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AN EXPLORATION OF TEACHERS' ONTOLOGICAL AND EPISTEMOLOGICAL BELIEFS AND THEIR APPROACHES TO TEACHING WITHIN AN IBMYP ENVIRONMENT

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Abstract

This dissertation uses a case study approach to investigate teachers' beliefs about the nature of reality (ontology) and knowledge (epistemology) within an International Baccalaureate Middle Years Program environment. The study explores the possible impact of these beliefs on teachers' approaches to teaching.

An interest in teachers' perspectives regarding the nature of reality and knowledge emerged during modular work associated with a Professional Doctorate in Teacher Education with the University of Nottingham. The final modular assignment, prior to the onset of the research stage, involved a consideration of the effect that perceptions of reality, knowledge and truth have on a researcher's philosophy of research. Due to an increased awareness of the impact that these beliefs have on my own philosophy of research, I became interested in how similar beliefs might impact the personal philosophies and pedagogies of teachers. I chose to explore the beliefs and practices of teachers at the International School of Amsterdam (ISA), the school environment in which I work. The study is positioned within the constructivist-interpretive research paradigm. It therefore allows for the emergence of a holistic and contextualized understanding of teachers' beliefs and practices. In choosing this approach, I hoped to explore whether a consideration of teachers' beliefs could play a role in the design of future professional development opportunities at ISA.

The research study involved the generation of teacher profiles for each of three respondents, who are all experienced international school teachers. The respondents teach Science, English Literature, and Spanish to middle year students at ISA, which is a private and well-established IB school that offers all three IB programs through English to the children of expatriates as well as to local Dutch children. Within this teaching environment curricula and assessment are concept and process-oriented, and teachers are encouraged to incorporate constructivist approaches into their personal pedagogies.

The generation and comparison of the teacher profiles helped to uncover the respondents' beliefs and practices in a comprehensive way. Each teacher was observed on several occasions and these observations were followed by lengthy conversations and semi-structured interviews that occurred over an extended period of time. During the follow-up discussions, teachers' ideas and preferences were aligned with contemporary literature that explores possible links between teachers' ontological beliefs, their epistemological beliefs and their teaching practices.

The findings of the research indicate that the blends of constructivism preferred by individual teachers mesh well with their ontological beliefs and their epistemological beliefs. The universal concepts they were drawn to, their impressions of the nature of learners, and their view of the learning capacity of groups all seem to connect with their beliefs. The findings suggest that there is a need to take teachers' ontological and epistemological views into account when considering and designing professional development opportunities. These findings contribute to areas of research that explore the impact of teachers' ontological and epistemological beliefs on teaching practice. They also provide direction for further discussion, exploration and research.

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CHAPTER 1

Introduction

1.1 Introduction

The purpose of this research is to explore the concepts of ontology and epistemology with my colleagues, and to consider whether their ontological and epistemological assumptions have any significant impact on their personal approaches to teaching. Before exploring their views, however, I will try and shed light on past experiences that have influenced the creation of my own ideas with regard to these same concepts. This personal introduction is followed by an explanation of the philosophy of the International Baccalaureate (IB), the organizing body that oversees schools like the International School of Amsterdam, the site of this research study.

A consideration of the IB's philosophy leads into a detailing of a modular assignment that I completed during the first phase of my doctoral studies at the University of Nottingham. The doctoral program involved the completion of four modules relating to different aspects of teacher education: Fundamentals in Teacher Education, Contexts of Teacher Education, Key Approaches in Educational Research and The Philosophy of Educational Research. Each module included a culminating modular assignment. The assignment I completed for The Philosophy of Educational Research module, prior to the onset of the research phase of the doctorate, involved a consideration of my personal beliefs regarding the nature of reality, knowledge and truth. It was necessary to contemplate how these beliefs might indicate a personal tendency towards a particular research paradigm. Whilst contemplating the impact of these beliefs on my research orientation as well as on my own teaching, I became interested in the beliefs and practices of other teachers. I had not previously been asked to contemplate these beliefs during my life as a classroom teacher, and I was curious as to whether the opportunity might be one worth affording to teachers through professional development.

A consideration of the impact of the assignment relating to reality, knowledge and beliefs is followed by a review of research developing in this area, as well as a consideration of how perceptions of reality, knowledge, teaching and learning have changed within educational contexts over time. The review underpins, and is informed by, an exploration of teachers' perspectives and practices through observations and interviews, and it culminates in the co-construction of teacher profiles that aim to capture the essence of teachers' beliefs and practices. A comparison of these teachers' profiles

generate conclusions that bring to light the significant concepts and ideas that emerged over the course of the study, and these conclusions are followed by consideration of the potential implications of the research findings.

Because Denzin and Lincoln (2000) suggest that the way a researcher approaches a given research situation is a reflection of who the researcher is as a person, and how she views and approaches the world, it should help to highlight my personal worldview. Therefore, I have compiled a brief biography of educational experiences that have fostered the development of my ontological and epistemological beliefs.

1.2 Personal Background

Having grown up in Ireland I have vivid memories of school as a place where knowledge came from external sources, and internalising this knowledge involved learning significant amounts of information by rote. Being an independent learner, even as a child, I enjoyed occasional project work best as it gave me time to integrate my own thoughts with what I was learning. Outside of project time there seemed to be little time to dally in school as there always seemed to be so much that teachers wanted to cover for exams. Similarly, at university, I found that the science labs were quite prescriptive, lectures seemed overly structured and linear while reasoning through problems seemed surplus to requirements.

However, there was one wayward microbiology professor who seemed to have a very different interpretation of what learning involved. I vividly remember the first laboratory lesson I had with him, or should I say without him. He arrived for class, wrote a problem on the board, and then disappeared. As a class, we stood around and looked at each other, confused as to what to do. After the initial panic had subsided we gathered the equipment that we needed and we set about finding the solution to the problem. I remember this as one of the first times that I experienced genuine excitement with regard to learning. It was not until much later that I looked back on the professor's unorthodox approach as one that had resonated strongly with my desire to think and act for myself when learning.

Following the completion of a Bachelor of Science degree in Biochemistry and Microbiology I went on to complete a postgraduate higher diploma in science education. I enjoyed the different courses on philosophy of education, psychology and education, history of education and educational methods. One of the most interesting project activities that I remember was the development of a creative poster to demonstrate the concept of evolution. It was during

this activity that I contemplated at length the degree to which evolutionary theory had been suppressed during biology and religion classes in secondary school. It must have been seen to conflict with the underlying tenets of Catholicism, but even so, to exclude it from the science curriculum seemed extreme. This was one of the first times, as a young adult, that I genuinely understood the degree to which my perception of how the natural world worked had been impacted by limited access to information and experiences.

Interestingly, these feelings emerged again later when I was teaching Science and Chemistry at a local secondary school in Sierra Leone, albeit for slightly different reasons. I vividly remember one conversation with the older girls where they diplomatically said that they would learn about evolutionary theory as they needed it for their A level exams, but they made a point of adding that they did not believe in these ideas. They felt that evolution conflicted with their personal and tribal beliefs with regard to how the natural world worked. Later, when I moved to live and teach in Myanmar, my interest in students' perceptions and worldviews continued. Whilst there, I carried out research into the perceptions of science and scientists held by my students. The research formed part of a Masters in Science that I worked on with Curtin University of Technology, in Australia.

Through the children's responses I realized that many of them perceived science as a Western endeavour, and the majority, including the girls, drew the scientists as middle-aged Caucasian males. It is important to note that the students were a mix of local and international students attending an American international school. I was genuinely intrigued, and I wondered how their limited perceptions of science and scientists had come to be. As my research continued, I began to notice that the use of educational materials and approaches that conveyed a picture of the scientist as a Western Caucasian male impacted heavily on student perceptions. An intervention program, that included a balanced mix of multicultural resources, and encounters with multicultural scientists, had a significant impact on these perspectives. The research served to remind me of how I had been inducted into a very particular way of seeing and being in the world as I grew up. However, access to a wider range of life experiences and non-Western worldviews was having a significant impact on my own personal worldview.

These realizations surfaced at a time when I was increasingly feeling drawn to Buddhist bound perspectives regarding the inherent interconnectedness of all living and non-living forms of existence. The Buddhist concept of inter-being, in particular, had captured my

imagination. These internal philosophical shifts and struggles also occurred alongside two Masters' modules relating to the underlying tenets of constructivism. Even though I did not realize or fully appreciate it at the time, these modules, as well as my experiences with the students, and my understanding of Buddhism, were instrumental in urging me to move towards more flexible interpretations of reality, and, indeed, towards more flexible interpretations of the origin and nature of knowledge. Fortunately, at the time, the teaching atmosphere at the international school, where I worked, was inquiry-based and dynamic and notably influenced by local Buddhist philosophy and Myanmar culture. This flexible and supportive space gave me the opportunity to infuse much of what I was learning into my teaching practice.

When the time came to move on from the school in Myanmar it was inevitable that I would seek out a teaching position in a school that would enable me to further develop my ability to teach in an open and constructivist way. Essentially, this meant moving to a school program and approach that did not follow prescribed curricula and where teaching centred on the engagement of students with big ideas and multiple worldviews. It was for this reason that I chose to move to the Netherlands to teach at the International School of Amsterdam (ISA), the site of this current research study.

1.3 ISA and the International Baccalaureate Organization

According to Gellar (2002), international schools sprang up around the world in the 1950s and 60s to educate the increasing numbers of children of internationally mobile diplomatic and business communities. Although there are many types of international schools, Gellar considers that the schools that are international can be distinguished from those that are not in two ways: through the education that is offered and through an emphasis on ethics. From an educational perspective he suggests that an international school's curriculum emphasizes world history, world literature, and world cultures. It stresses the interdependence of nations and peoples, and it does not emphasize the study of topics from the perspective of only one country or of a select region. Secondly, Gellar maintains that the ethical aim of an international school is to "espouse and uphold certain "universal" values and to make them an integral part of the life of the school, its community, and particularly the children in its care" (p. 31).

In line with Gellar's criteria, ISA's mission is to promote international understanding through an internationally focussed curriculum as well as through a school-wide focus on the universal values of integrity, respect and responsibility. Like many international schools examined by Gellar, ISA was set-

up in the 60s, to serve the needs of internationally nomadic families. Currently, the school also serves expatriate families who have chosen to settle in the Netherlands, as well as an ever-increasing number of Dutch children. In total, there are now 1,100 students stemming from 55 different countries with the dominant cultural groups being Japanese, American, Korean, and Dutch. The teachers and administrative staff who work with these students come from 22 different countries.

Given its international composition, the school has long since been a member of the International Baccalaureate and it was the first international school to offer all three International Baccalaureate programs at primary, middle and upper school levels: the Primary Years Program (PYP), the Middle Years' Program (MYP) and the Diploma Program (DP). The school continues to maintain a strong relationship with the program development centres of the IB and this relationship is set to develop further now that the IBO's global offices have recently moved to The Hague in the Netherlands. It is worth noting the guiding mission of the IB, as stated on its main website (2012):

> *"The International Baccalaureate aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect. To this end the organization works with schools, governments and international organizations to develop challenging programmes of international education and rigorous assessment. These programmes encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can also be right."*

Thus it is obvious that the ISA mission statement is directly reflective of the IB's mission and philosophy. This is especially important as the context of this study is the MYP (Middle Years Program,) which is best understood as it relates to its predecessor, PYP (Primary Years Programme) and the IB Diploma Programme, which follows it.

The (PYP) is designed for students aged 3 to 12 and focuses on the development of the whole child as an inquirer, both in the classroom and in the world outside. It is a framework guided by six trans-disciplinary themes of global significance, explored using knowledge and skills from six subject areas, as well as trans-disciplinary skills with a specific emphasis on inquiry. In addition, the programme addresses the social and emotional needs of students and encourages them to be take responsibility for their own learning. In the final year of the programme students undertake the PYP Exhibition, a collaborative and trans-disciplinary inquiry project that involves identifying, investigating, and finding solutions for real-world issues and problems with the help of in-house and external mentors.

The goal of this project is to prepare students for the predominately inquiry-based nature of the MYP Programme.

While the MYP programme will be described in more detail in a later section, for now it suffices to say that the MYP is the bridge between the PYP and the DP and it encourages students to make connections between the traditional subject disciplines and real world issues. It concentrates on the development of the skills of communication, inter-cultural understanding and global engagement. Similar to the PYP, the MYP provides the opportunity for final year students to undertake an independent inquiry called the Personal Project where students explore a topic of personal interest over time and in depth, with the help of in-house supervisors. This project helps prepare students for the level of independent learning that is required at the Diploma Programme level.

The IB Diploma Programme, for students aged 16 to 19, is a challenging and comprehensive academic programme, with final examinations, that prepares students for further study at university and beyond. In this programme students are encouraged to make connections across the traditional subjects and to explore different ways of knowing in the Theory of Knowledge (TOK) course. During TOK students develop an understanding of knowledge as a human construct and undertake in-depth research for the Extended Essay through which they explore a topic of interest. This in-depth and critical exploration through the lens of one or two of their main subjects helps prepare students for the kinds of critical thinking and critical writing that is required at university level.

In general I find that the teaching and learning approach at DP level is different to the approaches that are encouraged at the primary and middle year levels. The content-heavy nature of the DP program does not lend itself easily to the kind of open-inquiry that is the hallmark of the PYP and the MYP. The lack of a continuum between the earlier programmes and the DP has long been a concern for schools that offer all three programs, and plans are underway to bridge this gap. One of the most recent attempts to do so is the emphasis on the IB Learner Profile as a common factor and unifying thread of the three programs. The profile is a clear and concise statement of the aims and values of the IB, and it is viewed as an embodiment of what the IB means by "international-mindedness". The attributes of the Learner Profile indicate the importance of being an enabled thinker, communicator, inquirer, and risk-taker who is balanced, caring, reflective, principled, knowledgeable, and open-minded. The attributes represent a broad range of human capacities and responsibilities that go beyond intellectual development and academic success.

The next section, which takes a more detailed look at the MYP programme, indicates the placement and role of the Learner Profile within this programme and the other two programmes.

1.4 The IB Middle Years' Programme

To begin with, the following diagram gives a general overview of the different aspects of an MYP learning experience.

