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Editor:
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Editorial Committee:
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Greg Lee
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Merilyn Taylor
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Cover Design and Illustrations
Donn Ratana

Layout and Design
Barbara Hudson

Editorial correspondence and manuscripts submitted for publication should be addressed to:

Research Manager
Wilf Malcolm Institute of Educational Research
School of Education
The University of Waikato
Private Bag 3105
Hamilton 3240.
email: wmier@waikato.ac.nz

Website:
http://education.waikato.ac.nz/research/publication/

Books for review should be sent to:
Research Manager
Wilf Malcolm Institute of Educational Research
School of Education
The University of Waikato
Private Bag 3105
Hamilton 3240.
email: wmier@waikato.ac.nz

Business correspondence:
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Teachers and Curriculum
Hamilton Education Resource Centre
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Contents

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The Opinion item is contributed by a leading New Zealand educationalist.

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Notes for Contributors

Teachers and Curriculum provides an avenue for the publication of papers that:

- raise important issues to do with the curriculum
- report on research in the area of curriculum
- provide examples of informed curriculum practice
- review books that have a curriculum focus.

This peer reviewed journal welcomes papers on any of these from tertiary staff and students, teachers and other educators who have a special interest in curriculum matters. Papers on research may be full papers, or if time or space is at a premium, research notes, that is a 2,000 word summary.

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Debbie Hill

Gregory Lee *

Howard Lee *

David McKenzie

Trish McMenamin

Philip Munro *

Anne-Marie O'Neill

Roger Openshaw

A personal journey: Introducing reflective practice into pre-service teacher education to improve outcomes for students

Anne Hume
School of Education,
The University of Waikato,
Hamilton, New Zealand

Abstract

This paper traces the development over several years of an initiative, involving student journals, that was introduced into a tertiary science education course for pre-service teachers in order to improve communication between the lecturer and students.

The narrative recounts how the nature and uses of the journals evolve subsequently as a result of reflective practice by the course lecturer and students.

This introduction of intentional reflection by the course lecturer, informed by ongoing action research, is providing valuable insights into the nature and extent of student learning and the actions required to improve outcomes for students.

Introduction

Reflective practice is widely advocated as an important attribute to promote, develop, and foster in participants within teacher education programmes. Thinking about one's experiences is believed to enhance professional learning and growth by helping students to develop a schooling philosophy that will guide and improve their teaching practice in classrooms (Moon, 1999; Shireen Deouza & Czerniak, 2003, Wallace & Louden, 2003). This paper relates to a postgraduate course in science education that I began teaching in early 2005 at The University of Waikato, and to a teaching and learning initiative that—when first introduced and trialled—was based loosely on reflective practice. The course caters for students with science degrees who are seeking entry into the teaching profession, and is a component in a one-year programme for secondary teacher training. Graduates of this programme serve an internship for a further two years in schools before becoming fully certificated secondary teachers. My teaching and learning initiative in its original form involved the use of student reflective journals as a means of providing feedback about teaching and learning in workshops and for communicating to me their classroom experiences when students were away from the university on teaching practice in schools. In these accounts of classroom teaching and learning, I discovered that the students' comments tended to be descriptive and lacked depth of thought, but their comments (or lack of comments) frequently hinted at aspects of the course content that could be added or modified to improve the students' teaching practice. I used this information consequently to help design the workshop sessions and tasks for the remainder of the course.

Despite the sketchy nature of these early student journals, I saw potential to improve their effectiveness as tools for planning and student learning by introducing strategies that might strengthen the quality of information students provided. I was motivated by the results of my first foray into reflective journals to continue their use in the course, and decided to investigate their use formally through action research. So, in the second year of my course, I entered a first phase of planned action research that included measures to strengthen students' reflective skills and the quality of their reflections. As indicated in the following account, this second phase of the initiative had some success in promoting deeper levels of student reflective thinking and, again, proved valuable for informing my planning. However in my exploration of the research literature on reflective writing and journal keeping I have found strong evidence that more targeted scaffolding of student reflective skills is required if high quality thinking about teaching and learning is to result, especially activities that promote greater understanding of learning how to learn science. To conclude my narrative, I identify some specific strategies for use as interventions in a second cycle of action research involving reflective journals that I hope to implement soon.

Background to the initiative

In my secondary teaching career I had experienced reflective thinking as a teaching and learning strategy in workshop situations during my participation in research projects, such as the Learning in Science [Teacher Change] Project (Bell & Gilbert, 1996) where we were being introduced to constructivist approaches to teaching and learning (Freyberg & Osborne, 1985). In these once-weekly 'home group' sessions, facilitated by the researchers, I learned much from sharing reflections with other participants. We discussed our experiences with trialling innovations in our individual classrooms during the intervening week between our meetings. I vaguely remember being required to keep a reflective journal but it was the reflective conversations, especially the anecdotal accounts we shared, that influenced my teaching practice the most in the long term. In a personal conversation recently with one of the authors of this study, she commented that the reflective journals came to assume little importance in the overall data-gathering process. Far more pertinent information came from the facilitated reflective conversations.

