



TEACHING & LEARNING  
RESEARCH INITIATIVE

NĀU I WHATU TE KĀKAHU, HE TĀNIKO TAKU

CASE STUDY

# Knowing differently, not knowing more: A practitioner inquiry in primary pre-service teacher education

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# Abstract

This practitioner inquiry investigates how student teachers in a primary initial teacher education Professional Studies course understand knowledge, teaching and learning and their roles as teachers. It also explores my own conceptualisation of knowledge, as a teacher educator. I undertook a pedagogical initiative to engage student teachers with theory relating to epistemological understandings and to engage them in active reflection about their personal epistemological assumptions. The theoretical framework I developed was used to analyse the student teachers' personal epistemological understandings and their shifting (morphing) conceptualisations. A questionnaire survey, mind mapping activities and semi-structured interviews provided data for analysis.

Findings suggest that student teachers' personal epistemological understandings changed, although some embraced new ideas more fully than others and the nature of shifting understandings was complex. Shifts, or morphs, in understandings of knowledge were revealed as tensions and struggles. These tensions related to student teachers' shifting identities as they negotiated their identities as students and their emerging identities as teachers.

## Introduction

This inquiry is part of a Teaching and Learning Research Initiative (TLRI) project relating to initial and continuing teacher education, where teacher educators were involved in an exploration of shifting understandings of knowledge and learning, and how this influenced their ontological and epistemological thinking and their practice. Teacher educators researched their own practice in the context of their work with teachers and student teachers.

This particular inquiry is positioned within an initial teacher education context and includes investigations with primary student teachers who were entering the second of a three-year degree programme. The student teachers participated in a Professional Studies course, which was delivered online and included an intensive, one-week, on-campus programme. The inquiry explores my own and student teachers' conceptualisations of knowledge—what I and they thought knowledge was, how I invited student teachers to explore epistemological understandings through a pedagogical initiative and how the student teachers responded to this in their thinking and reported actions on their practicum experiences. The research was conducted with a view to informing my own practice and developments in teacher education more broadly.

The research questions were:

1. How have my epistemological understandings developed?
2. How do student teachers' understandings of knowledge, teaching, learning and curriculum shift in the context of a pedagogical initiative in a Professional Studies course?

This is a story, or narrative, told from two different but intertwined perspectives, the personal and the professional. The personal voice in the inquiry incorporates reflections on my thinking throughout the project and what was happening for me, my experiences and feelings. The professional voice I think of as my academic voice, where I have written more consciously to connect with research, theory and literature and to report the results of empirical research.

## What got me here?

Several significant things converged relating to my work and role at the University of Canterbury and to national curriculum developments. These factors included the introduction of the new *New Zealand Curriculum* (NZC), the redevelopment of the undergraduate teaching degree in primary education at the University of Canterbury College of Education, my appointment as a Practitioner Specialist, my awareness of the growing gap between my practice and rhetoric and a driving personal, professional desire to find new ways to theorise

practice and to practise theory.

As a primary school teacher in the 1980s and 1990s, I considered I had a constructivist approach to teaching. This approach framed how I interacted with children, parents and colleagues and how I thought about learning and teaching for as far back as I can remember. When I became a teacher educator at the Christchurch College of Education (CCE) this paradigm was severely challenged. The disjuncture between what I believed about how learning happens and how I was expected to teach in the tertiary context caused me some discomfort and I acted to change the courses I taught to enable me to align my practice with my beliefs, within certain structural constraints. However, I did not look closely at why these beliefs were so important to me.

From 2005–2007, I taught third grade in a large elementary school in the United States. I then returned to a tertiary environment at the University of Canterbury, following the initial stages of an institutional merger of the Christchurch College of Education and the university. This forced me to re-evaluate my role as a teacher educator in quite a different context. What is my role now as a teacher? How can I balance this with the increasing demands of being a researcher? How does my experience as a practitioner fit in this merged context? What is valued by the institution, students and the profession? How do these things align with my personal epistemologies?

The impetus to explore these questions came from this changing institutional context and also the publication of the draft NZC. I considered this document to be fundamental in terms of curriculum development in all schools. In particular, I felt that the front section of the curriculum articulated key understandings about the role and nature of education that were both holistic and contextual. The achievement objectives for specific learning areas appeared to be broader, more conceptual and less prescriptive in nature across all curriculum areas. This potentially allowed teachers more flexibility in the interpretation and implementation of the NZC. I was now asking questions about how the new curriculum could become a central part of our initial primary teacher education programme and how we could develop a considered and consistent approach to understanding and working with it.

Concurrently, a group of colleagues formed a research group to explore these ideas. Through discussions and regular seminars it became increasingly apparent that the NZC represented something far larger and more wide-reaching than I had ever envisaged. Words I had grasped at a superficial level now became the currency when talking about the NZC. Concepts of the 'knowledge wave', 'post-structuralism', 'post-modernity' and 'complexity thinking' were on the edge of my understanding.

This past year has been illuminating as I have grappled with different views of the world, trying to make sense of the theoretical frameworks and ways of thinking this research project has revealed. The ongoing work is challenging but invigorating, and 'wobblifying' (it has given me the wobbles in terms of my personal and professional identity and view of the world). There is much I still need to do to understand these complexities more fully and engage with them more critically.

## How is knowledge conceptualised in the NZC?

The NZC (Ministry of Education, 2007) has undergone major revision and was mandated by the New Zealand government in 2010 for implementation in all public schools. The curriculum document follows a deliberate organisation. The government's vision for young people is the starting point, eight principles follow, and seven values and five key competencies are then described. An overview of each of the eight learning areas outlines the core elements and understandings.

The NZC maintains the outcomes-focused curriculum model, implemented in 1992, by describing the objectives to be achieved in each of these learning areas across eight progressive levels, each representing approximately two years of schooling. At the same time, the philosophy of the curriculum, which is articulated in the vision, values, principles and key competencies, suggests a change in epistemological understanding. The placement of this philosophy at the front of the document can be taken as an indication of its assumed importance. This aspect of the NZC can be conceived as a reflection of post-industrial or 'knowledge age' ideologies and

conceptions of knowledge, learning and education in that it supports different ways of knowing, teaching and learning (Andreotti, Major, & Giroux, 2009; Andreotti & Souza, 2008; Gilbert, 2005; Hipkins, 2008).

These front-end components of the NZC are essentially future-focused. They describe learning as a lifelong endeavour, shaped by interactions with different people, places, ideas and things. It is about connectivity. Knowledge is more of a process than a product; it happens within the relationships established within teams and groups. Generating and doing things with knowledge is more important than acquiring knowledge. The context of this inquiry, in terms of the NZC, is the knowledge age conceptualisation of knowledge.

## Personal epistemologies and my personal thinking journey

### Theoretical influences

Theoretically, and from a psychological and educational perspective, research exploring personal epistemology or epistemic cognition focuses on how the individual develops conceptions of knowledge and knowing and how these are used in developing their understanding of the world (Baxter Magolda, 1992; Belenky, Clinchy, Goldberger & Tarule, 1986; King & Kitchener, 1994; Perry, 1968; West, 2004). Epistemological beliefs include understandings of the definition of knowledge, how knowledge is constructed, how knowledge is evaluated, where knowledge resides, and how knowing occurs.

Such beliefs are activated when students are engaged in learning, and learning is approached quite differently depending on how knowledge is conceptualised and how the learner perceives their role in the learning process (Hofer & Pintrich, 1997). Epistemological beliefs determine what and how meaning is made from information and experience and how learning and teaching are conceptualised (Bondy et al., 2007; Brownlee, 2004; Hill, 2004).