Fig 1.1: The IB Middle Years Programme
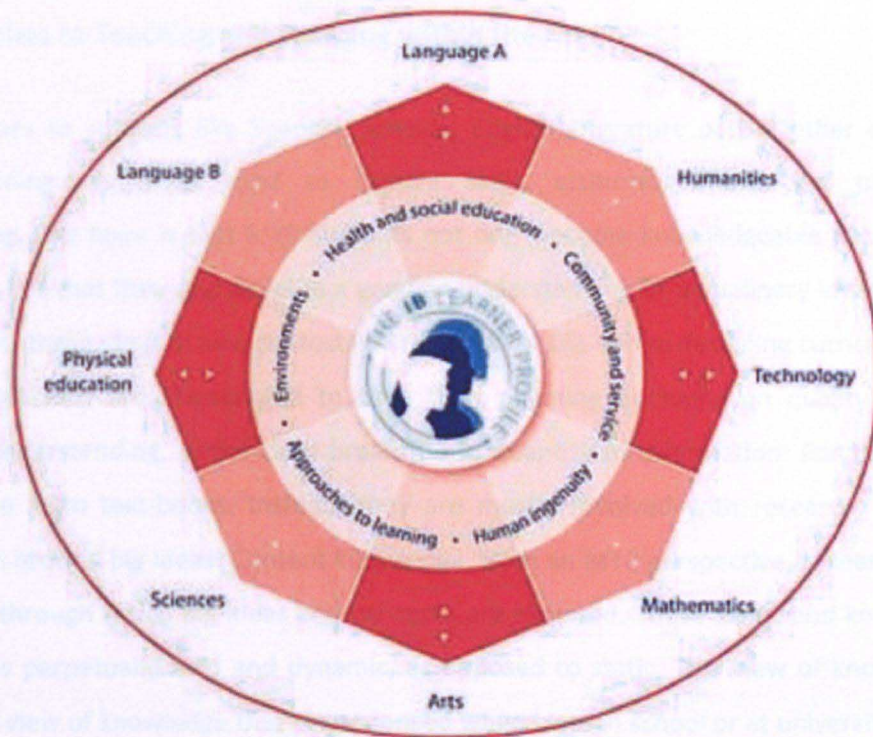
At the centre of the diagram there is an image depicting a number of heads. This image represents the aforementioned IB Learner Profile. All those who study, learn, and work in this environment are expected to embody the different elements of the profile. It provides a general indication of the personal characteristics that the school and the organization values.

On the next layer of the MYP diagram there are five headings: Environments, Human Ingenuity, Community and Service, Health and Social Education and Approaches to Learning. These are the Areas of Interaction. These areas are like a set of lenses through which one might look at real world problems, either from within or outside a particular subject discipline. The Areas of Interaction serve an integrative function, and each is supported by an array of questions that help guide the exploration of significant issues. For example, if exploring a topic through the lens of Human Ingenuity one might ask: How do humans create? What do they create? What are the consequences of these creations?

The subject disciplines are located towards the outer rim and they correspond with the disciplines in many school systems. The languages are broken into Language A and Language B. Language A represents mother tongue languages and Language B represents secondary or tertiary languages. The main language of instruction at ISA is English, but students are strongly encouraged to continue with the study of their mother tongue as well. They are also encouraged to study at least two additional languages. As one can imagine, this involves catering to a wide range of languages.

1.5 Approaches to Teaching and Learning within the MYP

When it comes to subjects like Spanish, Science, English Literature or the other disciplines, the general learning objectives tend to include skills, attitudes, knowledge, processes, and understanding. The hope is that MYP students not only become knowledgeable about a particular subject area, but that they also develop a genuine understanding of disciplinary ideas, as well as an ability to apply these ideas in new contexts (MYP, 2008, p. 16). When designing curricula and units of study MYP teachers are encouraged to base their planning decisions on quality and depth of conceptual understanding, rather than breadth and quantity of information. For this reason, few students read from text-books. Instead, they are mostly involved with research, discussions or presentations around big ideas. Content knowledge, from an MYP perspective, is seen very much as the medium through which big ideas and concepts are explored. These ideas, and knowledge itself, are viewed as perpetually fluid and dynamic, as opposed to static. This view of knowledge differs widely to the view of knowledge that I experienced when I was in school or at university.

The approach used to assess different forms of knowledge is a criterion-referenced one, and the criteria used relate directly to the over-arching objectives for each of the subject groups. These criteria aim to identify what students understand, know, can do, and feel at different stages of the learning process, and the continual gathering and analysis of the processes and products of learning take considerable time and attention. Criterion based rubrics are used frequently, and they provide timely and formative feedback that supports and encourages students as they learn (MYP, 2008 p. 41). Students are also encouraged to assess their own and/or each other's work. Indeed, this form of self and peer assessment is a common feature of and MYP program. Through the process students gain a better understanding of their own progress and develop the ability to provide positive and constructive feedback to others.

It stands to reason that assessment is seen as a student-centred approach that needs to be thoughtfully facilitated. Indeed, much of what could be described as good teaching within the MYP hinges on timely and effective facilitation of both assessment and learning (MYP, 2008, p. 60). And in

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as much as the students are engaged with the process of assessment, they are encouraged to understand the process of learning through the Approaches to Learning Area of Interaction. This Area of Interaction is guided by questions like: What is learning? How do I learn best?

As to how learning appears in context, students are often engaged with thinking routines and other strategies that are used to isolate prior knowledge. They generally reflect on the activities that they have just completed, in order to appreciate how their learning and conceptual understanding have been extended. These kinds of learning strategies abound as the MYP framework acknowledges students' beliefs, models, or constructs about how the world works. These constructs are based on prior knowledge, and it is believed that they need to be revisited and revised in the light of new experiences and further learning (MYP, 2008, p. 17). For this reason, students within an MYP environment are continually evaluating what they are learning about the world around them in light of what they previously thought as they consolidate learning and construct meaning.

This construction of meaning is thought to occur best when the learning activities are contextualized in the real world, and when they involve a significant degree of student inquiry, as well as the application of higher order thinking skills. All the while, this inquiry is to be carried out in a collaborative manner with each student expected to contribute to the well-being and learning of others.

With an emphasis on dynamic curricula, criterion-based assessment, inquiry, understanding, and the construction of meaning, as well as on the development of procedural skills, and differentiated learning strategies, one might ask how MYP teachers develop the necessary skills to be successful in this environment. Many ISA teachers, although originally trained in their home countries, have received specific IB training through workshops at beginner, intermediate and advanced levels. In addition, they have had access to a wide range of non-IB related international conferences and training relating to pedagogy, intercultural awareness, pastoral care, and the integration of technology. Many have also received additional training through Harvard University's Project Zero Teaching for Understanding and Visible Thinking programs.

1.6 Harvard's Project Zero: Teaching for Understanding and Visible Thinking

It is worth expanding on these complementary approaches, especially as Teaching for Understanding is an approach to curriculum design and teaching based on the premise that understanding involves being able "to think and act flexibly with what one knows" (Perkins, 1998, p.40). Visible Thinking is an approach that involves the use of an array of thinking routines to encourage meta-cognition in

individuals so that they become more aware of their own thinking processes, and are better able to manage their critical thinking skills when engaged with complex tasks. As mentioned earlier, it was my interest in Harvard's Teaching for Understanding framework that attracted me to ISA, and engagement with the literature as well as with the approaches have had a significant effect on my approaches to planning and on my understanding of what constructivist teaching and a learning environment looks and feels like.

Training in Project Zero and Visible Thinking have helped many teachers to hone their skills in order to better meet the needs of international MYP students, although I notice that there are individual teachers who genuinely struggle with what is understood as a conceptual approach to planning and a constructivist approach to teaching. Given the variety of disciplines taught through the MYP, and the variety of cultural backgrounds and levels of training of the teachers, it is quite possible that teachers have developed different interpretations with regard to a constructivist approach to teaching. This difficulty is compounded by the fact that the new Principles into Practice guide published by the MYP do not clarify what it means by constructivist teaching and learning practices. Indeed, when I look back, it becomes clear that experiences with my wayward microbiology professor at university, with my students in Sierra Leone and in Myanmar, and work on my Master's program with Curtin University, have all had profound effects on how I view constructivist learning and teaching. These personal impressions have deepened even further through engagement with Project Zero at ISA and, further again, through engagement with the modular assignments of the Ed. D program with the University of Nottingham.

It was during one of the module assignments of the Ed. D program that I came to appreciate the degree to which one's personal take on constructivism could be grounded in how one perceives the nature of knowledge, reality and truth. It was following prolonged engagement with these questions that I became curious as to how the personal philosophies of teachers at ISA might affect their personal takes on constructivism and their perceptions of knowledge and the nature of reality.

CHAPTER 2

ORIGIN OF INTEREST IN REALITY AND KNOWELDGE

2.1 The Fourth Assignment: Understanding of Knowledge, Reality and Truth

The fourth modular assignment required the consideration of my perspectives on the nature of reality and the nature of knowledge, thereby clarifying the research paradigm that I prefer. The assignment began with a contemplation of the nature of reality. Short dictionary definitions describe reality simply as "the state of things as they exist." Wider definitions tend to include everything that is and has been, whether or not it is observable or comprehensible to a perceiver. Over time a wide variety of ideas and theories have been put forward to describe the fundamental nature of reality and these tend to incorporate either the metaphysical or physical (material) aspects of reality, or both. Although there is considerable debate with regard to the validity of different theories, I acknowledged in the assignment that everyday Western thinking tends towards a materialistic view of reality: a reality in which everything that exists is made of matter, and where matter is the fundamental nature of things. It is a view of reality that is embedded in classical Newtonian physics.

I found that my own views were more closely aligned with those of quantum physicists, and in particular with the views of physicist and philosopher Amit Goswami. From Goswami's (1993) perspective "the principles of quantum theory, which sees reality as relational, make it possible to question and maybe even discard many of the assumptions of material realism" (p. 45). For Goswami reality is a form of unified consciousness. Consciousness, in this sense, is the essence that manifests all that exists, whether observable or not, and not the emergent phenomenon that is generally attributed to conscious beings. Goswami puts forward the idea that both the world of matter and the world of mental phenomena, such as thought, are determined by consciousness and he refers to this view of reality as monistic idealism. It is a monistic theory because it holds that there is only one type of substance in the universe, and it is a form of idealism because it identifies that one substance as consciousness. I estimate that my interest in monistic realism stems not just from an appreciation of the relational view of reality put forward through quantum theory but also from an interest in the deep ecology movement as well as exposure and contemplation of Buddhist philosophy and meditation.

With a better understanding of the possible source of my own ontological assumptions it was necessary to consider what my epistemological beliefs were. Epistemology, as I understand it, refers

to the study of the nature, possibilities, origins, and extent of human knowledge. I appreciate, as Griffiths (1998) did, that there seems to be "an extraordinary range in what is counted as knowledge" (p. 80). Although Griffiths did not specify the range, I am comfortable adding tacit, intuitive, spiritual and somatic based knowledge to the traditional lists that included knowledge by sense experience, language, logic, abstract reasoning, and experimentation. I appreciate that knowledge generated by humans cannot be considered a true reflection of reality, but merely as a reflection of how we perceive, experience, and categorize at different points in our biological, cultural and evolutionary development. I believe that conceptual knowledge is transient and open to change as we develop different ways of interpreting and engaging with reality. In addition, with long-term experience of meditation, I understand the impact of knowledge of the non-conceptual realm on the individual; non-conceptual knowledge meaning practical awareness of the relational nature of reality.

As the fundamental nature of reality appears to depend on personal perceptions and experiences, and as everyday concepts seem to be no more than provisional human constructs, it follows that any interpretation of events that I would make during a research project would only ever be a transient time-bound approximation of how things really are. Consequently, the research approach that best fit my views at the time of writing the assignment was the constructivist-interpretive paradigm. This approach takes the stance that through research we are confronted with impressions of each individual's unique way of perceiving the world. These personal realities, according to Pring (2000), are socially constructed, and he suggests that there could be "as many realities as there are social constructions" (p. 59). Pring reminds us, however, that "research is often focused on people's *perceptions* of reality" and not on a contemplation of reality itself. (p. 98).

2.2 Beliefs and Approaches to Teaching

On considering how my beliefs impact my approach to teaching I began to appreciate that a belief in the relational quality of reality and in the inherent wholeness and inter-connectedness of all living and non-living things permeates my humanities and science lessons. In addition, by using Jane Goodall's Roots and Shoots program these ideas flow into pastoral care activities through which students learn to engage with the concepts of inter-connectedness, inter-relatedness, holism and complexity.

The Roots and Shoots program, which is grounded in the deep ecology movement, echoes Jane Goodall's conviction that all living organisms and the physical environment exist as a fragile and interconnected web of existence. What she describes is a view of reality that closely resembles the

Buddhist concept of *inter-being*. She portrays this reality as a relational web of existence that exhibits transcendental qualities, qualities of a kind that she admits seem poorly understood from a conventional scientific perspective.

In addition to a focus on the concepts of interconnectedness, I regularly engage students with conversations, investigations and mindfulness-based activities that help demonstrate the limited nature of human perception, and the provisional, and socially constructed nature of human constructs. And in recent years, I have begun to engage students with learning theories that extend beyond a focus on the learning of the individual to incorporate theories that highlight the complex ways in which students mesh together to form learning collectives.

2.3 The Research Aim

While working on the assignment it was my interest in contemplating my own beliefs and practices that initiated further interest in exploring the beliefs and practices of my colleagues. I was curious as to whether their understandings of the nature of reality and knowledge had any significant impact on their personal approaches to teaching. And, seeing as I was finding my engagement with the assignment influential on my own perspectives and practices, I was curious as to whether explorations of this nature would be worth considering when designing professional development opportunities for experienced IBMYP teachers.

2.4 Initial Drafting of the Proposal

With a clearer idea on how some of my personal views regarding the nature of reality and knowledge affected my teaching practice, and with an understanding of the general aims of the research project, it was time to write the research proposal. The writing of the research proposal, however, was not a straightforward process.

Much of the research explored in the early stages is based on the work of Marion Schommer (1990) and on the more recent work of Schraw and Olafson (2008), amongst others. Marion Schommer developed a questionnaire to explore teachers' epistemological beliefs and Schraw & Olafson developed a two-dimensional quadrant to track the relationship between teachers' epistemological and ontological beliefs, meaning how teachers' impressions of the source, certainty and limitations of knowledge related to their impressions of reality. Other research studies carried out by Chan and Elliot (2004) and by Myint Shwe Khine (2008) required teachers to respond to three-part questionnaires designed to capture their epistemological views, as well as their conceptions of

teaching and learning. Much of this research has been carried out with students or with trainee teachers and, for the most part, is geared towards the situating of teachers along a spectrum that ranges from content-driven to constructivist teaching approaches.