While setting up my secondary teacher-training course I recognized parallels

between this university course and the research programme I had been involved in many years earlier. As course lecturer I was introducing my novice teachers to teaching and learning approaches in workshops that they, in turn, trialled and evaluated in classrooms in much the same way as the research facilitators had done. Unlike those facilitators, however, I could not observe first-hand my teachers' experiences in class, so I would have to rely on their personal accounts after the event. Moreover the period of separation from fellow participants was longer for students in my course (upwards of seven weeks on one occasion), and therefore the opportunities for shared reflections were more limited. This isolation during their teaching practice alarmed me because, not only were my opportunities to formatively assess their progress limited, but the students themselves were also missing out on a source of important feedback about their teaching performance from peers and their course lecturer.

As I sought ways to resolve this communication problem I recalled the use of reflective journals in the research project. I realised that although journals had not assumed prominence in that project they could provide a forum perhaps in which my novice teachers could reflect on and evaluate their own classroom teaching experiences while on practicum. These written records could also allow me a "window" into their experiences and provide self-assessment data to inform a conference I held with each student on his or her return to the university after teaching practice. Information I gained in these interviews contributed to my judgments about students' final course grades.

The first stage of the initiative

Reflecting on my own experiences with journal keeping, I was conscious that this exercise in itself did not contribute hugely to my professional learning. In the research project there was no guidance, that I can recollect, about how to structure our reflections, and there was little imperative on us to produce these journals at any stage. Our verbal reflections in the workshops seemed to carry more weight with the researchers. I realised that, in order to encourage my students to engage in purposeful and regular reflection, some measures and guidelines needed to be provided.

In my reading of the literature associated with teachers' professional learning I encountered a paper by Shulman (1987) on the nature of the knowledge base required by good (effective) teachers. His paper was informed by philosophy, psychology, and a growing body of knowledge gained from case studies of the practice of young and experienced teachers. In seeking to promote teaching that emphasises comprehension and reasoning, transformation and reflection, Shulman observed that good teachers utilise a complex knowledge base gained from a range of sources or "domains of scholarship and experience" (Shulman, 1987, p.5) for understanding. To deal with the complexity of the knowledge base good teachers draw upon, Shulman proposed a number of categories. These categories include:

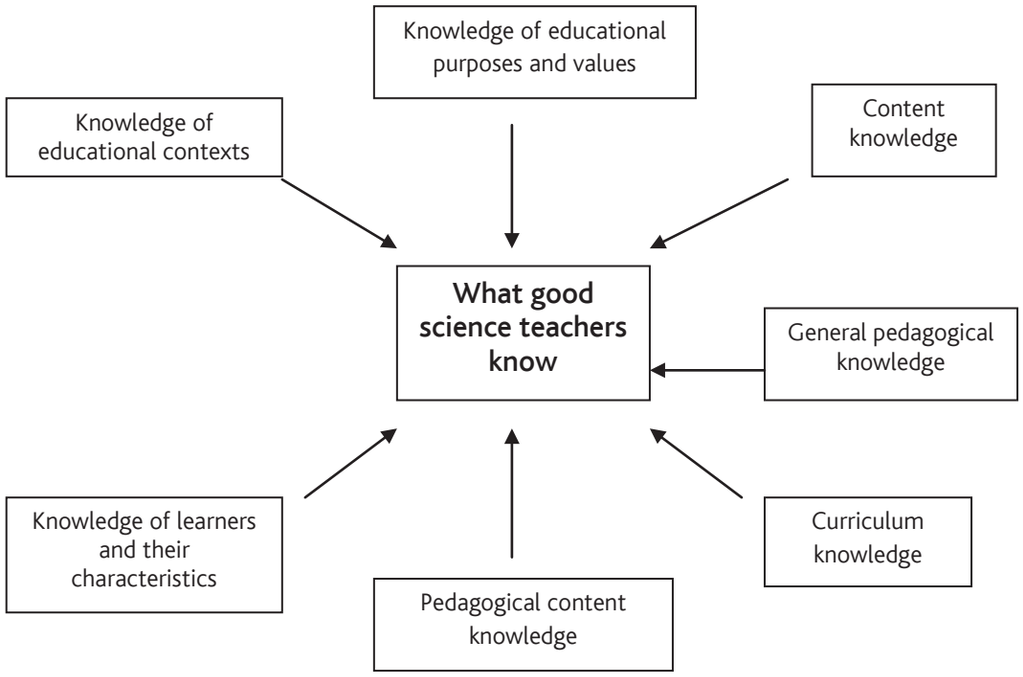
- content knowledge;
- general pedagogical knowledge, with special reference to those broad principles and strategies of classroom management and organisation that appear to transcend matter;
- curriculum knowledge, with particular grasp of the materials and programs that serve as "tools of the trade" for teachers;
- pedagogical content knowledge, that special amalgam of content and pedagogy that is uniquely the province of teachers, their special form of professional understanding;
- knowledge of learners and their characteristics;
- knowledge of educational contexts, ranging from workings of the group or classroom, the governance and financing of school districts, to the character of communities and cultures; and
- knowledge of educational ends, purposes, and values, and their philosophical and historical grounds. (p.8)