Theoretical frameworks propose a number of models and dimensions to understanding personal epistemological understanding. Here I synthesise those theoretical frameworks that have influenced my thinking and research, specifically those proposed by Baxter Magolda (1992, 2004), Hofer (2004), Hofer and Pintrich (1997, 2002) and Schraw and Olafson (2003, 2008).

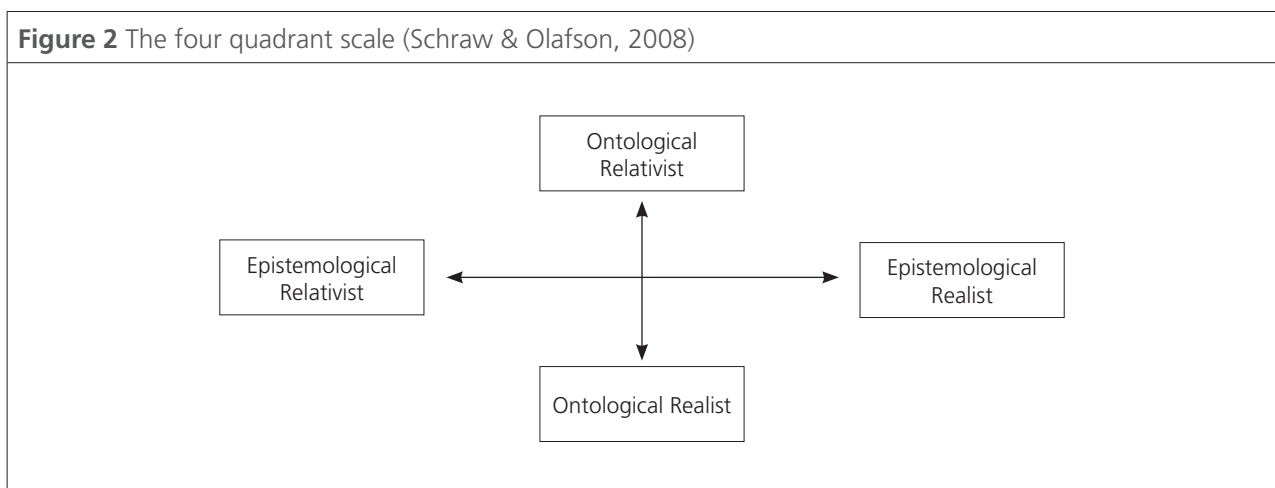
Baxter Magolda (2004) describes personal epistemology and epistemological reflection as following a developmental trajectory through four distinct stages, driven by a process of cognitive disequilibrium. She explains personal epistemology as a set of independent beliefs about knowledge which are socially constructed, context bound and intertwined with relationships and identity. Epistemological reflection is described as intertwined and dependent assumptions about the nature, limits and certainty of knowledge and how these evolve. This leads to a categorisation of epistemological positions and thinking as sequential stages; absolute, transitional, independent and contextual knowing (Baxter Magolda, 1999). People actively construct meaning from their experience, interpreting, evaluating and drawing conclusions about what these experiences mean (Baxter Magolda, 2004). This constructed meaning is dependent on the current assumptions people hold about themselves and the world, conflicting assumptions they encounter and the context in which the experience was situated. Movement through the developmental stages of this model stems from the interaction of these internal and external factors (Baxter Magolda, 2004).

Hofer and Pintrich's (1997, 2002) framework (Figure 1) is based on key aspects identified across the fields of personal epistemology and philosophy, in which they define personal epistemology as epistemological theories. This definition is characterised by more fluid development, and conceptualises personal epistemology as more theory-like rather than as a set of independent beliefs. The strength of this framework is that it combines a developmental perspective with a dimensional view of personal epistemology. This interpretation sits comfortably with my personal and professional experiences as a teacher and teacher educator.

Figure 1 Dimensions of knowledge (Hofer, 2004)	
Dimension	Continuum
Certainty of knowledge	Absolute truth ←————→ Tentative and evolving
Simplicity of knowledge	Discrete facts ←————→ Relative contingent and contextualised
Source of knowledge	Originating outside the self ←————→ Actively constructed in interaction with the environment and others
Justification for knowing	Observation, authority, what feels right ←————→ Evaluation of evidence, expertise, views of experts

Unlike many researchers who have explored teachers' epistemological beliefs in different academic domains (e.g., mathematics, science), Olafson and Schraw (2006) have explored the potential domain generality of teachers' knowledge beliefs. They concluded that teachers hold multiple beliefs and engage in teaching practices that are both domain-general and domain-specific.

In more recent research, Schraw and Olafson (2008) combine epistemological and ontological beliefs on to a matrix designed to provide insights into levels of realism or relativism. Two intersecting continua create a matrix with four quadrants (Figure 2). Their preliminary findings suggest that teachers tend to cluster in the quadrant of ontological and epistemological relativism; however, some teachers' responses map into the quadrants of both ontological relativism and epistemological realism. This suggests that there may be disjunctions between espoused epistemology and lived ontology, the reasons for which need further study (Schraw & Olafson, 2008).



For the inquiry I chose to use a synthesis of these definitions and approaches to personal epistemology to describe and identify epistemological thinking and shifts in thinking. I developed a conceptual framework (Figure 3), synthesising ideas from Hofer and Pintrich (1997) and Schraw and Olafson (2003). The framework blends ideas relating to epistemological dimensions and realist, contextualist and relativist ontologies and provides a summary of the research and theory I had been reading and an initial framework for the data analysis.

**Figure 3** Conceptual framework

<b>Approaches</b>	<b>Realist</b> ( <i>Olafson &amp; Schraw</i> )	<b>Contextualist</b>	<b>Relativist</b>
<b>Dimensions</b>	<b>Traditionalist, Mechanistic, Technicist</b> <b>Industrial Society</b> <b>Knowledge is 'knowing'</b>	<b>Cognitive Adaptability</b> <b>21st Century— Knowledge Society</b> <b>Knowing is 'being'</b>	<b>Epistemological Pluralism</b> <b>Knowing as 'becoming'</b>
Certainty/Stability of knowledge —explicitness	Fixed core body of knowledge More certain Pre-established curriculum Knowledge independent of the knower; relatively unchanging	Knowledge changes over time Situational—adapted by the knower to fit contextual demands—changes consensually Necessary to succeed in one's environment	Knowledge is subjective + particular Unique to the knower—subjective, highly changeable Tentative
Simplicity/ Structure of knowledge —consistency —stability	Knowledge is objective and universal, relatively unchanging Pre-established knowledge base—universal Facts	Process is more important than type of knowledge Knowledge is complex Knowledge is constructed collaboratively rather than reconstructing what experts say	More complex Shared understandings constructed in a collaborative context Idiosyncratic Conceptual
Curriculum (as context) beliefs	Acquisition of previously identified knowledge base and learning skills Teacher-designed curriculum (interpreted from official documents)	Acquisition of situationally relevant knowledge base + learning skills; encourages students to adapt and change knowledge to meet present demands	Emphasises multiple perspectives and analysis of knowledge adapted to meet individual needs and interests
Origin/sources of knowledge Experts/authority	Exogenous constructivism, primacy of experts. Emphasis on reconstruction Knowledge is best acquired through experts through transmission and reconstruction External	Dialogical constructivism, reciprocity between self and experts Learners construct shared understandings in supportive contexts	Endogenous—primacy of self-autonomy. Each learner constructs a unique knowledge base that is different but equal in value to other learners' knowledge Internal
Justification of knowledge—how individuals justify what they know and how they evaluate their own knowledge and others.	Accept without question the claims made by teachers, experts, books, what an authority indicates is correct. Knowledge is justified through observation of an authority.	Justifies knowledge claims by ones own feeling or perception of what is correct. Will question an authority if own experience is different. What feels right	Knowledge is justified in terms of other perspectives, an evaluation of evidence, expertise and authority and the assessment and integration of the views of experts. A critical reasoned evaluation of the available claims and evidence.