I was doubtful that what I was hoping to explore within an inquiry-based environment with seasoned teachers who are expected to teach in a constructivist manner, could be so easily captured on the existing grids and questionnaires. However, time pressures encouraged me to utilize existing constructs. For this reason the first proposal was designed to incorporate Schraw and Olafson's (2008) grid and Schommer's (1990) and Chan & Elliot's (2004) questionnaires even though I knew that I was more naturally drawn to qualitative approaches. Table 2.1 provides an overview of the stages involved in the drafting of the final proposal. It serves to highlight the changes that occurred over time with regard to the main areas of focus, the guiding questions and approaches to data collection. The final draft emerged prior to engaging with the research participants, and it highlighted a turning point in my understanding of how I might explore the relationships among teachers' beliefs. The turning point came through the writings of Brent Davis and Barbara Jaworski amongst others.

Davis' (2004) work was helpful in many respects as it traces the evolution of educational approaches through time, and suggests ways in which evolutionary stages in our understanding of the process of education may be grounded in perceptions of reality and beliefs with regard to the nature, source, and limitations of knowledge. His genealogical tree approach to the organization of conceptions of teaching theories is an attempt to trace some of the origins, evolutions, and entanglements of the terms we use to describe teaching. The tree was instrumental in helping me to appreciate the connections among many of the concepts of reality, knowledge and teaching that I had been grappling with. However, it is necessary to admit that Davis' views are grounded in a particular way of making sense of the world. Specifically, his thinking is informed by complexity and ecological discourses and while he seems to give a reasonably balanced account of divergent sensibilities between educational theories, he acknowledges that his views are not unbiased.

Table 2.1: Drafting of the Proposal

	Proposal 1	Proposal 2	Proposal 3	Transition Phase Prompted by additional reading and reflection	Proposal 4
Aim	Exploration of relationships between teachers' epistemological and ontological beliefs and their instructional choices.	Exploration of teachers' personal epistemologies, pedagogical beliefs and instructional approaches.	Teachers' epistemological and ontological beliefs and how they relate to conceptions of teaching and learning.		Teachers' beliefs regarding the nature of existence, the nature of knowledge, and the nature of learning - and how these beliefs may be reflected through their teaching.
Guiding Questions	What do teachers understand knowledge to mean? What do teachers understand by the nature of reality? How are epistemological and ontological beliefs reflected in instructional choices? What are the commonalities in beliefs across the disciplines	What are the epistemological beliefs? What are the possible variables among gender, ethnicity, subject area, level of IB, VT, PZ, etc? To what degree are teachers epistemological and ontological beliefs reflected in snapshots of planning and teaching approaches?	What are the epistemological beliefs of teachers? How do the epistemological beliefs of the teachers relate to their ontological beliefs? What are the conceptions about teaching and learning held by the teachers? How do these conceptions about teaching and learning relate to the epistemological and ontological beliefs? Are there noticeable commonalities or differences between teachers' epistemological, ontological and conceptions of teaching and learning within and across the disciplines? How do teachers' beliefs compare with the guidelines laid down in the new Principles into Practice guide?		What do teachers understand by the nature of reality/existence? What do teachers understand the nature of knowledge to be? How do teachers view the nature of learning? How are these understandings and beliefs reflected through their teaching? If so, how? (these questions solidified as the research progressed)
Research Paradigm	Scientific/Post-Positivist	Scientific/Post-Positivist	Scientific/Post-Positivist		Constructivist/Naturalistic
Methodology	Case Study Mixed Methods Quantitative and Qualitative	Case Study Mixed Methods Quantitative and Qualitative	Case Study Mixed Methods Quantitative and Qualitative		Case Study Qualitative
Participants	Maybe 12 => patterns	30 teachers => patterns	20-30 teachers => patterns		3
Data	2 Dimensional Quadrant Interviews Video footage analyzed using multimodal analysis. Document Analysis	Schommer's Questionnaire Interviews Video analysis but not multimodal analysis Document Analysis	2-D Quadrant Recent Questionnaires (EBQ and TLCQ) Interviews		Video footage of classes Open-ended conversations and semi-structured interviews Emergent Design
Research Studies	Jewitt, C . & Kress, G. (2003). Schraw & Olafson (2008)	Schommer (1990)	Khine (2008) Chan & Elliot (2004) Cheng et al. (2009)		Davis (2004) Jaworski (1994)
Remarks	Led by literature – instead of intuition	Dropping of ontological beliefs – leading to a period of confusion	Complicated collection of data using techniques that did not sit well with me.		A feeling of coming home – this approach feels more familiar and more in line with my intuitive sense of what was needed

Davis' (2004) genealogical tree approach begins with a branch that looks at ancient metaphysical perspectives regarding the nature of reality and knowledge and moves on to a consideration of how these perspectives changed following the onset of the scientific revolution. Another branch explores the different cognitive theories of learning that emerged during the 20th century and pays particular attention to the theories of two better known educational psychologists, Jean Piaget and Lev Vygotsky, and considers how their philosophies have informed past and current understandings of constructivism. Other branches consider the impact of inter-subjectivity on educational approaches and highlight the effect that changes in the physical sciences in the early 20th century had on our interpretation of the inter-objective nature of reality. More recent branches explore the contemporary ideas on reality, knowledge and learning that are emerging from within the social, physical and biological sciences. Not surprisingly Davis' tree emphasises the ideas of complexity theorists as well as the perspectives of ecological approaches to education.

Davis' (2004) review of changing interpretations of reality and knowledge helped introduce and re-introduce me to the writings of Jean Piaget (1967), Ernst von Glasersveld (1995), Lev Vygotsky (1978), John Dewey (1933), Paulo Freire (1971), Werner Heisenberg (1958), Thomas Kuhn (1996), and Fritjof Capra (1996), amongst others. Collectively their respective writings on cognitive constructivism, radical constructivism, social constructionism, pragmatism, inter subjectivity, the relational nature of quantum reality, inter objectivity, paradigm shifts, and complexity theory were instrumental in helping develop an appreciation of how understandings of cognition and learning, and our associated views on reality and knowledge have changed over time. In particular, these writers help clarify the differences between objective, subjective, inter-subjective and inter-objective views on the construction of reality. A clearer understanding of these distinctions became essential to the understanding of the research participants' viewpoints and practices.

Table 2.2 provides a summary of the changes relating to views on knowledge and reality over time as well as associated approaches to teaching and learning. These theories will also be referenced during the literature review. Although presented here in table format this does not mean that these philosophies and practices emerged in a neat, linear and chronological fashion.

Table 2.2: Overview of Beliefs and Related Practices over Time

Era/Philosophy	Reality	Knowledge	Learning	Teaching	Teacher's Role
Antiquity	Physical and Metaphysical Form Grand Unity/Oneness	Innate – contained within Concerned with Meaning Involves whole Being	Focus on Ultimate Issues and remembering innate knowledge	Socratic Method Inter-disciplinary	To ask questions To cause cognitive conflict
Scientific Era -Francis Bacon -Issac Newton	External-Can be known/Realism and Perceptual realism	Gained by Empirical and Rational Methods	Mentalisms Building Internal Representations	Imparting Curricula Behaviourism Proceduralism	Dispenser of Knowledge
Cognitive Constructivism - Jean Piaget	Reality unknowable Multiple personal realities	Knowledge of the world is constructed independently by individuals	Developmental Biological base Actions schemas	Facilitation of a discovery approach Cognitive conflict	Facilitator Cause cognitive conflict
Social Constructivism - Lev Vygotsky -Paulo Freire	Reality unknowable Multiple inter-subjective constructions	Knowledge of the world is constructed inter-subjectively through group dialogue and discussion	Collaboration - Social Depends on culture and the context of learning	Facilitation Deconstruction Emancipation	Facilitator Provocateur Guide
Pragmatic Constructivism - John Dewey	The nature of Reality is not seen as important	Needs to be practical Whatever fits the purpose Best kept unproblematic	Action and Thinking Involves Modeling Student as apprentice	Facilitation of practical learning experiences	Master inducting a novice
Changes within the Physical Sciences -Werner Heisenberg	Reality as relational Impacted upon by the observer	Knowledge cannot be separated from the knower	-	-	-
Holism Deep Ecology -Fritjof Capra	Reality as a state of inter-connectedness	Includes spiritual knowledge Focus on Ultimate Issues	Integral - Involves the whole Being	Authentic Needs Self-knowledge	Participant and Role Model
Complexity Theory -Brent Davis	Reality as inter-objectively created	Emerges through the interaction of individuals, collectives and contexts	Emergent - Learning groups as complex adaptive systems Expanding the possible	Inter-disciplinary Setting up complex real world problem solving opportunities	Participant and Learner

2.5 Insights Gained

Insights emerging from the table emphasize that when reality is seen within educational contexts as a state that exists externally to us, then it is believed that we are capable of accessing it directly and modelling it. On the other hand, where reality is seen as something that we create, then learners are better able to create their own knowledge. Likewise, where the nature of reality is not considered relevant, pragmatic approaches to education have emerged. Each interpretation brings with it a different view of knowledge, learning and teaching, and multiple shades and blends of constructivism and social constructionism have emerged over time to reflect these views. The more recent developments take into account the learning capacity of both groups and individuals. It is becoming clear that the emergence of the complexity sciences and connectivity theories are causing lines to blur between different views of reality. Reality, through a complexity science lens, for example, is seen as an emergent and multi-layered phenomenon.

Although these insights were instrumental in helping to understand the relationships between the philosophies of different thinkers through time, they did not provide coherent advice on how to go about exploring teachers' perspectives. At this point in the research process Barbara Jaworski's (1994) approach to constructivist inquiry in mathematics teaching was helpful. Jaworski, who was interested in exploring math teachers' approaches to math investigations, chose to explore the nature of constructivist math inquiry using a constructivist approach. Similar to what I experienced, she found that the methodologies generally employed in educational studies did not fit well with what she wanted to do, which was use an open exploratory approach both in terms of her research goals and her research methods.

Jaworski's advice regarding the importance of letting go of the need to have a well-worked out research plan in advance was beneficial when it came to getting started. Her thoughts reflected Brent Davis' idea of allowing learning to "expand into the space of the possible" (p. 179). Both Jaworski's and Davis' work, as well as a more informed understanding of the social construction of knowledge and reality reinforced the degree to which I adhered to an interpretive-constructivist research paradigm, as opposed to a more structured approach. The next section of the research study aims to review a range of literature that explores research into teachers' beliefs regarding the nature and acquisition of knowledge, the nature of reality and how these beliefs may impact practice.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

The past few decades have seen an increase in research into epistemological and ontological beliefs within educational contexts. Epistemology is defined by Schraw, Olafson and Vanderveldt (2011) as a study of beliefs about the origin and acquisition of knowledge. Ontology is defined as the nature of reality and being by Lincoln & Guba (2000) and Merricks (2007). In this study the term *epistemological beliefs* refers to a teacher's collective beliefs about the nature and acquisition of knowledge and the term *ontological beliefs* refers to a teacher's collective beliefs about the nature of reality and being. The term epistemological belief is thought to be synonymous with the terms epistemological worldview (Schraw & Olafson, 2002), and personal epistemology (Chan & Elliott, 2004; Hofer, 2001). Although up to this point there has been almost exclusive reference to beliefs about the nature of knowledge and reality, from this point forward epistemological and ontological beliefs will be used more frequently as these are the terms most often used in research.

Within educational research it is assumed that epistemological and ontological beliefs work in tandem to determine an individual's collective worldview about learning and instruction (Schraw & Olafson, 2008). Given the inquiry-based nature of the research context and the fact that different approaches to constructivism are underpinned by different ontological and epistemological views I will begin the review with a consideration of different constructivist approaches. This helps to differentiate cognitive constructivism and social constructionist from each other as well as to highlight how they compare to other approaches in teaching. The review then moves on to an in-depth consideration of the variety of research models that exist to explore teachers' and students' epistemological and ontological beliefs. This research has been divided into two main lines of inquiry: one that identifies stages of psychological development in epistemological beliefs (Perry, 1970; Baxter-Magolda, 2004; Belenkey, Clinchy, Goldberger, & Tarule, 1986; King & Kitchener, 2002) and a second one that explores the possibility that epistemological beliefs develop as a system of beliefs that are independent of each other (Kuhn, 1991; Schommer, 1990).

The review then moves to an evaluation of research into the relationships between teachers' epistemological beliefs and their conceptions of teaching (Chan, 2008; Cheng, Chan, Tang & Cheng, 2009) and as well as their approaches to teaching (Brownlee, 2000; Brownlee & Bertelsen, 2006; Sing & Khine, 2008) and the impact of teachers' beliefs on student learning (Muis, 2004). Considering

the concern among researchers about the extent to which epistemological beliefs should be considered as domain specific or domain general (Hofer, 2000; Tabak & Weinstock, 2005) the review explores research in this area whilst paying particular attention to a growing body of research on domain specific epistemology in science (Hasweh, 1996; Matthews, 1994). An interest in the epistemology of science introduces the relatively recent interest in the impact of ontological beliefs on epistemological beliefs (Kang, 2008; Schraw & Olafson, 2008).

Following an evaluation of past and recent research trends in the area of epistemological and ontological beliefs and associated practices, I will consider why an evolving interest in the roles of social constructivism, relational pedagogy and complexity theory in learning may suggest the need for more complex interpretations of constructivism, as well as the need for a broader range of research into the nature of ontological and epistemological beliefs and their related teaching practices.

3.2 Forms of Constructivism

The roots of constructivist thinking appear to date back to the writings of Giambattista Vico, an 18th century philosopher and scientist, who viewed knowledge as something created by the minds of humans as they actively engaged in the world. His slogan, according to von Glasersfeld (1989), was "the human mind can only know what the human mind has made" (p.3). Vico did not view knowledge that was gathered or generated by rationalist or empirical (positivist) means as objectively real. This is interesting given the fact that Vico lived during a time-period that seemed to favour a positivist belief in objective reality. Positivism as defined by Reese (1980) indicates "a family of philosophies characterized by an extremely positive evaluation of science and the scientific method" (p. 450).

Contrary to Vicos' philosophy, positivist views were governed by the realist presumption that there was an objective and tangible reality "out there" which went on about its business irrespective of any interest that an inquirer might have in it and it was thought that an inquirer could collect information about external reality whilst maintaining "an objective distance" (Guba and Lincoln, 1989, p.87). At the time, this view of reality had important implications for how knowledge could be sourced and known. For Vico, however, the nature of reality could not be accessed in this way, as for him, it was constructed internally by the individual. Indeed, he was one of the first educational philosophers to make regular use of the construction metaphor through the use of the words create, assemble, build, and shape (Sexton & Griffin, 1997).

Vico's views, however, had no significant impact on the empirically informed behaviourist approach to teaching that emerged during his lifetime within educational contexts. An empirically informed behaviourist view led to education ensuring that the learning (changes in behaviour) of students mirrored the objective representations of the real world that were laid down in the curricula. As Manus (1996) explains, this approach is presently often referred to as proceduralism: an approach to education that is highly structured, performance driven, and teacher directed. These are the hallmarks of a positivist approach to education and it was the dominant style of teaching in my experience both as a student and as a young teacher. It contrasts heavily with my current context where knowledge and reality are seen in less certain terms and where learning is less structured and less teacher-directed and where constructivist approaches to teaching are recommended. Although, as mentioned previously, what constructivism actually means is not always clarified for teachers within IBMYP literature.