I came to appreciate that the students taking my pre-service course were beginning a process of enculturation into the practice of teaching, rather like embarking on a journey of discovery. On this journey they would be learning progressively and filling their 'baskets' of knowledge, as defined above. I decided to introduce his classification system (which I termed "the Shulman framework"; see Figure 1) through a scenario-based task early in the course (see Figure 2), to raise students' awareness of the diverse knowledge sources which teachers draw on when engaged in their profession and to give them some sense of where their learning journey was taking them. During a follow-up analysis of the task, each of Shulman's categories was examined in turn and related to the scenario.

Following this exercise it occurred to me that maybe Shulman's framework could also fulfil reflective and self-assessment functions. Perhaps the framework could be used by students as a means of monitoring their personal knowledge and skill growth. Hopefully this reflective activity also had the potential to motivate my novice teachers further in their learning by illustrating the progress they were making in building the knowledge base of a good science teacher. I felt optimistic that the strategy had merit, so instructed my students verbally to begin recording their progress in relation to any or all of Shulman's knowledge categories in journals, and to note the circumstances under which this progress was or was not occurring. I was eager to read students' assessment of their progress after they returned from their teaching experiences in schools.

In this first experiment with journal writing, the end results fell far short of my hopes and expectations in many respects. The students' records of their experiences actually provided little information about the knowledge gains they were making, and very few students linked these experiences to Shulman's framework. I was disappointed that students' reflections were generally low level, with the emphasis on descriptive rather than evaluative thinking. In hindsight I can see that my expectations were unrealistic, especially when I considered they had had little or no coaching or practice with reflective writing in my course and that they had not had the opportunity to develop reflective skills. I believe also that I had overestimated their capabilities in terms of understanding the ideas that underpin the Shulman framework and of relating these concepts to their first experiences as novice teachers.

Figure 1. Shulman's Framework



After Shulman (1987)

Figure 2. Teaching Scenario Task

Where are we going in this course?

- Imagine the scenario: You have just arrived at your first teaching position and learned that as the first topic of the teaching and learning programme, for the Year 10 Science class you have been assigned, you are required to teach the topic "Chemical Reactions".
- In pairs discuss and record what steps you imagine you'll have to take in order to begin teaching this topic. For example, what will you need to do? How will you go about tackling this task? What information will you need? Resources? (what, how, when, where, why, etc.)
- Share findings with another pair – summarise key points for whole class report back.

Students' journal entries did however provide some valuable glimpses into their classroom practice, thereby allowing me to develop insights into their learning needs that informed my planning for the remaining workshop sessions. For example many of my novice teachers described lessons that were teacher-centred, reliant on text and set exercises, and involved rote copying of notes from whiteboards or overhead transparencies. They often commented that their lessons were unsatisfactory or did not go to plan, and issues with behaviour management were raised frequently. It was rare for students to make any comments about the nature or extent of student learning in their classes. Having observed some of my student teachers in single critique lessons while on practicum and having talked with them at their conferences, I became convinced that they needed to widen their repertoire of teaching strategies, place more focus on what learning was to occur, and decide what constituted "successful learning". I sensed that with more learning purpose in the lesson, greater use of active student-centred learning strategies and more attention to monitoring learning, behaviour management might become less of an issue for these teacher-learners. Consequently in the following workshops I introduced and modelled varied teaching strategies and approaches, and encouraged my students to devise appropriate strategies in given scenario situations, illustrating the old adage that "there's more than one way to skin a cat".

The second stage of this initiative

As part of my formal induction into university teaching I attended workshops run by the Teaching and Learning Development Unit (TLDU) at The University of Waikato. These workshops alerted me to the role of scholarship in my tertiary teaching and to opportunities for related research within programmes like the Post-Graduate Certificate in Tertiary Teaching (PGCertTT). My experimentation with reflective journals seemed an ideal subject to explore further, and during my second year, I set up systems and gathered information I thought might be relevant to research tasks in the first of the two papers required for the PGCertTT. This preliminary work included development and implementation of assessment tasks and criteria involving journal keeping in the second year of the course (see Appendix 1), use of the journal data to assess students' learning progress and inform ongoing programme planning, and making an application for ethics approval to use students' journal writing retrospectively as data sources for research.