### Understanding epistemological shifts as 'morphs'

Central to this research is a need to understand what shifts might be evident in my own and the student teachers' thinking and what triggered these shifts. Piantanida, Tananis and Grubs (2004) use the metaphors of a journey and morphing to convey the evolving conceptual nature of trying to understand complex concepts. These metaphors resonate with my thinking and experience of this inquiry and seem a better fit than the more linear project words 'shifting' and 'changing'.

The notion of morphing can be described as something that has triggered cognitive dissonance or a conflict with epistemological beliefs (Perry, 1968), a questioning of existing assumptions and crafting new ones to see the world from a more complex perspective (Baxter Magolda, 2004). It is also described as a dissatisfaction with existing beliefs and an acceptance that the alternatives are intelligible and useful and a means of connecting new beliefs to earlier conceptions (Hofer, 2004). Berger (2004) describes the space a person is in at moment of morphing as the liminal zone. This is the space between our knowing and not knowing and it is here, at the edge of our meaning-making and thinking, that we can come to terms with the limitations of our knowing and thus begin to stretch those limits. This is the most precarious, transformative space but difficult to understand as these zones are fluid and constantly moving (Berger, 2004). This moving beyond a previously held conception or belief, through an undefined and unfamiliar space and towards a different perspective, is to lose a sense of the former world before the new world is fully articulated (Belenky et al., 1986; Perry, 1968).

Of importance is what triggered the morphing or transformation and how this might be used to encourage student teachers to interrogate their personal epistemologies and understand how these unconsciously influence their learning and teaching. Drawing on Kegan's work, Berger (2010) describes such a transformation as more than adding information to a container (your mind), but about changing the very form of the container—making it larger, more complex, more able to deal with multiple demands and uncertainty. Baxter Magolda's (2004) ideas resonate with this in the description of a shift towards a more complex set of epistemological assumptions rather than the acquisition of particular learning strategies or skills.

These three conceptualisations of:

1. epistemological dimensions and understandings
2. morphing as shifting understanding
3. beliefs as transformational

all underpin this inquiry.

## Personal experience

My conceptual world changed irretrievably through participation in the project. I was negotiating an unknown space and my perspective on many complex and core concepts was being challenged. I was morphing. It was uncomfortable, like driving in fog. I was not sure where the journey was taking me but I knew I was safe (I trusted the project leaders implicitly) and moments of illumination, although intermittent, provided a little more certainty and explanation. I had a strong sense of wanting to leap back to the way I was. While I was in this space of uncertainty and ambiguity I could not express in language what these feelings and experiences represented. Also, it was difficult to reconcile the growing awareness I had of the discrepancy between what I was now thinking and understanding and how I was teaching; there was a distinct and troubling incoherence. It was as if I was growing into a new skin that only I could see. I felt as if I was a different person doing the same things which I no longer believed in.

What became clearer about this time was the significance of being in the space between the realist, contextualist and relativist positions as described on the conceptual framework (refer to Figure 3). This was my transformative edge (Berger, 2004; Perry, 1968) and it felt precarious. There was no clear delineation of my state, I wasn't experiencing a contextualist or realist way of knowing, I was somewhere in-between and this was an important discovery as it helped me understand and feel more comfortable with the uncertainty, fluidity and ambiguity of the nature of knowledge and knowing. It also helped me to think about what might be happening for the student teachers I was working with in terms of their 'being in the space' rather than in a more clearly defined position. Something had to change. I could not go back now that I knew and understood things differently, so it was my practice that I now needed to align more with these new perspectives. Hence the development of the inquiry, research, the pedagogical initiative and the research process that evolved and is described in the following section.

## Investigating student teachers' personal epistemologies—methodology

The focus of the empirical research is on exploring student teachers' personal epistemologies. What are they? Do they shift or morph? What is the nature of these morphs? What might facilitate a morph?

### Context

A pedagogical initiative, and associated research, was implemented in a compulsory, primary teacher education course, Professional Studies (pedagogical methods), in the Bachelor of Teaching and Learning programme in 2009. It investigated student teachers' epistemological understanding across two Professional Studies courses. There was one group of students who did the same two courses. The content of the Professional Studies courses was the process of designing, evaluating and assessing children's learning, through unit planning. This was also the focus of an assignment for the student teachers in a subsequent, five-week teaching practicum.

There were 23 student teachers in the group. Most of the students (18) participating in the courses consented to be included in the research. Initial concept maps, reflective statements and survey data were gathered for these 18 participants. Following the conclusion of the Professional professional Studies studies courses and an initial reading of the concept maps, reflective writing and baseline survey data, students whose data indicated morphs were selected for follow-up interviews. Interview data was gathered for six of the 18 participants. The findings reported herein relate to the larger group (18) of student teachers who participated in the study and to a more in-depth exploration of the understandings of knowledge presented by three participants—Jenny, Diane and Megan (pseudonyms have been used for all participants)—as individual embedded and illustrative cases. They were chosen because they reflect a range of responses, and for the purely practical reason that a full set of data was available for each.

### Pedagogical initiative and tools

The pedagogical initiative had three key components:

1. changed course content
2. the purposeful use of pedagogical tools (a table describing characteristics of two mental models of knowledge, learning and minds, presented in Table 1 on the following page, and concept mapping) to engage student teachers in thinking about knowledge
3. conscious actions to use more open, tentative and uncertain questioning strategies.

The aim of the initiative was to have students actively think about their epistemological positions and to stimulate their thinking about how this might affect their learning and teaching decisions. Andreotti and Souza (2008) describe the concept of 'pedagogical tools' as stimuli for reflection rather than as ultimate solutions. Their key aims are to enable engagement with different perspectives at a more complex level, to affirm the partial and limited nature of knowing and understanding, to provide a way of making explicit the interface between mainstream and emergent thinking through connections with pedagogical practices and to encourage student teachers to find their own voices and teacher identities.

Different pedagogical approaches and tools were developed and integrated into the Professional Studies course as part of the implementation, and their effects on student teachers' understanding were investigated. Early in the courses, principles and procedures relating to epistemological approaches to designing learning were discussed and exemplified, resource materials were introduced, and processes were modelled experientially. The pedagogical tools were used as both course content and a learning process. Students then used the tool with a view to developing understandings of how new conceptualisations of knowledge might be possible and how these could be applied in their teaching practice.

The main tool used with the student teachers was a comparative table, drawn from Gilbert's (2005) work, characterising mental models of knowledge, learning and minds as represented in twentieth and twenty-first century paradigms (see Table 1). The table was used to provoke an awareness of the students' tacit knowledge



and understandings which were informing their decisions when designing learning experiences for children. This was an interpretive tool that we kept referring to in class as we discussed different ideas about knowledge, teaching and learning.