Conventional constructivist teaching approaches tend to reflect the ideas of Jean Piaget, a Swiss cognitive psychologist, who suggests that humans build up their personal versions of reality though the construction of internal conceptual structures. Piaget (1967) refers to these conceptual structures as schemata and speculates that the development of the schemata occurs in developmental stages and that their development depends on active engagement with the world. Similarly to Vico, Piaget assumes that what counts as new knowledge depends on what one perceives and he maintains that one perceives only that which one can fit into the cognitive structures that one already possesses. Learning, Piaget (1967) argues, happens due to adaptations that occur in the schemata when an individual engages with the world and is faced with cognitive conflict. What a student can learn depends on their experiences.

Radical constructivism is the term that Ernst Von Glasersveld (1995) uses to refer to Piaget's constructivist view. Radical, not because it denies the existence of reality, but because it denies that this reality can ever be known rationally. Instead of focussing on an independent objective reality, Piaget focuses specifically on what an individual could know to be real, and, for him, what is *real* is always the experiential world. As each learner perceives differently Piaget maintains that there exist multiple realities, each constructed by individual cognizing agents and each based on their own individual experiences. Guba and Lincoln (1989) describe this ontological perspective as a relativist one. They suggest, however, that these individually constructed realities can be (and usually are) shared. They add, however, "that does not make them more real but simply more commonly assented to" (p. 86).

Instructional practices often attributed to Piaget's philosophy include "discovery learning", hands-on activities, tasks that challenge existing concepts, and questioning techniques that probe students' beliefs (Richardson, 1997). These practices usually involve attempts on the part of the teacher to prompt learners towards an understanding of commonly held beliefs. These are some of the approaches that many teachers generally make use of but I can see the tension that this approach would cause for a teacher who has an objective conception of reality, or when there is a heavily prescribed curriculum that has to be "delivered" to students. During her research into inquiry-based math teaching Jaworski (1994) acknowledges "a syllabus that is inherently absolute in conception would prove quite problematic for a teacher if that teacher was working from a radical constructivist perspective" (p.18). It might even pose greater problems for teachers who are expected to teach at MYP *and* DP levels as the two programs seems to be underpinned by different ontologies and epistemologies.

In recent years, to counteract confusion regarding the philosophical underpinnings of constructivism, a form of constructivism has emerged that is more pragmatic in nature. David Perkins, one of the founders of Harvard's Project Zero, seems to suggest such an approach and his ideas build on those of John Dewey who believed that theories about knowledge and learning should best be kept unproblematic. Dewey (1966) summarizes his pragmatic perspective well when he notes that if modern experimental science has taught anything it is that "there is no such thing as genuine knowledge and fruitful understanding except as the offspring of doing" (p. 275). Similarly Perkins (1999) considers learning (or understanding as he prefers to describe it) as a "flexible performance capacity" with an emphasis on the flexibility of one's ability to explain, justify, extrapolate, and apply information in novel contexts (p. 46).

Perkins' (1999) model of understanding contrasts with previous constructivist theories of learning as the development of internal representations, action schema or mental models. Perkins thinks that mental models and/or action schemas, of the kind suggested by Piaget and other cognitive scientists, should not be considered as understanding. He argues this point from the view that "we can possess mental models of something without understanding and we can often understand much without having mental models of that understanding" (p. 47). Perkins (1999) encourages an incremental view of learning, reflective engagement with tasks, and cognitive conflict with earlier understandings and his advice casts teachers in the role of facilitators or coaches whose job it is to is to "arrange, support and sequence performances of understanding so that students develop more complex understandings" (p. 52). He places no emphasis on discovery learning.

From an epistemological perspective it is clear that for Perkins, knowledge is constructed independently by the learner with the assistance of a more informed mentor and that learning is successful when a learner can independently apply what they have learned. It is unclear, or rather unstated, as to how David Perkins' ontological views relate to his idea of the performance of understanding, but given his frequent references to the theory of connectionism and the fact that he often compares the human neural network to a termite nest it appears that his ideas may be rooted in evolving interpretations of reality that are ground in the complexity sciences. This point will be discussed in more detail later in the review.

For now it appears that the variety of interpretations of constructivism and the different views of reality and knowledge they bring with them have fuelled much of the research into the epistemological and ontological beliefs of students and teachers in recent decades. Although, on examining the available research, it is important to point out that the research has concentrated predominately on epistemological beliefs, possibly due to the tacit and sometimes vague nature of ontological beliefs. The next section of the review explores research carried out in this area and then it moves on to consider the ways in which research into epistemological beliefs informs more recent research relating to ontological perspectives.

3.3 Exploration of Epistemological Beliefs

Many of the research models that exist today to explore epistemological views have their roots in Piaget's views with regard to cognitive development. To varying degrees they seem to rely on his work on stage development theory: the idea that learners' cognitive structures develop in stages as they learn (Hofer, 2001). LaFrazza (2005) suggests that the resemblance to Piagetian thought is in evidence through each of the models in the assumption that people move through certain stages in their beliefs with regard to the nature of knowledge and the different ways of knowing as they develop. Four of the earlier models in the area of research into epistemological beliefs include The Perry Scheme (Perry, 1970), The Epistemological Reflection Model (Baxter-Magolda, 1992), Women's Ways of Knowing (Belenky *et al.*, 1986), and the Reflective Judgement Model (King & Kitchener, 1994). Duell & Schommer (2001) highlight that these models are all unidimensional in nature given that they were created on the assumption that epistemological beliefs pass through individual stages in a predictable manner.

The models form the theoretical basis of much of the research in this area and they usually examine individuals' beliefs about the complexity and certainty of knowledge, the process of knowing, and the sources and justification of knowledge claims (Hofer & Pintrich, 1997). The models are based, to

some degree, on the seminal work of William Perry, who, in the 1960s, began collecting data relating to students beliefs on the nature and source of knowledge at Harvard University. Following the completion of long, un-structured and longitudinal interviews with male students, Perry (1970) posited that student epistemological beliefs changed in a sophisticated and predictable way over the course of the college years. From the results of the interviews he developed a model to indicate and measure how students' views changed. Perry and his colleagues called this model the Checklist of Educational Views (CLEV) and it was used to situate students on a continuum of development form dualistic to relativistic thinkers.

The checklist identified nine positions of epistemological development that were subsequently categorized into four major perspectives; dualism, multiplism, relativism, and commitment within relativism (Moore, 2002). The first category contained students who held simple, *dualistic*, right & wrong, understandings of knowledge. The second category reflected a *multiplistic* view of knowledge: an appreciation of uncertainty and the recognition of multiple stances on issues. Those in the *relativist* category, on the other hand, not only recognised multiple views, but also saw conflicting views as equally valid and the concept of truth as meaningless. Perry (1970) posited that students moved from here into the *commitment to relativism* stage when students came to see that some beliefs and opinions were more valuable than others depending on the circumstances. At this point he noticed that students needed to rely on their values and personal beliefs when making decisions (Hofer & Pintrich, 1997).

It is important to note that there were obvious limitations to Perry's work. It failed to accommodate women's perspectives, it did not explore the beliefs of younger or older people, and it excluded the perspectives of those from less affluent backgrounds. The perceived limitations gave rise to research that followed, including research involving female respondents carried out by Belenky *et al.* (1986). They built on Perry's work by interviewing 135 women, some from college and some not, and they focussed on the role of the self-as-knower and on how a woman's self-concept is intertwined with her way of knowing. Their theory was that women's epistemological views were closely related to their perceptions of self and how they related to the world in general (Hofer & Pintrich, 2004). They used a phenomenological approach involving intensive interviews in order to avoid imposing preconceived hypotheses and found that the women's data did not fit onto Perry's model (Duell & Schommer, 2001).

The scheme that they developed following the interviews places the different *ways of knowing* by women into five epistemological categories: silence, received knowing, subjective knowing, procedural knowing, and constructed knowing. *Silence* refers to some women feeling that they do not have a voice

and feel that they could not share their knowledge. *Received knowing* means that knowledge is considered as something that needed to be taken in from outside authorities. *Procedural knowledge* refers to both separated and connected ways of knowing. Separate means knowing through the more traditional objective epistemological stance and connected meaning refers to knowledge gained through an in-depth understanding of the perspectives of others. Although Belenky *et al.* (1986) makes no strong statements about the relationship of separate and connected knowing to genders, Galotti, Clinchy, Ainsworth, Lavin, & Mansfield (1999) hypothesize that women seem to emphasize connected knowing and men tend to separate knowing. The involvement of self with knowledge in either a connected or separate way leads, according to Belenky *et al.* (1986), into the *constructed knowing* stage, which indicates that the respondent is active in the meaning making process. This stage appears to echo Perry's (1970) commitment to the relativism stage of epistemological development where he acknowledges that at this point of epistemological development values and beliefs to impact what can be known.

Given the distinctions that were being observed between male and female ways of knowing and given the lack of a focus by Perry on the impact of context on beliefs, another epistemological beliefs model emerged which took both gender and contextual factors into account. The Epistemological Reflection Model, developed by Baxter-Magolda (1992), aims to isolate the epistemological belief patterns of male and female respondents whilst keeping in mind the contextual nature of epistemology.

Through her research Baxter-Magolda (2001) identifies a sequence of four levels of development which she refers to as "ways of knowing", a term originally used by Belenky *et al.* (1986). The levels identified are absolute, transitional, independent and contextual. In the *absolute* stage knowledge is seen to be certain. It is only partially certain in the *transitional* phase although this seems to depend on the disciplinary area. Knowledge is seen as more certain in science and math than in the social sciences, for example. (This point of interest will be returned to later in the review). In the *independent knowing* stage, knowledge is relatively uncertain and each person has her/his own beliefs and truths. At the *contextual knowing* level, although still uncertain, knowledge is judging by the evidence that appears within a given context.

Interestingly, Baxter-Magolda's research indicates that although developmental trends through the four stages are similar for women and men, men seem to adopt more individualistic ways of knowing while women adopt more personal and inter-individualistic ways of knowing (Hofer, 2001). This reflects to a degree the hypothesis made by Galotti *et al.* (1999) that women favour a connected way of

knowing as opposed to a separate way of knowing. Baxter-Magolda (2002) supposes that this may be because women appear relatively comfortable with uncertainty, whereas men tend to exhibit more of a need to defend viewpoints and to move towards certainty. Baxter-Magolda's research provides rich insights into the personal epistemologies of a range of individuals but, as Duell & Schommer (2001) point out, the open-ended questionnaire that she used to gather data during interviews, the Measure of Epistemological Reflection (MER), was thought to be too time consuming to conduct and difficult for other researchers to interpret.

Further models that emerged to explore epistemological beliefs focus less on gender related and contextual issues but more on how pre-existing epistemological beliefs influence thinking and reasoning. King and Kitchener (1994) emphasize, for example, on exploring the cognitive process involved in the solving of ill-structured problems by respondents, as they believe that epistemological beliefs were tied to the ability to understand and construct solutions for ill-structured problems. Ill-structured problems are ones involving dilemmas where even experts could not agree on a given solution. King & Kitchener (1994) developed the Reflective Judgement Model following cross-sectional and longitudinal research with students from late adolescent stages into adulthood. The term they use for the model *reflective judgement* was a construct that was originally introduced by John Dewey (1933) who claimed that when an individual is faced with provocative problems they need to draw on more than logic to solve them (LaFrassa, 2005). Dewey suggests that the context as well as one's own beliefs needs to be acknowledged in order to find suitable solutions. Similarly, this is an idea that is echoed in Perry's *commitment to relativism* stage of epistemological development. At this sophisticated stage of development he believes that an individual needs to access their own values and beliefs in order to make sense of new information. Contrary to Perry's four stages of development, however, the Reflective Judgement Model is comprised of seven distinct stages of epistemological development.

These stages were categorised into three distinct levels: the *pre-reflective* stage, the *quasi-reflective* stage and the *reflective* stage (King & Kitchener, 2002). The *pre-reflective* stage is characterised by a belief that knowledge can be known with certainty. At the *quasi-reflective* stage there is an understanding that knowledge can contain elements of uncertainty. Then in the *reflective stage* there is increased understanding that knowledge claims cannot be made with certainty and but that it is possible to make decisions based on what seems to be the most plausible approach using the evidence at hand. The last stage is considered more mature as it enables an individual to solve different kinds of problems especially those that do not have obvious solutions. King & Kitchener (2002) suggest that at this stage individuals are beginning to think more about the criteria of knowing.

Looking over the models and instruments that have been developed up to now to evaluate epistemological beliefs, it is clear that significant changes have occurred in the degree of sophistication and complexity of the models and the research approaches. From Perry's initial interest in male students' beliefs regarding the certainty of knowledge there was a move to a consideration of women's perspectives (Baxter Magolda 1992; Belenky *et al.* 1999). There was also a move to the justification of knowledge by King and Kitchener (1994). When the different models are aligned some interesting patterns emerge which are highlighted in Table 3.1. The table includes Kuhn & Weinstocks (2002) Argumentative Reasoning Model, which will be explained later.

Comparing the models it is clear that epistemological beliefs are thought to emerge along a trajectory from naïve to more sophisticated beliefs with the former being a belief in the certainly of knowledge and more sophisticated beliefs warranting more of a constructivist approach to the development of knowledge. At this level it becomes clear that knowledge is viewed as a human construct, reality is unknowable, and there is a pragmatic need to take personal beliefs and values, as well as the context, into account when generating solutions to problems. From an approaches-to-teaching viewpoint, the lower end of the continua seems to reflect a procedural/behaviourist model of education and the upper ends reflect the degree of sophistication required by students who have strong critical thinking skills and who may be familiar with inquiry-based learning and perhaps a theory of knowledge. Belenky *et al.'s* model stands out from the others through its emphasis on connected and separate ways of knowing and the fact that they have included a *silence* category for women.

