions such as those surrounding the value of
scientific terminology and assessment strategies that form the framework for future teacher-research.

The value of teacher-research is questioned because of the personal nature of the issues that are researched within one’s own classroom and because the findings may not be relevant in contexts other the one in which the research takes place. The complexity of the findings may also not provide future directions other than for the participants. However, what has been highlighted in this study is the difference between initial reflection on practice and data and later deeper interpretations of these practices. Investigation of teachers views on student writing and particularly ‘on the spot’ value judgments that teachers are required to make on a daily basis would be a valuable addition to knowledge about teacher practice.

As a teacher–researcher using action research in a single site, this study is not intended to have great implications for curriculum reform at the systemic level. However, it does suggest a teacher is capable of achieving awareness of and improving his/her practice through structured and systematic research of the activities in his/her classroom. It provides professional development at a most personal level that can be used to foster discussion between those with similar interests.

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