**Table 1** *Mental models of knowledge, learning and minds*

<b>Mental Models of Knowledge, Learning and Minds</b>	
<b>Knowledge Age/21st Century Thinking</b>	<b>Industrial Age/20th Century Thinking</b>
<p><b>Two key ideas:</b></p> <ol style="list-style-type: none"> <li>1. Traditional disciplinary knowledge is still important—performativity ('...the ability to take elements from one knowledge system and put them together with elements from another, different knowledge system, re-arranging them to do something new and different. It involves doing things with knowledge...'—Gilbert, 2005, p. 8)</li> <li>2. New models of organising education that allow flexibility, multiplicity and new ideas about ability (intelligence)</li> </ol>	<p><b>Two key ideas:</b></p> <ol style="list-style-type: none"> <li>1. The importance of traditional disciplinary knowledge—hierarchical—some disciplines are more important than others</li> <li>2. The need to sort people—egalitarianism (everyone has a chance)</li> </ol>
<p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>• Is a process</li> <li>• <i>Does things</i>—more like <i>energy</i></li> <li>• Happens in <i>teams</i></li> <li>• Can't be divided up into disciplines</li> <li>• Develops as <i>as and when needed</i> basis</li> <li>• Develops <i>to be replaced</i></li> </ul>	<p><b>Knowledge</b></p> <ul style="list-style-type: none"> <li>• Is a thing or stuff—knowing certain kinds of stuff is important (because it develops the mind in certain ways)</li> <li>• It is like <i>matter</i>—knowledge exists before learners learn it</li> <li>• Resides within individuals and <i>experts</i></li> <li>• Is separated into different subjects or disciplines—different types of knowledge. Some types are harder than others. These harder forms of knowledge can be used to work out who will benefit from higher education and who won't</li> <li>• Is gained and stored away and is added to, the more you know the 'smarter' you are</li> </ul>
<p><b>Learning</b></p> <ul style="list-style-type: none"> <li>• Involves <i>generating new knowledge</i></li> <li>• Is primarily a <i>group</i> activity</li> <li>• Happens in real world, problem-based contexts</li> <li>• Should be 'just-in-time'</li> <li>• Needs to be <i>a la carte</i></li> </ul>	<p><b>Learning</b></p> <ul style="list-style-type: none"> <li>• Involves understanding stuff, <i>storing</i> it away somewhere, and reproducing it later. Some people are better at this than others</li> <li>• Is mainly an individual activity—it happens in individuals</li> <li>• Is stored '<i>just-in-case</i>' it is needed sometime in the future</li> <li>• Is 'en bloc' and usually prescribed by schools, teachers and assessment systems</li> </ul>
<p><b>Minds</b></p> <ul style="list-style-type: none"> <li>• Are <i>resources</i> that can be <i>connected</i> to other resources for the <i>purpose of generative new knowledge</i></li> </ul>	<p><b>Minds</b></p> <ul style="list-style-type: none"> <li>• Are individual processing and storage centres</li> <li>• Are viewed as <i>containers, filing cabinets or databases</i>—places to <i>store</i> knowledge just in case</li> </ul>
<p><b>"Education Systems systems need to involve approaches that can:</b></p> <ul style="list-style-type: none"> <li>• Develop <i>new knowledge</i></li> <li>• Develop <i>multi-modal literacy</i></li> <li>• Foreground the <i>relationships, connections</i> and <i>interactions</i> between different knowledge systems and different modes of representation</li> <li>• Emphasise <i>difference</i> and <i>diversity</i>, not sameness and/or one-size-fits-all approaches</li> <li>• Foreground <i>process</i> not product</li> <li>• Help learners build a sense of themselves as <i>active knowledge builders</i>—as having a unique niche, role and/or point of difference/contribution to make." (Gilbert, 2005, p. 8)</li> </ul>	

(Derived from Gilbert, J., 2005.)

## Data sources and analysis

Different forms of data helped identify student teachers' epistemological understandings and morphs. Data sources included: questionnaire surveys (pre- and post-course), course tasks (concept mapping and reflective statements gathered during the one-week intensive programme), and interviews with particular student teachers. The concept maps and interviews were drawn on extensively in the analysis of epistemological shifts (morphs).

The concept maps task captured thinking at moments in time, at the beginning and conclusion of the one-week, intensive component of the course. A dual approach was taken in their analysis. Initially the continuity of the use of particular concepts was traced from the pre- and post-data and the maps were further analysed qualitatively for themes and patterns. Specifically, the structure of the maps was analysed, concept maps were visually compared and patterns in their structure, content and organisation were identified using the methodology developed by Kinchin and Hay (2000) who found that differentiation of maps in terms of their structural complexity (chains, spokes and networks) and hierarchical organisation gave tentative insight into students' understandings. Consideration of the reflective statements students wrote comparing their two maps was included in the structural and organisational map analysis. This was conducted to check consistency, congruence and bias in interpretations and to provide further triangulation of the data. Secondly, an analysis of the nature of the concepts, how they were hierarchically positioned on the participants' concept maps, and the links between the concepts was conducted. This analysis provided one view of the student teachers' understanding and thinking about knowledge and learning.

The semi-structured interviews with selected participants focused on the concept maps and/or practicum experiences of student teachers in implementing their unit plans (whichever individual students wished to talk about, sometimes both). Students were asked to 'tell me about your most successful unit of work...'. Probing questions were used to elicit explanations and elaborations that would help me understand what was informing their thinking when they were creating either the unit plan or concept maps.

I used iterative and constant comparative methods to analyse the interviews and other data sources pertaining to the three selected cases. A data set, comprising concept maps, reflective statements, pre- and post-survey responses and interview transcripts, was initially examined for one participant. A similar process was then used with the other two participants' data sets to determine what supported, elaborated, challenged or was counter to the initial findings. Data were coded for conceptualisations and understandings based on the conceptual framework (Figure 3), then a reductionist process to generate encompassing themes was adopted. A similar process was undertaken in relation to other participants and other dimensions. The reporting of the findings in relation to the three illustrative cases is based on the themes that emerged from this analysis.