Table 3.1 Overview of Epistemological Belief Models

Epistemological Model	The Perry Scheme	Ways of Knowing	Epistemological Reflection Model	The Reflective Judgement Model	Argumentative Reasoning Model
Researchers	Perry (1970)	Belenky *et al.* (1986)	Magolda (2001)	King & Kitchener (2002)	Kuhn & Weinstock (2002)
Respondents	Male University Students	Adult Females	Male and Female - adults	Male and female - late adolescence to adulthood	Mix of respondents – teenagers to elderly
Stages in Epistemological Development		Silence: Not having a voice			
	Dualistic	**Received Knowing**	**Absolute**	**Pre-reflective**	**Realism**
	Truth can be known Right and Wrong Views Certainty of Knowledge	Knowledge comes from an external source and not from within	Knowledge is certain	Knowledge can be known with certainty Cognition involves rote memorization	Assertions are copies of reality Reality is knowable
	Multiplism	**Procedural Knowing**	**Transitional**	**Quasi-reflective**	**Absolutism**
	Diverse view-points exist Uncertainly possible	Knowledge is seen to be gained by either separate or connected means.	Degrees of uncertainty depend on the discipline	Knowledge has a certain degree of uncertainty. Meta-cognition is required to sort through knowledge	Assertions can be either right or wrong Reality is knowable
	Relativism		**Independent Knowing**		**Multiplism**
	Different views exist - the views are equally valid Truth does not exist		Knowledge is uncertain		Assertions are opinions Knowledge is created and uncertain Reality is not directly knowable
	Commitment to Relativism	**Constructed Knowing**	**Context Knowing**	**Reflective**	**Evaluativist**
	There is a need to analyse viewpoints and choose one that is most valid.	Knowledge making involves the personal construction of meaning	Knowledge judged on evidence in a given context	Knowledge claims are uncertain Solutions depend on best fit for the context and referring to beliefs. Criteria of Knowing.	Assertions are judgements that can be compared and evaluated Reality is not directly knowable

The models and their conclusions have not been immune to criticism. Particular concerns have been raised that each seems to be reflecting a specific view of epistemological theory and that research has not been carried out in a variety of contexts. As a result, the instruments created may not transfer to different cultures and populations. Kuhn & Weinstock (2002) have argued that the various stage models and conceptualization of personal epistemology exhibit a lack of consistency in terms of the epistemological elements that characterize each stage of development. Duell & Schommer (2001) have also raised concerns that using a uni-dimensional approach is limiting due to the fact that with this approach the beliefs are determined by the researcher at each stage. Keep in mind that a uni-dimensional view of epistemological development means that epistemological development flows from lower levels of epistemological awareness to higher levels in relatively predictable stages. Therefore, a researcher holding this view may miss anything that does not fit into these preconceived patterns, thereby limiting the research.

Schommer (1990), being concerned that researchers focussed too narrowly on certain aspects of epistemological beliefs, suggests that personal epistemologies might be a system of beliefs and she developed the first multi-dimensional theory. The multi-dimensional theory included the possibility that each of the dimensions of epistemological beliefs may develop separately from the rest, especially when an individual's beliefs are in a transitional phase. Schommer's (1990) theory identified five beliefs that, in her opinion, make up a personal epistemology: the structural aspects of knowledge, the certainty of knowledge, the source of knowledge, the duration of learning, and the speed of learning. In order to assess these five dimensions she developed a questionnaire composed of 63 items that subjects responded to on a 5-point Likert scale. Schommer's Epistemological Beliefs Questionnaire (EBQ) has been used frequently by other researchers but has been challenged in various regards. For example, Hofer & Pintrich (1997) argue that the last two dimensions on the model, that is the speed of learning and the ability to learn, are problematic because they seem to make reference to beliefs and attitudes towards learning and not to individuals' personal epistemologies.

Another multi-dimensional theory, Argumentative Reasoning Model is put forward by Kuhn (1991). Similar to the Reflective Judgement Model, developed by King and Kitchener (1994), Kuhn's research focuses on the solving of ill-structured problems and the research was carried out with a variety of people from teenagers to the elderly. Kuhn & Weinstock (2002) proposed four levels of epistemological development: realism, absolutism, multiplism, and evaluativism. They define these four levels in terms of how respondents approach assertions, reality, knowledge, and critical thinking. At the *realism* level assertions are believed to be copies of reality and knowledge comes

from external sources. At the *absolutist* level assertions are thought to be right or wrong and critical thinking helps to compare them to reality. At the *multiplism* level assertions become opinions, reality is not knowable, and individuals create knowledge. At the *evaluativist* level assertions are judgements that can be compared, reality is not directly knowable, knowledge is a human construction, and critical thinking is necessary in order to understand.

At first glance, Kuhn's theory compares favourably with the previously described uni-dimensional theories as is evident in Table 3.1. What makes the model multi-dimensional is the fact that it includes five different judgement domains across which Kuhn posits that the epistemological beliefs develop. The domains include personal taste, aesthetic judgement, value judgement, facts about the social world, and facts about the physical world. Kuhn hypothesizes that people move from the realist to the evaluativist levels at different rates within the different domains (La Frazza, 2005). Although the multi-dimensional models introduced here are useful for identifying the overall strengths of one's epistemological beliefs, Duell & Schommer (2001) assert that additional instruments or approaches are needed to get a more in-depth view into each of the dimensions. They suggest that future research in this area should extend beyond the models in place and they advocate more unconventional research approaches.

3.4 Impact of Beliefs on Teaching and Student Learning

One of the areas in which research into epistemological beliefs is extending beyond the traditional models now used is in the field of pre-service teacher education. According to Chan (2008) there exist clear relations between pre-service teachers' epistemological beliefs and their conceptions with regard to what constitutes effective teaching and learning. It has been claimed that pre-service teachers' personal epistemologies influence what they "see" when observing exemplary teaching practices (Yadav & Koehler, 2007), and that these observations influence their teaching goals (Kang, 2008). A study involving pre-service 228 fourth year pre-service teachers carried out by Cheng *et al.* (2009) used a mixed method research approach to investigate conceptions of teaching and personal epistemologies. Their surveys measured pre-service teachers' personal epistemologies using the Epistemological Beliefs Questionnaire developed by Schommer (1990) and a Conception of Teaching (COTI) scale to measure beliefs about approaches to teaching. Both qualitative and quantitative sets of data show that a large number of pre-service teachers believe that knowledge was constructed by individuals over time, and that it is important to critique knowledge, particularly when it involved experts' knowledge. These personal epistemologies are found to relate well with the teachers' constructivist conceptions of teaching.

Similarly, in research into personal epistemologies carried out with early years' teachers by Brownlee (2000, 2001) it was found that teachers who hold evaluativistic personal epistemologies are more likely to describe child-centred, constructivist approaches to teaching. Child care teachers with more naïve personal epistemologies in which knowledge is considered absolute and simplistic were likely to describe teaching practices that require children to be less active and rely more on adults to direct their learning. Other studies that have investigated personal epistemologies have involved researchers observing teaching practice rather than simply documenting beliefs about teaching. For example, Tsai & Liang (2009) investigated 36 early childhood pre-service teachers in Taiwan who were studying a science education unit. Similarly to Brownlee (2000, 2001) they show clear links between more sophisticated personal epistemologies and child centred constructivist teaching interactions. Sing & Khine (2008) also find that teachers with more sophisticated views tended to have less didactic classes and that these teachers were less likely to control the flow of the lesson compared to teachers with more content-oriented perspectives.

Also, Schraw and Sinatra (2004) noted that teachers with more sophisticated personal epistemologies are likely to be adaptable in terms of teaching strategies and they tend to engage more with their students. Furthermore teachers with sophisticated personal epistemology use teaching strategies that detect student misconceptions and induce conceptual change (Hasweh, 1996). Interestingly, it has been suggested by Palmer & Marra (2008) that teachers' choices regarding the design of instructional environments may also be affected by the teachers' epistemological beliefs. However, they suggest that additional research is needed in this area before any conclusions can be made.

One of the concerns raised by Schraw et al. (2011) with regard to research in the area of teachers' epistemological beliefs is that beliefs and practice are not always consistent. To explore the possible gaps between beliefs and practices Sing & Khine (2008) believe that it is necessary to conduct more research involving observations in order to verify teachers' self-reported data. In addition, they suggest that longitudinal studies that trace how teachers' beliefs change as they enter the profession can offer valuable information for the professional development of teachers. In particular, they highlight the need to consider the influence of background and experiences on the epistemological and pedagogical beliefs of teachers. Once teachers' epistemological beliefs are made visible, Schraw et al. (2011) suggest a variety of on-going experiences to develop them further. They include activities that involve discussion, group reflection, essays, presentations that require individuals to describe and justify their beliefs, and action research. Although their suggestions are directed at pre-service/university based teachers I can imagine that they would work equally well with in-service

teachers. It may even be more important in an in-service context given that a review of literature by May, Gilson, & Harter (2004) indicates evidence to suggest that school culture can have an impact on teachers' personal epistemologies.

This is an important point within an IBMYP context given that new teachers joining the program are expected to switch from teaching approaches that may not have been inquiry-based to an inquiry-based approach without having the opportunity to assess how this shift effects their beliefs or their understanding of constructivism. An exploration of epistemological beliefs would be beneficial during the transition phase. Teachers new to the MYP continuing initially with content-oriented approaches must be very confusing for students who are used to more inquiry-based approaches. Very little attention is given to this struggle despite the fact that teachers' epistemological perspectives and their teaching approaches are known to be related to the development of students' epistemological development. As Muis (2004) maintains "the types of instruction which students are immersed in parallel the types of beliefs they develop" (p.363).

3.5 Approaches to Teaching and Students' Epistemological Beliefs

Windschitl (2002) suggests that teachers with developed epistemological beliefs and practices promote what he describes as *strong acts of constructivism* in their students. This helps their students develop strong epistemological views and enables them to build personal meaning. Windschitl posits that teachers operating with strong acts of constructivism focus on what matters to students by helping them to make connections to their own experience, and they try to use real world experiences in which students are encouraged to collaboratively weigh up different types of evidence. Thus, the students are engaged in higher order thinking rather than on reproducing knowledge. In contrast, he explains that teachers who have less sophisticated epistemological beliefs promote *weak approaches to constructivism*. They create learning environments that promote surface approaches to learning where students do not have the opportunity to demonstrate personal understanding. Windchitl (2002) acknowledges that teachers generally make an effort to use constructivist strategies but there are different degrees of commitment to constructivism depending on how sophisticated one's epistemological beliefs are.

Despite the fact that strong acts of constructivism and evaluativistic positions are associated with sophisticated epistemological beliefs and stronger academic achievement on the part of students, Tabak & Weinstock (2011) have found through their research, that the general level of sophistication of students' epistemological beliefs tends to rest on multiplistic positions. The main difference between the multiplistic position and an evaluativist position, as previously highlighted in Perry's

(1970) research, is the notion that with a multiplistic position there are many different truths and from an evaluativistic position knowledge claims are judged and some can be preferred over others.

Khishe & Abd-El-Khalick (2002) suggest that evalautivistic positions may be rare in students, despite increasing exposure to inquiry-based experiences, because of the ways in which inquiry-based learning is enacted. They have argued that mainly engaging in inquiry is not sufficient and they recommend explicit reflective instruction focused on epistemological ideas. However, Tabak & Weinstock (2011) suggest a different explanation for the shortfall in evaluativistic positions. They point out that inquiry-based instruction tends to focus on individual construction and, thereby, neglects the processes of comparison, and evaluation needed among competing accounts. They suggest that although constructivist-teaching approaches achieve movement away from absolutist positions to multiplistic positions, they may leave learners with a sense that all accounts are equally valid. Indeed, this is a mistake that I sometimes make with my own students. Tabak & Weinstock recommend that in order to cultivate evaluativist positions in students it is necessary to highlight the constructed nature of knowledge and to provide individual students with the possibility of articulating their own explanations, while also engaging in the critical comparison and judgement of the explanations.

3.6 Domain Specific Beliefs

An additional factor that is thought to impact the levels of sophistication of teachers and students' epistemological positions is the degree to which epistemological beliefs are considered domain specific or domain general, meaning that different beliefs may be attributed to different disciplines (domains) or they may be more general. In research carried out by Hofer (2000), for example, it was found that first year college students held different beliefs about the disciplines of science and psychology. In addition, Stodolsky, Salk, & Glasser (1991) found support for the existence of domain specific beliefs about knowledge in their research with fifth graders. By means of interviews they found that students held different views with regard to the learning of mathematics and social studies. Students expressed that knowledge in mathematics was more certain than in social studies and they felt that although they needed instruction in mathematics they thought they could learn social studies by themselves, if given the materials. Stewart (1987) suggests that students' responses may stem from the possibility that they see subjects such as math or science as involving definite solutions derived from algorithmic procedures whereas they may see history and literature as involving heuristic procedures that do not have clear outcomes.

Buehl & Alexander (2006) contend, however, that epistemological beliefs may not be so clear-cut. They suggest that an individual may hold domain specific epistemologies but they may also demonstrate beliefs of a relatively stable general epistemology. In their review of nineteen empirical studies investigating the domain generality versus domain specificity of epistemological beliefs Muis, Bendixon, & Haerle (2006) found that there is evidence for both sets of beliefs and they argue that there may be an interactive relationship between students' beliefs. Contrasting research, by Jehng, Johnson, & Anderson (1993) indicates that the general assumptions that students have with regard to knowledge influences their choices of college courses. For example, they find that students choosing the natural sciences and engineering are inclined to view knowledge as typically certain and they view learning as an orderly process regardless of the discipline. One of the concerns raised with research into domain specificity in personal epistemology is that researchers use the same items (e.g. those that assess the certainty of knowledge) across domains and hope to find differences in how the dimensions are applied. Yadav, Herron, & Samarapungavan (2011) suggest that in order to truly measure domain-specificity in personal epistemologies, researchers need to develop unique sets of items to measure dimensions that may not be shared across different domains and different contexts.

Even though it is currently unclear how domains may impact epistemological perspectives, there has been particular interest shown in the epistemological views of science teachers. For example, the importance of science teachers acknowledging their beliefs has been highlighted in studies involving surveys carried out by Hasweh (1996). The studies explore the relationships between the teachers' beliefs and their approaches to teaching and it was found that science teachers' epistemological beliefs about science are usually consistent with their teaching practices. The research found that teachers with a more empirical view of science were less likely to explore students' alternative understandings of concepts or problems compared with teachers who held more sophisticated epistemological views and constructivist teaching practices. The constructivists had a richer set of teaching strategies to draw upon and they were more likely to promote student conceptual change.

Ryan and Aikenhead (1992) advise an increase in teachers' awareness of the epistemology of science and several suggestions have been put forward with regard to how this might happen. One possibility is the explicit teaching of the history of science and the philosophy of science (Matthews 1994; Mathews 1997). It is thought that this would help to unearth teachers' and students' beliefs relating to the value of science, the characteristics of scientific knowledge, and the role of consensus making in scientific communities. Others advocate an approach whereby epistemological ideas are made transparent in contexts encountered by students during normal teaching (Driver, Asoko,

Leach, Mortimer, & Scott, 1994; Leach, Millar, Ryder, & Sere, 2000). In this way it is thought that epistemological perspectives can be better contextualised. The same goes for the assessment of the enacted beliefs of teachers.