Ethics approval was granted, and at the end of the course, students were invited to participate in the proposed research by allowing access to their journals. This access was granted by all students in the course. Armed with this data I enrolled in the first paper of the PGCertTT.

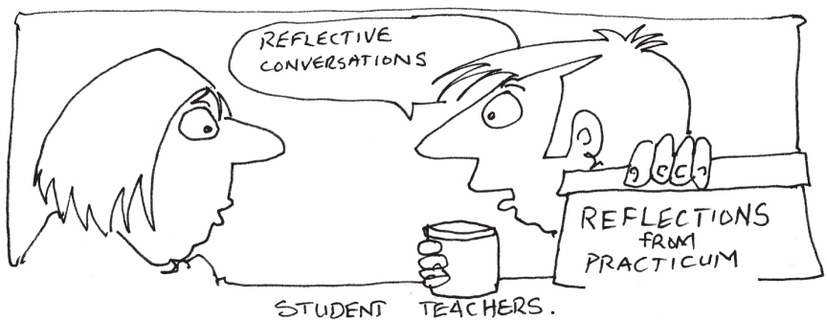
The tasks for the first PGCertTT paper required me to draw on scholarship to assist in the design of a teaching and learning initiative. In my academic reading for my doctorate, and more latterly for formulating a proposal for an education research bid, I became aware increasingly of the potential of a research paradigm known as critical theory (Cohen, Manion, & Morrison, 2000) for informing my teaching practice. Exponents of critical theory believe in the value of emancipatory research that is deliberately political and transfomative in its intent (Harding, 1987; Lather, 1992; Walshaw, 2001). A methodology that is well suited to critical theory investigations is action research, which involves participants in a form of disciplined self-reflective inquiry that is collaborative and designed to enable them to understand, improve, and reform their educational practice (Engstrom, Engstrom, & Sunito, 2002; Kemmis & McTaggart, 1988). Such inquiry is said to promote an appreciation by participant researchers of the relevance of research for their practice (Kennedy, 1997) and it builds their capacity to improve practice through their own research (Keeves, 1998). This methodology seems highly appropriate to my situation. Remembering the insights I had gained through personal experience as a teacher-researcher in the Learning in Science [Teacher Change] Project (Bell & Gilbert, 1996) convinced me that this was an ideal time to introduce this research approach to my tertiary classroom practice. The nature of action research enables me to make use of the current findings from my first informal attempts at problem solving, and to move forward by utilising the full potential of the methodology for improving my practice.

My new career as an action researcher

As a newcomer to this form of research I chose to use an action research design known as *practical action research,* as outlined by Cresswell (2005). The action research component involves a dynamic, flexible, and iterative methodology—one that allows me to spiral back and forth between reflections about a problem, data collection, and action. The methodology comprises a general spiral of generic steps that lets me pursue solutions to my identified problems in collaboration with other researchers or mentors, and to enter the spiral at any point appropriate to my particular action research project. In the following description I relate each of the steps in this (my first) cycle of action research to appropriate features of my experiences with student journals in the science teacher education course. These steps are:

Step 1: ***Identification of a specific practical problem to solve.*** This process is facilitated in reflective episodes that allow the action-researcher to explore, discuss with others, and identify the nature of issues facing him or her in the classroom and see the possibilities for change and improved practice. For example, in collaborative discussions with fellow participants in the PGCertTT course and the course tutor, I shared the difficulties arising from not being able to witness my students' experiences first hand while they were on teaching practice, and how I had attempted to solve this communication problem by introducing reflective journals. My research colleagues, interested in how I utilised information from students' written comments to decide on the content of my workshops when they returned to university, encouraged me to explore the potential of these journals to inform my planning. Motivated by my colleagues' arguments, I began examining some aspects of the student journal initiative retrospectively.

Step 2: ***Locating resources to help address the problem.*** As part of my investigation into journal use I began a purposeful, ongoing process of information collation and assimilation that informs my "evolving" research project. This process includes locating and digesting relevant literature on topics such as research methodologies, pre-service teacher education, reflective practice and the role of student journals in reflection; teaming up with other university-based education researchers to discuss issues; and identifying existing teaching and learning materials in text and on websites. I am fast recognising the contribution that this step is making to the growth of my personal knowledge base as a tertiary teacher, particularly my pedagogical content knowledge (PCK) (Shulman, 1987) for this course, because I am exposed to new ideas and approaches. PCK is that "blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners and presented for instruction" (Shulman, 1987, p. 8) that is so essential for meeting the specific needs of learners in this particular course.