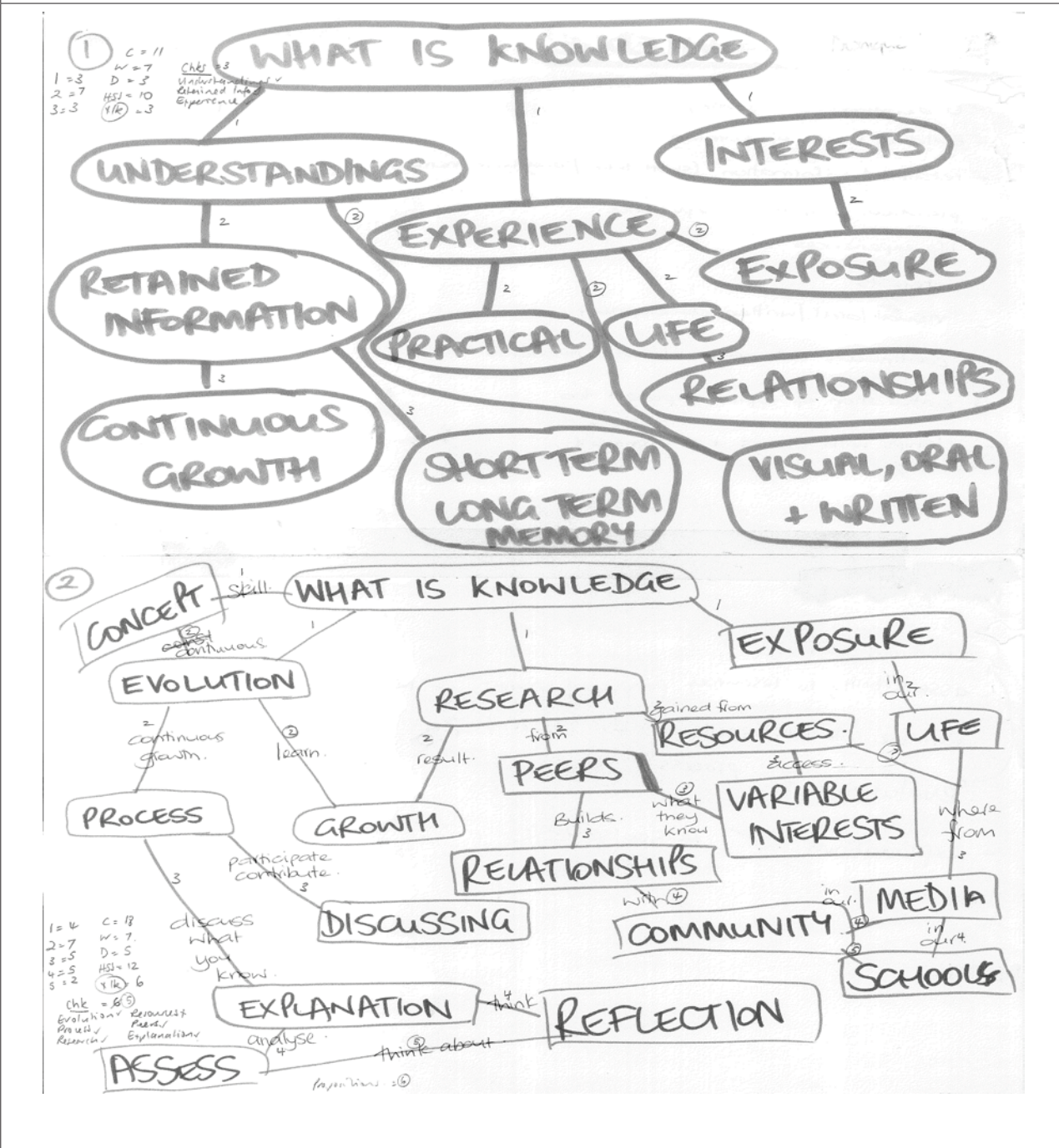
## Research findings

### Understandings of knowledge from student teachers' concept maps

An analysis of the nature of the concepts, developed around the question 'What is knowledge?' and how the concepts were positioned hierarchically in the participants' maps, provides a view of student teachers' epistemological understandings. It explores the complexity and connectedness of the concept maps and reveals how these changed between the pre- and the post-maps (Figures 4 and 5).



Figure 5 Megan: Pre-intensive and post-intensive concept maps



Analysis of chunks (a group of linked concepts for which a leading concept has at least two successors) reveals a shift towards describing knowledge less as information and more as a process, something that is fluid and changeable. Table 2 summarises these results.

<b>'Chunk' Themes</b>	<b>Pre</b>	<b>Post</b>
Information/facts	14.8%	5.6%
Experience	13.5%	4.2%
Learning (prior, ability to)	6.7%	5.6%
Share/interactions/interchange	2.8%	4.2%
Ideas	2.8%	2.8%
Things I know/know about	5.4%	
Understanding	4.0%	
Process		12.6%
Evolving/changing/expanding		12.6%

Comparing the nature of these chunks with the nature of knowledge and knowing dimensions summarised on the conceptual organiser (Figure 3) indicates that the more prevalent chunks on the pre-intensive maps present knowledge as information or facts and knowledge as experience. Knowledge as facts or information aligns with a realist conceptualisation of knowledge. Knowledge as experience aligns with a more personal way of knowing, where knowledge is more uncertain and develops in contexts of personal experiences.

While many post-intensive maps included chunks of this nature (information/facts, learning) some linked more closely with descriptions of post-industrial conceptions of knowledge. These chunks also aligned more closely with the higher stages of the personal epistemological development models. King and Kitchener (1994) describe this change from conceptualising knowledge as certain to a more firmly established belief that knowledge is uncertain, as a major epistemological shift.

Given that Novak and Gowin (1984) consider the hierarchical structure of concept maps to be important, the position of the concepts and their nature were further examined.

<b>Chunk &amp; First Level Concept Themes</b>	<b>Pre</b>		<b>Post</b>	
	<b>First Level Concept</b>	<b>Chunk</b>	<b>First Level Concept</b>	<b>Chunk</b>
1. Information/facts	50%	50%	28%	22%
2. Experience (I have, life, practical...)	50%	44%	0%	5%
3. Learning (prior, ability to)	11%	28%	33%	22%
4. Share/interactions/interchange	11%	11%	0%	11%
5. Things I know/know about (Understanding)	28%	27%	6%	5%
6. Process	0%	0%	50%	44%
7. Evolving/changing/expanding shifting	0%	11%	56%	33%

Two patterns of change are evident in this table:

1. Percentages of students recording concepts aligned with themes 1 and 2 change considerably between pre- and post-maps; approximately half of the students identified these as first level concepts and chunks on the pre-intensive maps and relatively few students had these recorded on their post-intensive maps.

2. Percentages of students recording concepts aligned with themes 6 and 7 indicate the opposite trend. While half of the students had these recorded as first level concepts and chunks on their post-intensive maps, they were not evident on the pre-intensive maps.

Thematic changes in the concepts recorded as chunks reveal that new concepts or understandings of knowledge have emerged for students and these ideas have been given a more central position in their conceptual frameworks (maps) as first-level concepts.

Further qualitative analysis of the structure and organisation of the concept maps provided additional evidence to support these initial findings. Using Kinchin's (2000) spoke, chain and net structures the maps were analysed for changes. Three typologies of change emerged:

Typology 1—little organisational or structural change

Typology 2—maps that changed from a spoke to a networked structure

Typology 3—maps that were initially networked and became more complex network structures

Typology 4—networked maps that decreased in complexity

A relatively even distribution of participants was evident across four categories. For a number, but not all, of the participants, the concept maps appeared to get more complex. Five of the 18 participants' maps changed from chains of ideas radiating from the concepts on the map (spokes) to a more complex network structure. Most of the pre-intensive maps showed three or four chains (a lineal, hierarchical portrayal of concepts) or smaller spokes of concepts and some cross-links which were predominantly between the lower-level concepts. Post-intensive maps were organised using a network structure and changes in the number and nature of the links, cross-links and chunks are evident on these maps. The complexity and connectedness of these maps had increased.

In this study, 6 of the 18 participants' pre-intensive and post-intensive maps were organised as networks with cross links and chunks (Table 4).

**Table 4** Comparisons of number of concepts, cross links and chunks in pre- and post-intensive concept maps showing a networked organisation.

Participant*	Concepts		Cross Links		Chunks	
	Pre	Post	Pre	Post	Pre	Post
Linda	15	21	14	14	6	5
Jean	18	18	7	6	5	2
Tina	13	14	4	14	5	8
Tracey	16	13	4	14	5	8
Megan	18	21	3	5	4	2
Kirsty	10	10	4	2	3	1
<b>MEAN</b>	<b>15.56</b>	<b>15.83</b>	<b>6.9</b>	<b>6.2</b>	<b>5.28</b>	<b>5.67</b>

\* Pseudonyms used

The numbers of concepts, cross links and chunks are very similar in both pre- and post-intensive maps, with the exception of two participants' maps, where one student (Linda) identified markedly more concepts and another (Tracey) made notably more cross-links between concepts. This suggests that these two students were conceptualising knowledge in a more complex way by the increased number of ideas about what they considered knowledge to be, and the greater amount of interaction they were seeing between these ideas.

Approximately six participants' (different from those represented in Table 4) pre-intensive maps were organised and structured more complexly than the post-intensive maps. These maps followed a net cognitive structure, with several levels and several cross-links. Some of the post-intensive maps included relational link descriptions but included fewer cross-links, and most had fewer chunks than the pre-intensive maps. This would indicate a decrease in map structural complexity. This might be explained by Novak and Gowin's (1984) theory that map structures typically become less complex when understanding is less certain. Reduced complexity, then, may be indicative of shifting epistemological understandings as students become less certain about what they think knowledge is.

What is important to consider is the change in the nature and hierarchy of the concepts. The reflective statements indicate that some of the student teachers were reconceptualising their epistemological belief, for example:

My first map was more comprehensive than the second, I felt that I understood more the first time we discussed knowledge.