Recent work by Guerra-Ramos, Ryder, and Leach (2010) indicates that when questions were research grounded in pedagogically relevant contexts, primary teachers showed more sophisticated and nuanced understanding of the nature of science than they typically display in response to questionnaires. Yadav *et al.* (2010) suggest more research of this nature that will help distinguish teachers' enacted personal epistemology from more general decontextualized beliefs, both domain-general and domain-specific. More recent research in this area has found that the ontological dimensions of epistemological beliefs are particularly useful for understanding pre-service teachers' personal epistemologies and their approaches to the teaching of science (Kang, 2008).

3.7 An Exploration of Ontological Beliefs

Where epistemological beliefs, as have been seen, are concerned with the nature and acquisition of knowledge, ontological beliefs are concerned with beliefs about the nature of reality and being (Guba and Lincoln, 2000; Merricks, 2007). Ryan (2006) suggests that it is from within our ontological being or worldview that we interpret the world and how we see our place in it. Our epistemology is dependent on our ontological worldview and it allows us to identify what we see as knowledge, and how this knowledge is generated to describe reality. Hyde (1995) wonders if we focus our attention more on epistemology than on ontology because our *way of being* is not always readily available to be interacted with. Yet, it is this way of being that is the context in which our knowledge is held. As Hyde explains, our ontology is who we are in the matter of what we can know.

Shadish, Cook, & Campbell (2002), on carrying out research into teachers' ontological beliefs, placed teachers' ontological beliefs on a realist to relativist continuum. A realist, they assert, believes that entities or phenomena exist and can be understood and explained, at least to some degree, even if experts do not currently understand the phenomena (e.g., dark matter). In contrast, they assume that a relativist believes that entities may exist in an ever-changing manner (e.g., the idea of human rights) or that we can never know with certainty whether something exists (e.g., the existence of God). From an educational perspective, Shadish *et al.* (2002) have found that a teacher with a realist world-view would be more likely to endorse a belief that knowledge can be transmitted to a student, whereas a relativist would be more likely to express a constructivist perspective that each student constructs knowledge that is relevant to him or her with the help of the teacher (Brownlee & Berthelsen, 2006; Chan and Elliot, 2004).

Their research is similar to that of Schraw & Olafson (2008) who developed a strategy that simultaneously addresses epistemological and ontological beliefs. They created a scaled two-dimensional quadrant requiring research participants to place themselves in one of four quadrants formed by two axes representing the ontological and epistemological dimensions underlying their beliefs. The axes form a continuum with realist positions on one end and relativist positions on the other. A pilot study carried out by Schraw and Olafson (2008) suggests that the four quadrant scales provide a viable measure of teachers' beliefs and they assert that the system's most important advantage is that it enables one to distinguish clearly between teachers' epistemological and ontological perspectives on the same metric scale. They indicate that teachers who score higher on the epistemological and ontological dimensions tend to support constructivist pedagogy, and employ a more diverse curriculum than teachers than those who score low on the two dimensions.

Although I appreciate Schraw & Olafson's (2008) efforts to isolate epistemological and ontological beliefs I find the instrument too obvious to use in an environment where it can be estimated that experienced MYP teachers will already have constructively oriented teaching approaches as well as reasonably developed epistemological beliefs. Also, the way in which ontological beliefs are described by Schraw & Olafson appears to miss the point with regard to the broader meaning of ontology. I find it curious that they have ignored the concept of *being* especially as I found the nature of being to be an integral component of my personal interpretation of reality during the modular assignment that originally prompted an interest in ontological perspectives. Concern over the limitations of the instruments used to record ontological beliefs in educational research is what encouraged me to extend my focus beyond existing epistemological and ontological belief models during the research study.

3.8 Social Constructionism and Epistemological and Ontological Beliefs

The need for an alternative framework to record data was amplified further following an interest on the part of the research participants on the nature of learning in groups. More will be said about this later in the study, but for now it is important to note that much of the research relating to ontological and epistemological beliefs rests on the assumption that learners learn as individuals. This is not surprising given that much of the research into epistemological and ontological beliefs is based on Piaget's views on the construction of knowledge. However, as Ismat Abdal-Haqq (1998) critiques, Piaget makes little reference to the role that interpersonal dynamics and collectives play in learning. By contrast, Lev Vygotsky, a contemporary of Piaget, views cognitive development more as a product of social interaction than of individual construction. Vygotsky (1978) is renowned for

having said that "every function in the child's development appears twice: first on the social level and later, on the individual level" (p. 89). Vygotsky's view of cognition came to be known as social constructionism and it is a theory that suggests that reality is a social construct.

Vygotsky's ideas on the construction of knowledge had a lot to do with how he perceived the role of human consciousness in learning. According to Davis (2004) Vygotsky views human consciousness not purely as an individual phenomenon but as "a reflection of collective human phenomena" (p. 137). So understood, he sees the relationship between teacher and learner (or between learners) as a sort of *mind -sharing* where knowledge emerges *between* individuals. Jaworski (1994) describes knowledge that emerges in this way as "common" or "intersubjective knowledge" (p. 24-25) but clarifies that intersubjective knowledge is not shared by individuals: it only seems *as if* there is common knowledge or shared understandings (p. 25).

The shared knowledge that is constructed depends on the conceptual frameworks and categories used by the people in a given culture. Burr (2003) highlights that our shared conceptual frameworks are acquired as we develop the use of language and they are, thus, reproduced everyday by everyone who shares a particular culture and language. Knowledge, from this perspective, is not seen as something that a person has but as something that people do together in a participatory manner. Burr adds that the essential difference between Piagetian constructivism and Vygotsky's social constructionism is the extent to which the individual is seen as an agent who is in control of their construction process, and the extent to which our constructions are the product of social forces, including the specific cultural and historical lens through which we engage with the world.

According to Myers (1996) the focus of social constructionists is as much on how collectives construct the world as on how the world constructs the collectives. For this reason they believe that the context of social reality needs to be deconstructed in order that the cultural assumptions, power relationships and historical influences are exposed, critiqued, and, when necessary, altered. Gordon (1972) suggests that teaching from this critical perspective involves *making the familiar strange* so that it can be changed. These thoughts are echoed in the writings of Paulo Freire (1971) who perceives education as a process that has the power to emancipate and liberate. As Gordon (2009) comments, the work of Vygotsy, Freire, and others, helps teachers to become critically aware of important educational problems so that they might become positive change agents (p. 53). In this way social constructionism becomes the basis for the transformation of intersubjectively constructed social realities.

Teaching practices that are informed by social constructionism include dialogic education. Guilar (2006) suggests that an educational community is intersubjective and dialogic when all parties relate to each other as having a sense of agency and a unique perspective. In such a community there is not a knowing subject (teacher), and a known object (student or content of instruction). Rather all three elements – the teacher, the subject, and the content - relate in an inter-subjective, interpretive community where meaning is established between people through conversation. Johnson, Woodside-Jiron, & Day (2001) claim that effective use of dialogue is associated with sophisticated epistemological beliefs on the part of teachers. They found that dialogue in the classroom of teachers with naïve epistemological beliefs was less complex than the dialogue in classrooms of teachers with more sophisticated beliefs. Nevertheless, a concern is raised by Aspellin (2011) with regard to the impact of intersubjective approaches in education. She cautions that an overemphasis on intersubjectivity may lead to an overshadowing of the inter-objective dimension of knowledge construction.

3.9 Inter-objectivity and Relational Pedagogy

A focus on inter-objective aspects of learning stems from philosophical shifts within the physical sciences which lead to a view of reality as relational. During the 1920s, following experiments involving sub-atomic particles, it was found that physical reality seemed to be constituted not of separate substances or separate particles but of relationships. In the words of Henry Stapp (1979) "an elementary particle is no longer seen as an independently existing, un-analysable entity. In essence it is "a set of relationships that reach outward to other things" (p. 94). A series of experiments demonstrated not only the inter-related nature of physical reality at the quantum level but also indicated that the outcomes of experiments could be impacted upon by the instruments used and the presence of an observer. This has led to the view within the physical sciences that "what we observe is not nature itself, but nature exposed to our method of questioning" (Heisenberg, 1958, p. 58).

Davis & Sumara (2003) suggest that from this standpoint knowledge can no longer be seen simply as a matter of intersubjective agreement but of the mutually affective relationship between phenomena and knowledge of phenomena. The term that is increasingly being used to refer to this intricate relationship is interobjectivity and it engages us with an emergent view of reality as relational. Interestingly, the basic assumption of this relational ontology is that the relationships *between* entities are seen to be ontologically more fundamental than the entities themselves (Wildman, 2006). Naturally, this idea contrasts provocatively with the mainstream substantivist

ontology in which entities are seen as ontologically primary and relations are thought to be ontologically derivative. This shift towards a view of social and physical realities as relational has pre-empted a shift within education towards a form of relational pedagogy incorporating elements of intersubjectivity *and* interobjectivity.

Several definitions of relational pedagogy have emerged in recent decades. For example, similarly to Wildman (2006), Emirbayer (1997) describes relational pedagogy as a social ontology that sees the social world as constituted of relations rather than substances. Aspellin (2011) describes relational pedagogy as a theoretical discourse based on the idea that relationships are the basic unit of education and Baxter-Magolda (1993) and Belenky *et al.* (1986) describe relational pedagogy as the collective drawing together and connection of personal knowledge, theoretical knowledge, and knowledge of relevant contexts. Although there are a variety of definitions emerging to describe relational pedagogy, the common thread appears to be that the approach emphasises a connected way of knowing.

Explorations of relational pedagogy within teacher education contexts by Brownlee & Bertelsen (2006) and Brownlee (2004) find that relational pedagogy fosters more sophisticated epistemological beliefs amongst pre-service teachers particularly when the cognitive and affective aspects of learning are seen as inseparable to knowledge construction, when learning is situated in students' experiences, and when there is mutual respect between student teachers and facilitators. Brownlee & Bertelsen (2006) maintain that the use of relational pedagogy encourages student teachers to examine personal beliefs and experiences against evidence and theory that may validate existing ideas or require reconstruction of existing beliefs in a supportive learning environment. Student teachers are encouraged to become what Baxter-Magolda (1996) describes as "contextual knowers".

3.10 Complexity Science and Collective Constructivism

Despite efforts to move towards relational pedagogy within educational contexts, concern has been raised with the degree to which education focuses predominately on the learning outcome of individuals whereas an interest in the learning potential of groups has become relevant in recent years. An interest in groups stems from strands of inquiry including cybernetics, systems theory and non-linear dynamics. These areas of study are oriented by interobjectivitist views and are collectively called the complexity sciences. According to Davis & Sumara (2003) complexity science is interested in unities that live and learn – and those unities include not just humans, but various collectives

(student bodies, bodies of knowledge), sub personal phenomena (immune system, brain regions), and super cultural forms (species, the biosphere).

Essentially, complexity science is the study of complex adaptive systems. A defining characteristic of a complex adaptive system is emergence or self-organization. For reasons that are not fully understood, under certain circumstances individuals (agents) can spontaneously cohere into functional collectives and these collectives have integrities and potentialities that are not represented by individual agents (Newell, 2010). Sullivan (2010) suggests "referring to emergence could be a way of understanding how learning happens in classroom groups" (p. 27). Sullivan investigates learning with secondary school students, and his research indicates that emergent learning is a phenomenon that happens in classrooms to different degrees when the group are allowed to behave as a complex adaptive system. The degree of learning, Sullivan reports, depends on the amount of agency afforded to students, the amount of networking enabled, and the degree to which the curriculum is bounded.

From a complexity science perspective, reality, knowledge and learning are seen as increasingly emergent, complex and multi-layered phenomena. This view allows for the possibility that "groups of students and teachers co-create new knowledge together" (Sullivan, 2010, p. 27). This is different from the social learning theories advocated by Vygotsky where the focus is on how the group or external forces help the individual to learn beyond their individual learning potential. It differs in the sense that its focus is on the potential of the group as a collective to self-organize and co-create new knowledge *from within*. Although an interesting theory, the concern with complexity science approaches in education is that these approaches do not fit with mainstream conceptualizations of learning. In addition, Newell (2010) highlights the point that although complexity science offers language and concepts to match the sensibilities and intuitions of practicing teachers, a beginner teacher may have difficulty with such an approach due to its perceived lack of structure.

3.11 Consideration of Data Collection

Given that relational pedagogy and complexity science related concepts and practices are in a developing phase, their underlying impact on educational practices seems to lie beyond the boundaries of much of the current research available relating to teachers' epistemological and ontological beliefs. For this reason, and given the inquiry-based nature of the research context, I decided that the questionnaires and quadrants usually employed to assess teachers' epistemological and ontological beliefs and their approaches to teaching were limiting. Besides, researchers have criticised the use of standardized multiple-choice instruments to study personal epistemology

because they do not provide an understanding of the complexity of personal epistemologies (Wood, Kitchener, & Jensen, 2002). As Guerra-Ramos, Ryder, and Leach (2010) maintain, teachers demonstrate a more sophisticated understanding of their beliefs when research is grounded in pedagogically relevant contexts compared with the responses that they give through questionnaires. It was for this reason that I chose to move forward with a more collaborative, open-ended and interpretive approach to the research study: an approach that was connected to the pedagogically relevant contexts of the respondents' classrooms. It was hoped that the use of observations and open-ended interviews would offer more of a complex description of the respondents' beliefs about the nature of reality, knowledge and knowing.

Choosing not to use the questionnaires and surveys typically used in research into ontological and epistemological beliefs and related teaching practices left a need to consider an alternative means of organizing the qualitative data that would be gathered. The model that I chose is briefly introduced here as a contrast to the previously highlighted models. At this stage it is important to note, however, that the selection of the model occurred following the collection of data. Unlike the questionnaires generally employed to explore ontological and epistemological beliefs, the model served to organize the data and not to determine what data was to be collected in the first place.

The model was originally developed by Banks, Leach, & Moon (1999) in order to bring together the different components of teachers' professional knowledge, and it draws on a number of perspectives in presenting a view of teacher knowledge and beliefs as dynamic and interactive. The original model is in the form of a Venn diagram and it highlights as significant: pedagogical knowledge, subject knowledge, school knowledge and personal constructs. Figure 3.1, the modified model that appears here, is an adaptation of Leach & Moon's (2000) later version of the model. This is the framework that I used to organize the data collected during the research study.