Step 3: ***Planning a strategy for identifying and gathering relevant information to solve a specific problem related to the action-researcher's practice.*** This step involves determining what types of information are appropriate for this purpose, how much to collect, and how best to collect it. Data collection techniques can draw on three dimensions: experiencing (through observations and fieldnotes); enquiring (when the teacher-researcher asks); and examining (using and making records). Appropriate techniques in the context of my problem could include participant observation in workshops, interviews with students and/or questionnaires, literature reviews, and examination of artifacts such as existing teaching and learning materials in text and on websites. For this first cycle of research, I decided to draw on recollections of my observations of the student teachers in workshops, my personal interviews (conferences) with them, the contents of their reflective journals, and my planning notes for the course.

Step 4: ***Implementing the collection of relevant information, ensuring that accurate records are kept and organised to facilitate analysis and that the quality of information is maintained.*** Some of this data had been collected already in "hard copy" form (i.e., photocopies of students' journal data), and my course planning notes were still available. I had to rely on my personal recollections of students' behaviours in workshops and comments in interviews to complement this "hard"

evidence, which did compromise the "trustworthiness" of my data (Guba & Lincoln, 1989). Given the opportunity again, I would audiotape and transcribe interviews and construct a set of reflective thoughts or head notes (Cowie & Bell, 1999) as soon as possible after each workshop session.

Step 5: ***Analysing the information in a manageable and useful way for formulating a plan of action.*** In my informal analysis of this data after students returned from teaching practice, I simply searched for indications of growth in the student teachers' knowledge categories, in line with the Shulman framework (and to confirm that my teaching strategies were working), and to identify gaps where further learning was required. As I discovered, students made some comments about their impressions of workshop activities and classroom activities but they rarely made specific references to Shulman's framework and to the growth of their knowledge bases. There were exceptions. One student, Jennifer (a pseudonym), who had been a research scientist in her previous career related her experiences to Shulman's framework and demonstrated a deep level of understanding. Under the heading of "Pedagogical content knowledge" Jennifer wrote:

> *Discussions on the nature of science (in workshops) highlighted discrepancies between what I as a research scientist did and what students learn at school. I can see that classroom teaching of science in a procedural manner where the teacher states this is the question; this is the path to the answer and this is the answer you should (have) got will give a false perception. [Though it is taught this way for:*
>
> *1) getting results to prove a theory/ concept,*
>
> *2) time constraints so must get work done, no side tracks,*
> *3) making sure all students have same experience and meet learning objectives for assessment purposes.]*
>
> *BUT science research is not like that. The question comes before the concept (based on observation and why it is like that), and many questions are needed in order to define the problem because often one knows a lot of information just not how it relates (until one asks the questions that show this). Then comes trialling different methods/easy of answering a/some question(s) to define the problem more exactly [during which process one discovers other question(s) that need thinking about]. Experiments seldom give straightforward results; they always raise other issues (more questions). It is the questions that drive science knowledge and discovery, not the solutions. How does this relate to teaching science in a classroom?*

Jennifer's insight into the "authentic scientific inquiry" versus "school science" dilemma and her willingness to explore this complex issue—one that worries many eminent science educators (e.g., Atkin & Black, 2003; Hodson, 1996; Hofstein & Lunetta, 2003)—is indicative of the type of reflective thinking that many writers in reflection believe to be most effective for learning (e.g., Coble & Koballa, 1996; Shireen Deouza & Czerniak, 2003; Wallace & Louden, 2000). Moon (1999) has considered such reflection to be "a form of mental processing with a purpose and/or anticipated outcome that is applied to relatively complex or unstructured ideas for which there is not an obvious solution" (p. 23). Schon (1987) was interested in exploring the type of thinking that professionals engage in when confronted with practical problems that are unique and not in "the textbook". He coined the phrases "reflection–in-action" for those actions where teachers draw on tacit knowledge to solve immediate problems and "reflection-on-action" for retrospective thinking about problems after the event. In both instances, practitioners learn and change practice on the basis of real life, in situ, problems. It would appear that people learn best from reflecting on situations or events that are not straightforward or out of the ordinary.