Second map seems to be a bit more detailed thinking and deeper than the first. The first map was observations on the surface.

These emerging ideas and tensions were explored more deeply in the analysis relating to the illustrative cases, the results of which are presented in the next section.

## Understandings of knowledge from illustrative cases

The qualitative, thematic analysis relating to the illustrative cases provides insight into how students' conceptualisations of knowledge were morphing and reveals consequent tensions and discomfort for student teachers.

Four key strands emerged from the data relating to the three focus students, grounded in and developing on the analytical framework provided by Figure 3. While these strands are presented in different sections, there is much overlap between the epistemological morphs, knowledge conceptions, context and identity threads.

### **Strand 1: Certainty and source of knowledge**

Participants challenged ideas about the certainty or stability of knowledge and its origin. This was the dimension that students most frequently addressed in the concept map, survey and interview data, through explicit comments and tacit assumptions. In her reflective writing when comparing her concept maps, Megan says:

I am beginning to come to grips with knowledge being 'fluid'. There is no destination to reach but only the journey.

On the second map only, 'knowledge can't be stored'. This is a real change in thinking for me. Previously I saw it as a 'treasure' to collect. Now I see that it is like sand— slipping through our fingers.

Using the 'treasure' and 'sand' metaphors, Megan's conceptualisation has morphed from a realist to more of a relativist orientation where knowledge is subjective and unique to the knower and is highly changeable and tentative. Megan seems to be in the fog or the space between these dimensions, in a transformative space (Berger, 2004) struggling to find the language to express her sense of knowing. She explains in her interview:

... it's finding the right words to match your thoughts, I find quite difficult at times; there's a little bubble up there, that's how I see something, and it's verbalising it in a way that others understand the way I'm thinking. And, that's a real challenge.

Jenny describes more of a realist orientation when she talks about how she prepared for teaching in different curriculum areas during her practicum. Differences emerged between her conceptualisations of content knowledge and pedagogical knowledge. She considers there is a body of content knowledge she needs to have to be able to teach particular things and she describes using external sources to gather this knowledge (books, internet resources, associate teacher feedback). However, she conceptualises her pedagogical knowledge

differently and she seems to have a more relativist view, describing it as more internal, fluid and performative as she reflects on her experience in the context of a poetry unit.

I didn't know about poetry, so instantly you've got to learn about all the different sorts of poetics, and then what's best to teach it at that level ...

... my learning increased a lot. Um. Um, my, yeah, my knowledge. I think, um, I particularly got better at using open questions, and promoting their own thinking. I got much better at my wait time as well...

This could be interpreted as a shift towards a contextualist-relativist way thinking about the source and structure of knowledge. It was supported by Jenny's reflections on her two concept maps. 'Knowledge is evolved by the person' is the concept on her second map (not on the first):

People's understanding even from the same learning can be different, different minds will process knowledge for the tasks that they need to apply it to. We all think differently. It is the way we process then use knowledge that makes us individuals.

Jenny was thinking differently although she was unclear about how this might translate into practice. It seemed as if she was moving between realist and relativist notions of the origins of knowledge and needed to explore how context and role affected these notions.

Diane also focused on ideas relating to the dimensions of knowledge sources and structure in her reflection on the changes in her concept maps. Diane's first map describes knowledge as external to self whereas the second map uses 'global', 'process' and 'evolving' as the main, first-level concepts and she describes this conceptualisation of knowledge as 'a process which is evolving' as the most significant change in her thinking.

I believe that in interacting and experiencing the process of knowledge develops and that the result—or 'product' is not as important.

This changing perception of the nature and stability of knowledge was a recurring theme in Diane's data. Initially, she was thinking of knowledge as objective, universal and relatively unchanging. Subsequently, she emphasised the importance of knowledge construction through interaction and experience. She further explained a morph from knowledge conceived as primarily residing in experts and external authorities, to a more contextualist epistemology where there is more reciprocity between self and experts in knowledge construction. Diane talks here about how an aspect we explored in our course (different mindsets, drawn from Carol Dweck's 2007 work) helped reveal her tacit conceptualisation of knowledge:

And now I know that you've got to make mistakes, you make mistakes as part of the learning, and that's ok ... I expected to be able to do it, straight away. That's part of that fixed mindset, I think, isn't it? Just, expected to know it, or to be told it and then to go off and do it ... But it wasn't until I actually put it into practice and made that mistake that I actually go 'hm, ok, I know for next time'.

These ideas are supported by further comments she made in her interview:

That has been the essence, to me. The biggest, as I say, light bulb thing [understanding the growth mindset]. Because I think I was limiting, oh, I think before I thought that you either knew, or you didn't. That you were able, or you weren't.

## Strand 2: Learning through experience

Experience and practice were integral to the students' personal theorising and understanding of what they considered knowledge to be. Experience was the second most common chunk on the pre-intensive concept maps (Table 2) and was included by half of the 18 participants as a first-level concept on these initial maps (Table 3). As an example, Diane identified 'experience' as the common element which was included on both of her concept maps (pre- and post-intensive). She recorded this on her post-intensive concept map as 'Knowledge is evolving through experience.' In her reflection Diane observes:

Experience occurs on both maps. I actually have less detail on the second map but I believe this to be the essence of learning.

While 'experience' didn't feature as prominently on the post-intensive maps, the students talked more about the importance of this in their interviews. Sometimes they did not speak overtly about how they were



conceptualising the role of experience in terms of the nature of knowledge and knowing, but implied it through what they thought they had learned during their practicum. Diane explains:

It taught me a lot about scaffolding ... [during] the first lesson in particular, I sort of went straight through it [the instructions for completing the art activity], and then sent them off, whereas I should have broken it down a lot smaller.

When Jenny talks in her interview about knowledge in the context of practice she describes the fluidity and richness gained from different experiences which contributed to her knowledge.

I've learnt to understand from being a student, and being in the classroom, and I guess as a mum, is that, ... your knowledge is richer from what other people... people put into it. So, you're not gonna go just down one road and find knowledge, um, there will be rich other aspects that add to it.

Megan describes what was happening for her as she was experiencing the practicalities of classroom life, how this changed her practice and the struggle she was encountering as she came to implement her ideas:

Yeah, um, it's, I think it's, it's also about being brave enough to try new things, as well, trial and error.

I had in my mind I was gonna do all these things with the children ... but then you get into the reality of the situation ... and I felt that, um, it wasn't structured in a way that I would have if it was my own classroom ... I didn't quite take the step I feel I could have taken...

Here, the students are reflecting on experiences and thinking about what they did, or might have done differently. This reveals an interest in strategies that are creative and generative (even if they were not implemented) and shows an emerging awareness of the inconsistency between beliefs and practices and tensions involved in changing practice. The students were striving to be more contextualist and student-centred in their approach. Jenny describes her conversation with a boy who adapted and invented games:

... a little boy, extremely just so bright, so intent. And, we used to play games every morning before the bell went, and he actually was so clever, he'd make up games, and he'd adapt games to be different. ... Anyway, so I said to him one day 'you're so good at this, you're so good at this, maybe one day you could invent games, you could own a company that made games'.

In her concept maps and reflective statements, Megan intellectualised a contextualist way of thinking about knowledge. She then described a more process-oriented experience when helping children write and present their speeches:

... so I just looked around for ideas for how we could assess, basically, in this unit. How the children could actually get a picture of themselves as performers, as well. ...

... using the video and the fact that they could immediately reflect on what they'd just done, and self-assess, with my assistance, I think, because ... I don't think they'd done much of that themselves, before. And, I found that really gave them, um, a boost, and they could move on from that point.