In the modified version of the diagram, pedagogical knowledge refers to approaches to teaching and learning. Subject knowledge refers to an understanding of knowledge and ways of knowing particular to one's disciplinary area. Knowledge of school context refers to knowledge of the MYP and ISA, and personal construct is identified as a complex amalgam of teachers' past knowledge, experiences and beliefs. The personal construct section of the diagram refers specifically to teachers' ontological assumptions, as well as their personal backgrounds, and their view of the nature of learning and learners. These labels refer to the organizing themes that emerged as significant during the data collection and analysis stages of the research study.

Figure 3.1: An adaptation of the Leach and Moon (2000) Teacher's Knowledge Model
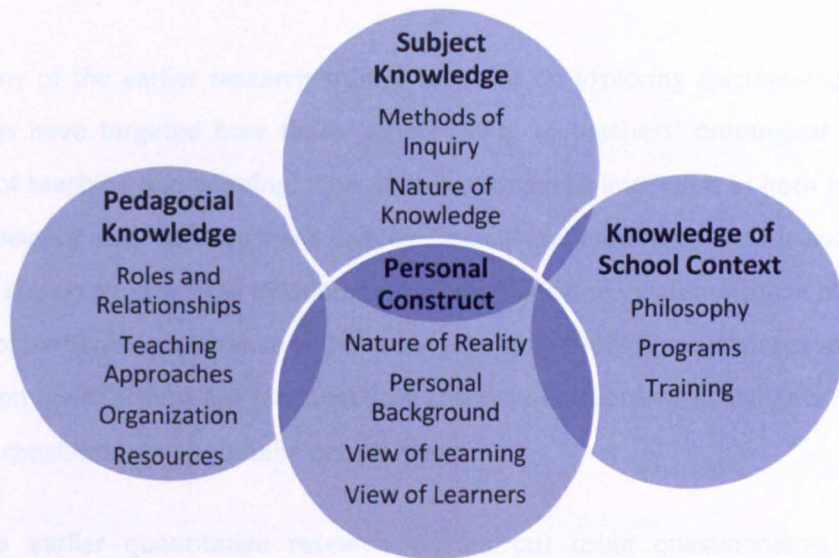
The term personal construct, which appears at the centre of the diagram, was originally proposed by George Kelly in the 1950s and it reflects the idea that an individual is always trying to grasp hold of the nature of reality but since reality does not reveal itself to us directly, each person constructs his or her independent version of it. By putting the personal construct category at the centre of the model Banks and Moon (2000) suggest that teachers' professional knowledge is influenced by a teacher's personal beliefs regarding the nature of reality. This positioning of teachers' ontological beliefs also reflects Kang's (2008) and Hyde's (1995) views that an understanding of ontological views helps teachers better comprehend their epistemological perspectives and their approaches to teaching. The placement of teachers' personal constructs at the centre of the framework fit well with my ideas on what was needed to organize the data.

3.12 Summary of the Literature Review

Over the past decades an interest in teachers' ontological and epistemological beliefs has yielded a variety of research studies in this area. Many of the research models that exist today to explore epistemological views have their roots in Piaget's views with regard to cognitive development, and to varying degrees they seem to rely on his work on stage development theory, i.e. the idea that learners cognitive structures develop in stages as they learn. The earlier models and approaches include The Perry Scheme (Perry, 1970), The Epistemological Reflection Model (Baxter-Magolda, 1992), Women's Ways of Knowing (Belenky *et al*. 1986), the Reflective Judgement Model (King &

Kitchener, 1994), Schommer's Epistemological Beliefs Questionnaire (Schommer, 1990) and The Argumentative Reasoning Model (Kuhn & Weinstock, 2002).

Although many of the earlier research studies focussed on exploring epistemological beliefs more recent studies have targeted how these beliefs relate to teachers' ontological beliefs and their conceptions of teaching and learning. This shift is considered important in both teacher education and teacher development as a teacher's epistemological and ontological beliefs and their associated practices are known to effect the development of sophisticated epistemological beliefs in students. This point is of particular importance within an inquiry-based IBMYP educational context that places an emphasis on constructivist teaching practices and the development of higher order thinking skills, including the consideration of multiple perspectives.

Much of the earlier quantitative research carried out using questionnaires and check lists demonstrates that teachers and students hold a range of epistemological beliefs ranging from absolutist to relativistic beliefs. Teachers with more relativistic and evaluativistic epistemological beliefs tend to craft constructively oriented classrooms that incorporate dialogue, conceptual change, thinking strategies and process oriented approaches. They also tend to focus on the contextualization of knowledge and they may integrate theory of knowledge related concepts into their lessons. On the other hand, teachers with less developed epistemological beliefs use teaching approaches that are more teacher-centred, didactic, and content driven and they provide fewer opportunities for students to develop higher order thinking skills and to consider multiple perspectives. Degrees of sophistication in teachers' beliefs lead to what researchers describe as *weak* or *strong* approaches to constructivism.

Different approaches to constructivism are compounded by the fact that emerging interpretations of constructivist teaching and learning extend beyond a focus on the subjective nature of cognitive constructivism and the intersubjective quality of social constructionism. Reflecting interpretations of the relational view of reality from within the physical sciences, it is suggested by theorists that reality is relational, with relationships being considered to be of greater ontological importance than individuals or objects. The relationship between the knower and the known is considered mutually affective. The concept and practice of relational pedagogy has emerged to accommodate the interobjective view of integration of knower, knowing, knowledge and the context. Research carried out involving relational pedagogy with pre-service teachers has demonstrated that a relational approach to teacher education is yielding more sophisticated epistemological beliefs on the part of teachers.

Another interobjectivity oriented discourse that has emerged within educational spheres is that of complexity science and emergence theory. This approach to the construction of knowledge focuses on the learning quality of collectives and it assumes a view of ontology, epistemology and learning that is complex, and emergent. Although still in the early stages of development within educational contexts, complexity theory has raised interesting questions about the learning potential of groups and it suggests a view of the teacher and the group as co-constructors of knowledge. Table 3.2 provides a summary of the main ideas and research threads from the literature review and indicates how the different blends and shades of constructivism are aligned with different ontological and epistemological beliefs as well as different approaches to learning and teaching. Building on the concepts that were introduced in *Table 3.1,* this table includes a listing of some of the main researchers and theorists referred to throughout the literature review, indicating the shades of constructivism that their research and theories seem best aligned with.

Given the variety of interpretations of what it means to construct knowledge and to teach constructively, it becomes clear that the use of questionnaires grounded for the most part in Piaget's theories of cognitive constructivism seem limiting when it comes to an exploration of epistemological and ontological perspectives within a co-operative inquiry-based environment. For this reason, and also due to the limited references to ontological beliefs in current research, I chose to carry out an interpretive study involving observations and open-ended interviews to explore the beliefs and practices of the research participants. Choosing not to use questionnaires meant that I needed to choose an alternative framework to guide the organization of the data. The framework settled on takes the shape of a Venn diagram that incorporates teachers' personal constructs, including their ontological and epistemological beliefs as well as their approaches to teaching and learning and their knowledge of the research context.

Table 3.2: An overview of the relationships between constructivism, ontology, epistemology and approaches to learning and teaching

Constructivist Related Term	Ontology	Epistemology	Learning	Teaching	Research Related Terms	Theorists and Researchers Referred to
Construction of Mentalisms (Exact Representations)	Reality is "out there" *Objective*	Knowledge is a match with the external world	Learn by internalization – memorisation prescribed curricula	Dispenser of knowledge Autocratic	Positivist Absolutist Dualistic	Perry (1970) King & Kitchener (2002) Schraw & Olafson (2008) Chan & Elliot (2004)
Cognitive Constructivism /Radical Constructivism	Reality is inside the individual *Subjective*	All knowledge is constructed by the individual -	Learn by building mental models Cognitive dissonance Discovery learning	Facilitator Guide Causes cognitive dissonance	Relativism Commitment to relativism	Schommer (1990) Kuhn & Weinstock ((2002) Khine (2008) Kang (2008)
Social Constructionism	Reality exists between individuals *Intersubjective*	Knowledge as common understandings	Learn through dialogue and conversation Co-operative	Facilitator Guide	Interpretive Collaboration Evaluativistic	Vygotsky (1978) Hofer & Pintrich (2001) Magolda Baxter (2001) Belenky et al(1986)
Critical Constructivism	Reality exists between individuals *Intersubjective*	Knowledge as a form of enculturation	Learning involves the deconstruction of "hidden" conceptual frameworks	Teacher as Provocateur Dialogic	Emancipation Dialogic Education Discourse Analysis	Vygotsky (1978) Freire (1974)
Pragmatic Constructivism	The nature of reality is considered *irrelevant*	Knowledge is knowledge when it is practical	By integrating thinking and doing Mental models not always necessary	Teacher as mentor and student as apprentice	Teaching for Understanding Experiential Learning	Dewey(1966) Perkins (1999)
Relational Constructivism	Reality inheres in the relationships between phenomena and knowledge of phenomena	Knowledge is relational	Learning by connecting knowers, teachers, knowledge, and contexts.	Relational Pedagogy Teacher as co-constructor Teacher as learner	Connected ways of knowing Contextual knowers	Brownlee (2004) Brownlee & Bertelsen (2006) Magolda Baxter (2001) Belenky at al (1986) Fritjof Capra ((1996)
Collective Constructivism	Reality is emergent It is in a constant state of becoming *Interobjective*	Knowledge is co-created from within the collective	Emergent learning through self-organization	Complexivist Occasioning Teacher as participant and co-constructor	Complex adaptive system – improvisation, Self organization Emergence	Sullivan (2010) Newell (2010) Davis (2004) Sumara (2003)

CHAPTER 4

RESEARCH METHODOLOGY

4.1 A Constructivist-Interpretive Approach

Following a consideration of personal life experiences, insights gained from the fourth modular assignment, and the contemplation of reading relating to the research topic, the time came to evaluate the most appropriate methodology for the project. Guba and Lincoln (1989) describe methodology, as "the overall strategy for resolving the set of choices or options available to the inquirer during the research process" (p. 183). They consider it to be more than a matter of making a selection among methods, but that methodology involves a consideration of the researcher on every level "from unconscious worldview to the enactment of that worldview via the inquiry process" (p. 183). This being the case, it might be the best to recap on the conscious aspects of my worldview with a particular emphasis on personal ontological and epistemological positions.

As Lincoln and Guba (1985) suggest, I believe that we literally "create a reality that reflects our views of the world and who we are in relation to it" (p.39). These versions of reality are constructed as we attempt to make sense of natural phenomena and our life experiences, but at the same time aspects of these personal realities seem to merge with those of others. Within a research context, then, I acknowledge that I bring my constructed realities to the table in the same way that the research participants bring theirs and I remain aware that there exist points where our ontological and epistemological assumptions may either align or diverge.

In addition, during the research, it has been impossible to separate myself from the outcome, as it is the relationship and interaction with the research participants and the research context that creates the data. It is almost as if deciding to take a constructivist-interpretive position eliminates an ontology-epistemology distinction entirely. The answers that emerge from the process are embedded in the conversations that are held. The process of inquiry involves, therefore, less of a hunt for the reality of the research situation, and more of the process of development, verification and communication of the shared constructions held by those involved in the study and the context of the research.

The theory of truth that conforms to this particular ontological-epistemological position is the consensus theory advocated by Lincoln and Guba (1985, p. 84). According to the consensus theory it

is possible to make at least some assumptions with regard to what happens in a research context due to the fact that a number of the constructions humans make, can and usually are, shared between individuals. However, as Guba and Lincoln (1989) caution, that would not necessarily make them real, but simply "more commonly assented to" (p.86).

The methodology is one that enables exposure of the initial constructions of the research participants and revises these constructions over time through follow-up observations and conversations. This approach is generally described as a hermeneutic methodology. Guba and Lincoln (1989) highlight that the ultimate pragmatic criterion for a hermeneutic methodology is that it leads to "a successively better understanding of the interactions in which one is usually engaged with others" (p.88). In order to carry out such an inquiry it is necessary to institute a process that iterates the variety of constructions that exist. These constructions need to be analysed to make their elements communicable to others, and they need to be reiterated in light of new information. This process continues as a researcher gets as close to consensus as possible within the confines of the project.

4. 2 Axioms of the Constructivist-Interpretive Research Paradigm

In considering how the constructivist-interpretive research paradigm compares with an approach ground in positivism, the following table indicates a comparison of the axioms that underpin the two approaches. Lincoln and Guba (1985) describe axioms as "the set of basic beliefs" accepted by convention or established by practice as "the building blocks of some conceptual or theoretical structure or system" (p. 37). The paradigms differ in how realities are perceived, with the constructivist-interpretive paradigm viewing reality in a more holistic and less separable manner than the positivist paradigm. Similarly, the relationship between the knower and the known is viewed in more of a relational manner within the constructivist-interpretive paradigm, but in a more dualistic way through a positivist lens.

Table 4.1: Comparison of Research Axioms (adapted from Guba and Lincoln (1989))

Axioms	Positivist Paradigm	Constructivist /Interpretive Paradigm
The Nature of Reality	Reality is single, tangible and fragmented	Realities are multiple, constructed, and holistic.
Relationship of Knower to Known	Knower and known are independent, dualistic	Knower and Known are interactive, inseparable.
Possibility of Generalization	Research is time and context free. Generalizations possible	Time and context bound working hypotheses are possible
The Possibility of Causal Linkages	There are real causes, temporally precedent to or simultaneous with events	All entities are in a state of mutual simultaneous shaping, so that it is impossible to distinguish causes from effects
The role of values	Inquiry is value-free	Inquiry is value-bound.

In doing research in the style of the constructivist-interpretive paradigm, although the five axioms listed above serve as a guide, they fall short for this approach to research. Lincoln and Guba (1985) suggest an array of additional characteristics that form a sort of research synergism to the degree that "when one of them is selected the others more or less follow" (p. 39). Although they suggest that the elements of the synergism are applicable to naturalistic research, it is worth mentioning that the term naturalistic inquiry resonates strongly with the idea of constructivist-interpretive inquiry.

The elements of the constructivist-interpretive (naturalistic) research synergism advocated by Lincoln and Guba (1985) include the need for a natural research setting, the purposive sampling of respondents, an emergent design approach, the interplay of data collection and analysis, negotiated outcomes and the writing of a case report.

4.2.1 Emergent Design

Whereas a positivist researcher begins an inquiry knowing (in principle) what they don't know, Guba and Lincoln (1989) suggest that from a constructivist's perspective, "one starts a research project not knowing what it is that one does not know" (p. 175). Keeping this in mind, what I stood to learn through the process was dependent on the interaction between myself, the respondents and the context, and that this interaction was not predictable. The design of the research, therefore, needed

to be "played by ear" as it emerged; having faith that the process would unfold in a way that made sense. And indeed, in true constructivist fashion, the design emerged as the research became more focused and as insights grew. It was, eventually, only possible to describe the research process by tracing its evolution after its completion.