While most students did not make specific reference to Shulman's framework as Jennifer did, some students displayed higher levels of reflective skill generally than had been the case in the previous year. This outcome, I believe, can be attributed to the use of clear learning goals and achievement criteria in my assessment practice (Sadler, 1989). For example, in her reflection on the unit writing assessment task (see Appendix 2) Rosemary (a pseudonym) wrote:

> *I really enjoyed writing unit plans – a lot of effort and thought but so useful in time to come. [I] think the unit plans are far more useful and practical than lesson plans as they are more flexible and give you a really good overview of where you are heading. …. Also teaching in context allows you to teach the interactive nature of science eg how the chemical/material world impacts on the living world and vice versa. Although we have different branches/areas of science they all have overlapping areas.*

I consider that the explicit sharing of success criteria with the students, including my formative assessment practice of providing written feedback and feedforward (next learning steps) on their assessed work (Bell & Cowie, 2001; Black & Wiliam, 1998), contributed to Rosemary's ability to evaluate experiences—rather than merely to describe them—by providing a model of effective evaluative practice. She developed her reflections with justification and evidence.

Despite students' general failure to use Shulman's framework as a thinking structure, their comments prompted thinking on my part that informed my planning. Students' comments tended to reflect a "need to know", or "what needed to happen" approach, but usually the next step was missing—that is, the specifics of how to address the need. To this effect Flora (a pseudonym) commented:

> *I need to do activities/use strategies during the lesson to get them thinking about what is occurring and for me to see that they are understanding …. they can work through the problems but [I am] not sure they always understand why.*

Sometimes she hinted at the next step, but not the detail:

> *I also was reminded of the importance of variety–I need to try and use demos/ experiments/interactive activities (other than group discussions) so that the students stay interested for longer.*

Similarly, Doug (a pseudonym) identified the problem as follows:

> *[My] Year 11 is still going badly classroom wise with students not wanting to be in the class and [I] attempted to address the issue: [I] have tried to be hardcase. . .*

but found he "wasn't consistent enough with that as it is not natural for me to be like that so this caused problems". Clearly the solution to Doug's problem was how to make students want to stay in class.

Student comments, as illustrated above, challenged me to devise subsequent workshop sessions that provided my student teachers with the means of dealing with these problems themselves. Thus several of my workshops featured guest speakers and the development of lessons and units in science settings that were potentially fascinating for students (like forensics, the alchemy in Harry Potter stories, Polynesian navigation, and tsunamis) to raise their awareness of how teaching in context can stimulate student interest and engagement in learning. These workshops were very successful in this regard and well worth introducing into the course. In this context Linda (a pseudonym) wrote:

> *I really enjoyed both speakers especially the navigation [one]. I learnt a lot about how the Maori people came to NZ and could feel how the science was so much more exciting as it had relevance and emotion attached to it. These are both good ways to incorporate science learning in context*.

I am hopeful that this awareness will translate into practice when my student teachers work with their own science classes.

Step 6: ***Developing a plan for action that is a strategy for trying out some ideas to help solve the problem.*** The continued prevalence of lower level reflective thinking in the students' journals, as revealed in my data analysis, can be explained in part by the lack of practice available to students in my course. Any plan to improve the quality of students' reflections therefore should include opportunity to practice skills. Writing in support of journal use in pre-service teacher education Bain et al. (2002) reported that many researchers and theorists maintain that reflective skills can be taught and learned, despite early difficulties. My own experience and research into formative assessment suggests that these skills should be made explicit (Clarke, 2001). Exemplars that illustrate good reflective journal writing, as suggested by Moon (1999), form part of a valuable pedagogical strategy to promote reflection that results in transformational learning; that is, changing the way students view the world (Pavlovich, 2007a). Bain et al. (2002) investigated the role of feedback in improving journal writing, and found that "feedback focusing on the reflective writing process – giving guidelines and a suggested framework for moving into higher levels of cognitive activity – is both more effective and more easily generalised than feedback focusing on the *teaching issues* raised by teachers" (p. 193). Providing students with feedback in relation to exemplars seemed a promising strategy to include in my action plan, therefore. In the domain of mathematics teaching Moore (2005) encouraged her trainee teachers to use reflective journals to learn how to learn mathematics. In their journals she required students to critically assess their own learning experiences in workshops and then to apply that experience when creating learning opportunities for their students. Moore reviewed their journals periodically, and found this structure for reflection to be very effective in helping students develop personal knowledge in relation to the development of their content knowledge. Again, such a strategy appears compatible with other components of my plan. It is worthy of inclusion.