This process-orientation and adoption of a role as collaborator are contextualist in the emphasis on knowing as 'being' and 'doing'.

These student teachers emphasised the importance of learning through experience, and seemed to be moving between realist, contextualist and relativist ways of thinking about the nature of their own knowledge.

### **Strand 3: Importance of context**

All the student teachers who participated in the interview process had more of a realist way of thinking about content knowledge. This they saw as quite certain, independent of the knower and relatively unchanging. As they discussed their teaching, an understanding that there is basic or foundational knowledge that students need to have in different subjects emerged; also, that there are situations where teachers need to go to sources to get information. However, the students also describe a process whereby they engaged in designing and blending ideas in the creation of units of work, which is a more generative process. Jenny describes the process she went through when designing her poetry unit, Diane reflects on her painting unit and Megan talks about her speeches unit:

I had sort of designed the unit ... not really knowing their ability. So, we did a lot of pre- sort of work, before we got into the art, I did a lot of, um, work trying to understand what they knew, their prior learning as far as the animals were concerned.

I had to do a lot of learning. So, I had to go to the resource room at the school, and I read a lot of things, she [associate teacher] gave me a lot of things. I then used TKI a lot. I used, um, just searching lesson plans on the internet for poetry, and then kind of put it all together, and designed, and made a little bit of a structure thing...

I think having the video camera ... gave me an idea in the first place ... so I just looked around for ideas for how we could assess, basically, in this unit. How the children could actually get a picture of themselves as performers, as well. So, I felt that it was the obvious way to go.

Later in her interview Megan continues to grapple with more relativist ideas as she reflects on the knowledge of different disciplines and the concepts of absolutism and fluidity of knowledge.

Because sometimes the different, different context call[s] for different types of thinking about knowledge, doesn't it? Because, you know, my son's studying engineering, and, you can't have, there's a lot of right and wrong answers, you know! They're facts, in a way...That have to be adhered to.

...with analysis of, um, literature, or music, everyone has a valued and shared viewpoint, you know, I'm very familiar with music, and I've found that interpretation is a very big part of, um, yeah, interpretation is important ... does it matter if it is interpreted differently, [if] a piece of music [is] played in a way that the composer didn't intend, does it make it wrong?

Megan's experience is that the discipline context is important. Different types of knowledge or ways of knowing apply, or have greater emphasis, in different disciplines and different ways of knowing can be validated in different contexts.

However, most participants conceptualised the source of the children's learning as external with the teacher being the authority, as Diane describes here:

Because you know what they're supposed to learn. What they need to learn to get to the end result... I find that tough; what they're actually supposed to learn. What small key thing they need to learn to get to the big picture. Breaking it down again.

Others, like Megan, talked about how the children were actively engaged in developing and constructing their knowledge and how the teacher needs to understand how individuals learn, perspectives they have and contexts that inform who they are.

... the assessment I did with the children, using the video and the fact that they could immediately reflect on what they'd just done, and self-assess, with my assistance ... And, I found that really gave them, um, a boost, and they could move on from that point. And, they were really good at being reflective.

Megan identifies a tension between aspirations to teach in a particular way and the reality of the assessment processes and criteria. She seems to be working at the transformative edge. She is thinking in a more relativist way about the source of knowledge but cannot yet see how to apply this thinking to her practice. She seems to move into a more contextualist orientation (dialogical constructivism, exemplifying more of a reciprocity between self and experts), as articulated in her interview.

I'm still at the point where I want to have everything set out and planned very much in advance. Rather than I'm going from the feedback of the children immediately. I haven't been able to structure the lessons such a way that the children are able to find their own success criteria.

This suggests that a simple dichotomy between realist and relativist thinking may be inadequate to explain what is happening. Learners can adopt both realist and relativist positions, with each position being seen as valid depending on context.

#### **Strand 4: Tensions and challenges**

Shifts or morphs in understandings of knowledge were revealed as tensions and struggles. These tensions are evident in questions participants ask relating to expectations of themselves as teachers, reflections on their own learning experiences and resistance to change. Tensions emerged in Megan's and Diane's interview data as they talked about the nature of knowledge. As Megan reflects on her own schooling experiences and her recent practicum experiences, she describes her shifting understandings of the certainty and source of knowledge and the interaction between these dimensions.

... that's the way I've been taught all my life, in many ways, through the schooling system. It's a matter of passive receiving ... I can also see the value, very much now, in the process of, um, sharing the doings, to create the knowledge ... It's quite hard to get my head around now, actually, because it's a whole new concept change, and we still cling on very much to what we've always been taught, and how we've been taught it.

Megan appears to experience pressure, relating to anticipated and expected student outcomes, which compels her to act as the teacher expert. This could reflect external and institutional pressure on teachers to ensure student performance. Megan expresses a desire for the children and the teacher to develop shared understandings of the achievement criteria in a collaborative context. However, her strong sense of the role of the teacher as the expert and responsibility to complete the unit over-rides her emerging reconceptualisations. These are ideas that she endeavours to reconcile during her interview:

I had to finish off the unit with a week to go, and I wanted to make sure that the work got done. And again, I feel I'm also into, um, evidence and results, and, um, learning, having to be seen. You know, so I can reflect on it by looking at it. Whereas quite often I'm discovering learning is often just in the doing. And, sometimes the evidence isn't tangible. And, that's fine.

Yeah, to take out the bustle and the urgency that I often feel, and the anxiety, just to enjoy ... Focus on them, rather than stuff, and, you know, 'am I getting the coursework [done]', you know ... it's focusing on the learner, isn't it, not so much my performance as a teacher. It's like you can see the shift, it's lovely.

What is important here is Megan's awareness of tensions as she negotiates her role (way of being) as a teacher. This awareness might indicate shifting epistemological understanding, even if Megan experiences challenges in enacting new ideas and tensions in her beliefs about learning.

Diane also experienced tensions linked to ideas about the nature and source of knowledge. When discussing the painting unit, Diane showed that she considered this to be a process and skills-based unit. The children were learning skills that they were to apply as they created their paintings. Realism, in the form of realistic representation, was important to Diane. The animal the individual children were painting needed to reflect reality:

... one particular boy had difficulty. He couldn't look at a picture and relate that to his own work. Like, he was doing an elephant, and it had quite a small body, and little stick legs. So, to try and get him to think ... I said to him 'look at the picture, does the elephant have a skinny body, or a fat [body], or, how does it look?', 'oh, right, so I need to make that quite round'. So, once he sort of spoke, once you really focused him, he was away, but he had trouble initially. And it had little, long skinny ears, so yeah.

As the interview progressed, what Diane initially considered to be quite certain became more tentative:

... some of them were really interesting colours, they wanted green horses and things, and I wanted to say 'but a horse isn't green!', but they, as long as they could sort of justify it, which a lot of them could, you know. And I was surprised with some of their answers, because I probably had, you know, preconceived ideas about what I would do, and just because they'd done it differently didn't make it wrong, did it?

Diane focused on the technical skills of students, but also acknowledged their imaginative use of materials.

... they had a really good grasp of mixing colours, so that was, I didn't have to go over a lot of that, which I thought I may have to. And a lot of them were quite imaginative as far as the tools that they could use to get some, you know, that graffiti effect of splattering things.

She considered that particular knowledge is needed but also appreciated the creative and generative way of knowing that was displayed by the children. Diane described creative processes happening during the painting task, where children knew the effects they wanted and then experimented with the different tools. Her epistemological understandings appear to have been challenged and to have become less certain as she observed and recognised the imaginative and creative capacity of the children.