Because analysis of my data revealed that students made little reference to the Shulman framework in their journal reflections, I needed to ask why this had occurred. Could it be that students were unable to fully comprehend Shulman's classification system due to a lack of pedagogical experience and knowledge of the education "community of practice" system in education, or was it simply their lack of skill and practice in reflection? As indicated in earlier discussions, I suspected both contentions to be factors in this problem. I did not want to abandon Shulman's elegant interpretation of a teachers' knowledge base as a reflective tool, but appreciated that I needed to do more intensive scaffolding of students' learning about the true nature and extent of each knowledge category before the framework was used in their reflections. Education experts, however, are still grappling with the finer details of what constitutes pedagogical content knowledge in Shulman's view of teacher knowledge (Van Dijk & Kattmann, 2007). Without a deeper understanding of what it is that they need to learn as good teachers, in Shulman's view, my students cannot classify successfully what it is they are and are not experiencing using his framework. Perhaps more overt identification of knowledge gains in workshop activities in relation to Shulman's framework could help in the times that are dedicated specifically to reflective writing and sharing (Moon, 1999). For example, following the activities in workshops on curriculum documents, including the writing of specific learning outcomes in various science contexts, students could be asked to reflect (in writing) on their experiences, with specific comment on the knowledge categories in which they believe they are gaining ground.

In summary, I decided to retain Shulmans' framework as the basis for student reflection but planned to strengthen student understanding of the knowledge categories and reflective capabilities by promoting more purposeful scaffolding of their learning. This was achieved by strengthening my own formative assessment practice through the use of exemplars, focused feedback, and feed forward (next learning steps) comments in journals. My mission was to develop specific tasks and approaches for workshops in the next semester that would enable me to address the various issues raised in this phase of action research in the ways discussed above. I planned to use a reflective journal myself that would serve as a data collecting and analysing tool; that is, a record of my actions, observations of students' behaviours, and reflective comments in the form of head notes. Other data collecting methods comprised student interviews and documentation, including my planning notes and students' reflective journals. Ethics approval was sought.

Step 7: ***Implementing the plan to see if it makes a difference.*** This step involved trying out my proposed solution to the problem the following semester, as outlined in Step 6, and monitoring whether it had an impact. Reflecting on what has been learned from implementing the plan and sharing with others was essential, therefore. This step has now been completed, and the findings will inform further publications and another action plan for research.

Concluding thoughts

The use of this particular form of action research (Creswell, 2005) has given me a clear sense of direction and purpose in my own professional growth. With this focus comes the confidence that each modification I make to my teaching approach is having positive outcomes for my students, because my decisions are guided by evidence-based reasoning that is specific to our teaching and learning situation and targeted at our identified needs. It has been gratifying to read the thoughts of one author (Moon, 1999) who has worked for an extended period of time

in the field of reflection. In her book on learning journals she commented:

> *In the preparation of this book, a number of situations have become evident where journals have been introduced without much forethought. This can work. It is almost in the nature of journal writing to be experimental–but some thought may mean that the exercise is more likely to be sustained, with a more substantial and satisfying outcome. However, while forethought is important, it is unlikely that a journal will be 'right' the first year. Journal writing evolves with the experiences of the learners and the teaching staff. (p. 78)*

These thoughts certainly reflect my experiences with reflective journals. I am motivated sufficiently by successes to date with this tool for reflection that I look forward to the results of the next phase in my personal journey towards enhanced professional practice.

Dr Anne Hume is Senior Lecturer in Mathematics, Science and Technology Education in the School of Education at The University of Waikato. E-mail: annehume@waikato.ac.nz

References

Atkin, J.M., & Black, P. (2003). *Inside science education reform: A history of curricular and policy change.* New York: Teachers College Press.

Bain, J.D., Mills, C., Ballantyne, R., & Packer, J. (2002). Developing reflection on practice through journal writing: Impacts of variations in the focus and level of feedback. *Teachers and Teaching: Theory and Practice, 8*(2), 171-196.

Bell, B., & Cowie, B. (2001). *Formative assessment in science.* Dordrecht: Kluwer.

Bell, B., & Gilbert, J. (1996). *Teacher development: A model from science education*. London: Falmer.

Black, P.W., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7-74.

Clarke, S. (2001). *Unlocking formative assessment: Practical strategies for enhancing pupils' learning in the primary classroom*. London: Hodder & Stoughton.

Coble, C. R., & Koballa, T. R. (1996). Science education. In J. Sikula (Ed.), *Handbook of research on teacher education* (pp. 459-484). New York: MacMillan.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed.) London: Routledge.

Creswell, J.W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. New Jersey: Pearson Education.

Engstrom, Y., Engstrom, R., & Sunito, A. (2002). Can a school community learn to master its own future? An activity-theoretical study of expansive learning among middle school teachers. In G. Wells & G. Claxton (Eds.), *Learning for life in the 21st century: Sociocultural perspectives on the future of education* (pp. 211-224). Oxford: Blackwell.

Guba, E., & Lincoln, Y. (1989). *Fourth generation evaluation*. Newbury Park: Sage.

Harding, S. (Ed.). (1987). *Feminism and methodology*. Bloomington, IND: Indiana University Press.