## Strand 5: Changing identities

The student teachers participating in this study were in a state of continual identity negotiation and tensions were evident between their identities as students and their emerging identities as teachers. This was especially evident in the context of their practicum experiences:

... as a student [teacher] you go in each time to a new level ... it's a different culture, too, in the school. And, a new learning ... I didn't know about poetry, so instantly you've got to learn about all the different sorts of poetries, and then what's best to teach it at that level, and then sort unknown sort of abilities. So, you get the plan, you get what she wants to do, and you can kind of do a bit of preparation ... but all of a sudden you've got a lot of learning to do yourself, haven't you?

There is a tension for Jenny in being the teacher and being a student on professional practice placement with such a lot of learning to do and also needing to understand the context and expectations of the associate teacher in this context.

The concepts of novice (student) teacher and expert (experienced) teacher provide ways of understanding the identity tensions experienced.

I can see the constraints, as a student teacher, being different to the freedom of being, you know, the real teacher, in a way. ... Um, yeah, it's, again, it's that confidence thing, maybe.

Megan's reference to a 'real teacher' suggests that she sees herself as a novice but that she aspires to the 'real' position. Students talked of the associate teacher being the expert and of the importance of following their associate's plans and guidelines.

The student teachers were aspiring to be like, and to learn from, expert teachers, but were also learning that these experts may support views of knowledge and learning contrary to their own developing ideas. The students were going through complex processes of challenging ideas about knowledge, understanding how children learn, fitting into a classroom context and relating to associate teachers. At the same time they were negotiating their own identities as teachers and ideas about how they themselves learn to be teachers.

The responses of Megan and Diane in particular seem to show tensions between their developing conceptualisation of knowledge and their attempts to align their practice with this, and between what they were learning and what their associate teachers were espousing and modelling. This presented tensions for the student teachers in relation to their developing teacher identities. These tensions can be explained in terms of the merging or meeting of subjectivities (Alsop, 2006) as students and as teachers.

## Conclusions

The research questions for the TLRI project are briefly addressed to highlight key findings of this inquiry and draw threads together.

1. How do I conceptualise knowledge and learning in the context of Professional Studies and Practice in initial teacher education?

To interpret the shifts in my conceptualisations of knowledge and learning in Professional Studies and Practice, I first had to understand the notion of personal epistemology. Developing a conceptual framework (Figure 3), drawing on theoretical models developed by Hofer (2004), Baxter Magolda (1992, 2004), Hofer and Pintrich (1997, 2002), and Schraw and Olafson (2003, 2008), provided a starting point. The conceptual framework blended ideas from these models relating to epistemological dimensions of the nature of knowledge and knowing and realist, contextualist and relativist ontological positions.

Key to my understanding of shifting conceptualisations of knowledge is the idea of morphing. The conceptual framework developed from personal epistemological models was very useful in clarifying my own thinking and providing a structure to interpret the data for this research, although the more I worked with the framework the more limiting it seemed to become. I became increasingly conscious of situations where the data did not

seem to fit neatly into the defined categories and of tensions between categories in the framework. I felt there was nothing to define the spaces in between where the data seemed to fall. I found myself personally struggling to negotiate the fog in the spaces between new conceptualisations and I also got a sense of confusion from the student teachers in the study. This confusion seemed to be better represented in the idea of a 'morph', rather than a 'shift', in epistemological understanding.

I was teaching in courses that were not specifically curriculum-oriented, meaning that they did not relate to particular learning areas in the NZC. Rather, the courses reflected a body of knowledge and understandings about teaching and learning processes. It is in this context that I was looking to explore ideas about teaching and learning and to align my practice with my morphing understandings. This led me to focus on the broad framework of the curriculum, including the values, principles, effective pedagogy descriptions, and key competencies, as a philosophical guide that was consistent with my developing epistemological understandings. These understandings emphasised Gilbert's (2005) idea of knowledge as performative.

I was grappling with what seemed to be incongruencies in the NZC, the position and descriptions of the vision, values, principles and key competencies at the front of the document conceivably reflecting more of 'knowledge age' beliefs than the outcomes-based achievement objectives at the back of the document. What I saw taking precedence in the student teachers' practice was the designing of lessons to meet the requirements of the achievement objectives, which I consider align with more realist strategies, when the ideas presented at the front of the NZC seem to be more relativist in their ideological underpinnings. My approach within this context has been driven by my resolve to help student teachers identify and understand their beliefs about knowledge, teaching and learning and to think about how these might influence their practice.

2. How do student teachers' understandings of knowledge, teaching, learning and curriculum shift in the context of a pedagogical initiative in a Professional professional Studies studies course?

Student teachers' conceptualisations of knowledge changed considerably during this inquiry. What began, for many, as a realist notion of knowledge morphed into a more firmly established belief that knowledge is uncertain and is actively and personally constructed. The students began to question the certainty and source/authority of knowledge and developed more relativist views of these dimensions. An initial realist view of knowledge as certain facts and information that could be transmitted to an individual from an authority or expert, grew into a much less certain view and a cognisance of the complexity of what knowledge is and where it comes from.

A complex interaction was evident between how the student teachers conceptualised knowledge and how they approached learning, teaching and the implementation of the NZC. Student teachers with relativistic epistemological beliefs were more likely to conceive of teaching as transformative (constructivist) rather than as transmissive. However, the student teachers in this inquiry were struggling with their morphing epistemological understandings and with aligning their practice in the classrooms with their developing understandings of teaching and learning. The data collected over the course of the inquiry illuminated tensions and difficulties for student teachers at this time. These were mainly contextual constraints and included the classroom and school timetables, expectations to meet the achievement objectives for the learning areas stated in the NZC, and being in classrooms where the associate (host) teacher held different beliefs and understandings about teaching and learning. These tensions were also connected with the students' perceptions of their personal identities. The student teachers were in a continual state of negotiation as they endeavoured to reconcile their student and emerging teacher identities within specific teaching and curriculum contexts. Nonetheless, they were exploring ideas related to the curriculum in practice, engaging with curriculum as a guide for ways of being as a teacher and for interacting with children and supporting their learning, rather than as a prescription of subject content.

The time frame of the study provided the opportunity to work with these student teachers over just 18 months and the extent to which these changes are being implemented in their ongoing practice is unknown. Real life in the classroom is very complex and the decision making by teachers and student teachers is influenced by a myriad of factors. Further exploration of the role of personal epistemology, how student teachers construct these beliefs, what causes them to change and how they affect classroom practice would help us understand how to develop teacher education programmes that focus less on technique and more on the 'how' and 'who' of teaching.

In summary, I have been privileged to teach courses in initial teacher education which emphasise the 'how' to teach, and explore ideas about 'who' teachers are, more than 'what' is to be taught. This has given me flexibility to explore strategies and approaches which can assist student teachers move beyond technicist ways of thinking about teaching and being a teacher. This awareness of the ontological nature of teaching, I believe, needs a more privileged position in teacher education programmes.

I learnt from engagement with this research that shifting conceptualisations of knowledge bring confusion and uncertainty. It feels like driving in the fog and brings to consciousness a deep personal awareness of the partiality of the nature of knowledge and knowing. It produces the 'wobbles' as identities undergo constant change. This is aptly described in the following quotation from Alice in Wonderland:

'Who are you?' said the Caterpillar.

This was not an encouraging opening for a conversation. Alice replied, rather shyly, 'I – I hardly know, sir, just at present—at least I know who I was when I got up this morning, but I think I must have been changed several times since then.'

'What do you mean by that?' said the Caterpillar sternly. 'Explain yourself!'

'I can't explain myself, I'm afraid, sir,' said Alice, 'because I'm not myself, you see.'

'I don't see,' said the Caterpillar.

'I'm afraid I can't put it more clearly,' Alice replied very politely, 'for I can't understand it myself, to begin with; and being so many different sizes in a day is very confusing.'

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