Hodson, D. (1996). Laboratory work as scientific method: Three decades of confusion and distortion. *Journal of Curriculum Studies, 28*(2), 115-135.

Hofstein, A., & Lunetta, V. (2003). The laboratory in science education: Foundations for the twenty-first century. *Science Education, 88*(1), 28-54.

Lather, P. (1992). Critical frames in educational research: Feminist and post-structural perspectives. *Theories into Practice, 13*(2), 87-99.

Keeves, J.P. (1998). Methods and processes in research in science education. In B. Fraser & K. Tobin (Eds.), *International handbook of science education* (pp. 1127-1153). Dordrecht: Kluwer.

Kennedy, M. (1997). The connection between research and practice. *Educational Researcher, 26*(7), 4-12.

Kemmis, S., & McTaggart, R. (Eds.). (1988). *The action research planner* (3rd ed.). Victoria: Deakin University Press.

Moon, J.A. (1999). *Learning journals: A handbook for academics, students and professional development*. London: Routledge.

Moore, J. (2005). Transformative mathematics pedagogy: From theory to practice, research and beyond. In A. Rodriqez & R.S. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 183-202). London: Lawrence Erlbaum.

Osborne, R., & Freyberg, P. (1985). *Learning in science: The implications of children's science*. Hong Kong: Heinemann.

Pavolich, K. (2007a). Putting the 'who' back into learning. *Education Review*, February 16, p.16.

Pavlovich, K. (2007b). The development of reflective practice through student journals. *Higher Education Research & Development, 26*(3), 281-296.

Sadler, R. (1989). Formative assessment and the design of instructional systems. *Instructional Science*, *18*, 119-144.

Schon, D. (1987). *Educating the reflective practitioner: Towards a new design for teaching and learning in the professions*. San Francisco, CA: Jossey-Bass.

Shireen Desouza, J.M., & Czerniak, C.M. (2003). Study of science teachers' attitudes towards and beliefs about collaborative reflective practice. *Journal of Science Teacher Education, 15*(2), 4-14.

Van Dijk, E.M., & Kattmann, U. (2007). A research model for the study of science teachers' PCK and improving teacher education. *Teaching and Teacher Education, 23*, 885-897.

Walshaw, M. (2001). Engaging postpositivist perspectives in mathematics education. In R. K. Coll (Ed.), *SAMEpapers* (pp. 19-33). Hamilton: The University of Waikato Centre for Science, Mathematics and Technology Education Research.

Wallace, J., & Louden, W. (2000). Interests and forms: Johanna. In J.Wallace & W. Louden (Eds.), *Teachers' learning: Stories of science education* (pp. 99-125). Dordrecht: Klewer.

Appendix 1

Assignment One: Development of a Science Teaching Portfolio and Professional Tasks

The section below relates to the instructions for the reflections journal that is part of the requirements for Assignment One.

As a key component of your portfolio I want you to keep a **reflections journal.** This is an ongoing record of your thoughts as you reflect on the progress you are making and the areas you need to further develop. Use the Shulman framework as a basis for your reflections, ask yourself questions like:

- what knowledge/understandings have I gained from the various learning experiences occurring during this course, including practicum?
- what's going well?
- what areas do I need to do more work on/gain more experience of?
- What can I do to improve my capabilities in these areas?

I suggest you use a **small notebook** for this purpose.

The journal was assessed using the following criteria

Each aspect will be graded as follows:

No evidence of development	0
Evidence of some development	1
Evidence of sound, appropriate development	2
Evidence of high quality, insightful development	3

Criteria 1: Provides details of knowledge and understandings gained from practicum experiences, with reference to the Shulman framework,

Grade	0	1	2	3

Criteria 2: Describes areas of strengths in teaching with instances of successful teaching and learning

Grade	0	1	2	3

Criteria 3: Describes areas of teaching practice that need strengthening, with reasons

Grade	0	1	2	3

Criteria 4: Discusses possible strategies for further development and improvement of teaching capabilities

Grade	0	1	2	3

Appendix 2

Assignment Two (35%)

Unit Plan in Context (Outcomes 1-10)

Prepare and submit a unit of work based on *Science in the NZ Curriculum*.

The unit must cover 12 hours of work, and must use achievement objectives from **at least two contextual strands** and **both integrating strands.**

The unit must be word processed and submitted electronically for inclusion on a CD ROM

It needs to include:

An overview of the unit that links:

- achievement objectives (including skills)
- specific learning outcomes (SLOs) including investigative skills and knowledge
- learning experiences and sequence
- assessment methods

Attached to this must be

- 6 original learning experiences (in a form ready to be used by others)
- 3 assessment items with marking schemes (linked to achievement objectives)
- evaluation forms for both teacher and student)
- resources and references
- safety notes