4.2.2 Purposive Sampling

When choosing respondents within a constructivist study the term purposive sampling can be used. This means that when choosing the respondents, one looks for the broadest scope of information possible within the confines of the research project. Random or representative sampling would not have been useful as these modes of sampling are usually designed to maximise generalization whereas the aim here is to maximise the range of information. This method of choosing respondents increases the array of realities that can be uncovered. As Lincoln and Guba (1985) maintain, the object of this type of sampling is not to focus on the similarities that can be developed into generalizations but "to detail the many specifics that give the context its unique flavour" (p. 201). I believed that purposive sampling would help me to take adequate account of the local context and that it would encourage me to consider my choice of respondents carefully.

Hoping to engage with teachers' perspectives on the nature of reality and knowledge I choose three respondents from different disciplines who I thought might bring different perspectives and beliefs to the table. At the time that the research study began, all three were relatively unfamiliar to me. John Charters, a New Zealander, new to the school at the time, is a teacher of science with a special interest in Physics. The second respondent, Corinna Hasbach is a German/Canadian/American teacher of English literature. The third respondent Anna Lopez-Dekker, is a Dutch-Spanish teacher of Spanish who I knew to have an interest in philosophy. Their actual names are used in this document, as they consented to being identified through the research study.

4.2.3 Natural Setting

I chose to engage with the respondents in their natural work environments. For example, I observed and videotaped Anna during her Spanish lessons, John during his science lessons, and Corinna during her English literature classes. In this sense, I developed an understanding of not just what the teachers believed but also an awareness of how they engaged with their students, how they reacted in a variety of learning situations, and how they organized the different learning environments. The reason for doing so is highlighted by Lincoln and Guba (1985) who maintain that "reality

constructions are wholes that cannot be understood in isolation from the world in which they are experienced nor can they be fragmented for separate study of the parts" (p. 189).

4.2.4 Human as Instrument

A contextualized inquiry of this kind can only be carried out successfully by, what Lincoln and Guba (1985) describe as, a human instrument, and one that is familiar with the context and adaptive to the uncertain situations that might arise. They suggest that "only the human instrument has the characteristics necessary to cope with a situation of this kind" (p. 193). They identify several characteristics that uniquely qualify a human for this form of research. They argue that only a human can sense and respond to the personal and environmental cues that exist in a natural setting. By virtue of this responsiveness they add that humans can sense the dimensions of these cues and make them explicit.

4.2.5 Interplay of Data Collection and Analysis

A constructivist-interpretive research approach enables the processing of data as it becomes available. It also makes it possible to ask for clarification of the data and to deal with the kinds of atypical responses that can sometimes go un-noticed when using more quantitative approaches to data collection. I found that whilst collecting the data there was a continuous interplay between the data collection and analysis stages.

4.2.6 Grounded Constructions and Negotiated Outcomes

Inevitably, the findings that emerge through a constructivist approach are grounded in the constructions of the respondents themselves. In this study as the data collection and analysis proceeded, joint constructions were formed, and as the research proceeded it was noticeable that the later constructions differed considerably from the original ones. By the time the final teacher profiles emerged, they had been negotiated upon several times.

4.2.7 The Case Report

The choice of reporting format for the research study is a case study report. Erlandson, Harris, Skipper, & Allen (1993) believe that the primary object of writing a case study report is to write in such a way that "the research product is credible to the respondents in the context" (p. 165). A case study report is an ideal way of providing a "thick description" of the research context in order to reveal personal values and background, to describe the research context, and to communicate the

different realities present. Lincoln and Guba (1985) describe a case study report as a "portrayal" of a situation that "may read like a novel in order to make clear the complexities of the context and the ways these interact to form whatever it is that the case study portrays" (p. 214). This is, indeed, what it feels like to write a case study report. I tried to keep in mind that the report needed to orient readers in such a way that if they were transported to the inquiry site, they would experience a feeling of *déjà vu*.

4.3 Research Methods: Observations and Interviews

With a relatively clear overview of the theoretical and practical implications of a constructivist-interpretive approach, consideration of how to start collecting the data was necessary. According to Erlandson *et al.* (1993) the primary purpose of gathering data is "to gain the ability to construct reality in ways that are consistent and compatible with the constructions of a setting's inhabitants" (p. 81). This required experiencing the everyday teaching reality of the teachers and gather data from a variety of sources that represented this reality. As Erlandson *et al.* suggest, the best way of gathering this kind of data is by using natural attributes: the five senses, intuition, thoughts and feelings. Bassey (1999) indicates that the main methods that complement this approach are the asking of questions, listening carefully to the answers, observing events, noting what appears to be happening in observational settings, and reading related documents.

Given the nature of the study, the methods chosen were observations, open-ended informal interviews and semi-structured interviews. Marshall and Rossman (1989) describe observations as the "systematic description of event, behaviours and artefacts in the social setting chosen for study" (p.94). The observations were videotaped for subsequent review. Interviews after the observations helped to dig beneath the data in order to flesh out the constructed realities of the respondents. Dexter (1970) describes interviews as conversations with a purpose and I theorized that purposeful conversations would provide leads for the observations and that the observations would in turn suggest probes for the interviews. The interviews would help to revisit sections of the transcripts together with the respondents in order to cross-check, in a trustworthy manner, that the ideas that emerged were shared understandings.

4.4 Rigour in this Study

As the study is approached from within the constructivist inquiry paradigm, rigour is addressed according to the constructivist quality criteria of *trustworthiness*. Lincoln and Guba (1985) and Erlandson *et al.* (1993) propose that the conventional criteria for trustworthiness – internal validity,

external validity, reliability and objectivity need to be replaced with credibility, transferability, dependability and confirmability respectively (Lincoln and Guba, 1985, p. 219). These techniques, with examples of how they are used in the study, are presented in Table 4.2.

Table 4.2 Constructivist-Interpretive Techniques to Establish Trustworthiness

Conventional Term	Constructivist Term	Constructivist-Interpretive Techniques
Internal Validity	Credibility	Prolonged Engagement Triangulation Member Checks Reflexive journal
External Validity	Transferability	Thick Description Purposive Sampling Reflexive Journal
Reliability	Dependability	Dependability Audit Reflexive Journal
Objectivity	Confirmability	Confirmability Audit Reflexive Journal

(Adapted from Erlandson *et al.*, 1993, p. 133)

In order to ensure the credibility of the research study the respondents were engaged for an extended period of time within their natural work environments. However, given the difficulties involved with combining my free teaching periods and their teaching schedules, classroom setting time was less than desired. An effort was therefore made to compensate for any shortfall in classroom time by videotaping the lessons and spending additional time on conversations, semi-structured interviews and follow-up reflection sessions.

To further ensure credibility, teachers were encouraged to participate fully in the conversations and reflection sessions and they were also given the opportunity to review, discuss and suggest changes to the profiles that were eventually generated. Lincoln and Guba (1985) declare "such negotiation is essential if the criteria of trustworthiness are to be adequately met" (p. 213). However, had there been more time available during the data collection stage of the project, supplementary information from students in the observed classes would have been solicited. This would have been a beneficial means of substantiating or questioning points raised by the teachers.

With regard to complying with the criteria of transferability, an effort was made to provide a case study report that provides a detailed description of the context of the research. The report indicates the unique qualities of the environment including the specific values that it upholds as well as an account of the programs that are taught. In addition, in order to maximise the range of information gathered, and thereby the range of realities present among those teaching in this environment, purposive sampling was used to choose the respondents so that teachers from different cultural groups and disciplinary areas were chosen as study participants.

To ensure the criteria of dependability and confirmability, meticulous records of all documentation related to the study were kept and provided, along with an account of the processes of the inquiry to my supervisors. This involved providing transcripts from the observations and the interviews, as well as comprehensive analysis grids and early drafts of the respondent profiles to supervisors on a regular basis. A reflexive journal was also kept to document the research process and to keep a running account of insights and transition points that informed the direction of the study.

4.5 Ethical Considerations

Prior to the initiation of the research study, and in accordance with the British Educational Research Association's revised ethical guidelines for educational research (BERA, 2004), I sought written permission from the Director of School to carry out the research study at ISA. He was supplied with a copy of the research proposal and a letter containing information on the study as well as information on the potential impact on staff members who chose to participate in the study.

The three respondents, who were invited to take part in the research study, Anna, Corinna, and John, were each given the opportunity to discuss the nature of the project and their potential involvement prior to signing a letter of informed consent. Appendix G contains a copy of the consent form. Following conversations with the respondents it was decided that the research would be carried out at mutually convenient times in such a way as to minimize disruption to their teaching schedules. The respondents choose the lessons that could be observed and we negotiated the times when we could meet for conversations and interviews.

The respondents were given the option of having pseudonyms used in the final teacher profiles, which were generated through the study, but they wished to have their real names used instead. However, it was decided that if any details of the project were ever to be published or disseminated then pseudonyms would automatically be used in order to protect their identify.

CHAPTER 5

DATA COLLECTION AND INITIAL ANALYSIS

5.1 Conducting the Observations

Barbara Jaworski's (1994) accounts of her research experiences were useful as a guide to getting started with the data collection stage. It was reassuring that she had also been uncertain with regard to how to proceed at this point in her own research. I decided to observe three full lessons with each of the respondents and to follow these with conversations and open-ended interviews as the need arose. The recording of field notes to complement the videotaping of each lesson was also used.

Being a full-time teacher I needed to work around both my free periods and the lessons of the respondents. This meant that the observations were carried out over a two-month period. With John and Corinna the observations involved individual classes, whereas with Anna there was a need to observe several different classes as our teaching schedules overlapped. Her classes were shorter than John and Corinna's and involved a variety of students, as opposed to just one grade level. The following table gives a brief overview of the lessons observed and the themes being explored during the lessons.

Table 6.1: Overview of Lessons Observed

Respondent	Discipline	Topics	Lessons Observed	Interviews (approx)	Grade Level
John	Science	The Carbon Cycle Modeling Combustion Reactions Planning a Practical Investigation	3 x1.5hrs	3 hours	Grade 8
Corinna	English Literature	The Meaning of Life – Reflection Mary Shelly's *Frankenstein* This I Believe – Personal Essays	3x1.5hrs	3 hours	Grade 9
Anna	Spanish Language	Multimedia Campaign – Based on Philosophical Themes Significance of Myths & Stories Individuals' Impact on World Problems and Issues	3x45mins	3 hours	Grades 7 to Grade 9

5.2 Use of the Thinking Routines to Collect Data

To help collect data during the observations I used thinking routines. Thinking routines are strategies that I practice with my students when working on activities where they need to think deeply about what we are working on. For example, when deconstructing an image or situation we might use a See-Think-Wonder routine. This routine helps students to account for all that they see in an image before they start to pass judgment and think about what it might mean. In effect, it slows the thinking process down to help understand the complex nature of events before rushing to premature descriptions or conclusions. A variety of routines have been developed by Harvard University's Project Zero research. They can be used to consider different viewpoints, to describe something closely, to capture the heart of ideas, and to uncover the complexity inherent in an event or situation. There are also routines that encourage wondering.

The routines are used so that my thinking can be made visible to myself and to the respondents throughout the data collection and processing stages. Using the See-Hear-Feel-Think-Wonder in order to be aware of my thoughts and sensations as they emerge helps to catch assumptions and curiosities as they surface. The questions that appear in the wonder section of the routine guide the initial and follow-up conversations and later interviews with the respondents. Appendix A presents segments of transcripts showing the use of the thinking routines when recording comments during the observations. The segments include the beginning of John's class on the combustion investigation, the beginning of Corinna's class on the analysis of *Frankenstein*, and Anna's class on the presentations relating to the *Thinking Game* book.

5.3 Transcription of the Observations

The videotaped observations were transcribed in full, as it seems important to include as much information as possible due to the limited number of observations. Transcribing was a time consuming endeavour but illuminating with regard to how much would have been missed had there been only field notes. After completing each transcript, another routine *Connect-Extend-Challenge* was employed. This is a routine that helps reflect on an event or experience. The *connect* section helps select items from the observations that relate to the research questions; the *extend* section records how this information expands thinking beyond what is known, and the *challenge* section highlights issues that need to be raised or referred to in follow up observations and interviews. The routine also helps in the writing of summaries and reflections for each of the observation periods.

5.4 Conducting the Interviews

The interviews were carried out between observations and following the final observations. An additional interview was held during the write-up stage, as it was necessary to flesh out some of the themes that had emerged during the writing of the case report. I decided not to predefine the amount of time that we would speak. After the interviews started I found that they took on more the form of dialogue than interview. I started with relatively open structured questions stemming from the observations, but neither the wording nor the order of questions was predetermined. I found that I did not stick closely to the guiding questions once the conversations got underway as the respondents were eager to talk about their own points of interest. This open-ended or informal interviewing process felt similar to and yet slightly different from an informal conversation.

Questions became more and more specific as the research study moved along and as I began to sense what was important to each of the respondents. Keeping an easy rhythm during the conversations, I tried as much as possible to let the respondent talk. A flexible approach became necessary because there were often points that the respondents were eager to discuss which I had not considered prior to the interviews. I appreciated the fact that the respondents developed their own points of interest and that they considered themselves to be partners in the study. Themes began to emerge during the interview sessions and in successive interviews I referred to these emerging themes as a means of crosschecking the respondents' thoughts. At a later stage, the interviews became more structured as their purpose became more about crosschecking themes and categories that had emerged and less about unearthing new information.

5.5 Transcription of the Interviews

As with the observations, the interviews were digitally recorded. Bassey (1999) says that the advantage of recording interviews is that it frees one to attend to the direction rather than the detail of the interview when it is happening. The recorded conversations and interviews were later transcribed and used to substantiate interpretations that had been made at different stages. All the while, there was a delicate interplay between the interviews and the observations. The interviews seemed to provide natural leads for the observations and the observations suggested leads for the interviews. As Erlandson *et al.* (1993) indicate, "the interaction of the two sources of data not only enriches them both, but also provides a basis for analysis that would have been impossible with only one source" (p.99).

5.6 Events of Significance

During the data collection and transcription phases some events became more noteworthy than others and I referred to them as "significant events". Although many of these significant events were explicit I am aware that some of the data selection may have arisen unconsciously. While it is hard to be aware of unconscious activity, I tried to be mindful of what Furlong and Edwards (1977) in Jaworski (1994) describe as "too much *prior theorizing*, the observer simply having to select the right example to fit his preconceived ideas" (p. 70). Essentially, this meant trying to make an effort to consciously guard against the exclusive selection of examples that served to support my ideas as opposed to deriving ideas from a wider range of examples.

5.7 Concerns about Subjectivity

When questioning what might constitute events of significance, my concern with the degree to which my observations and selections were conditioned by my involvement in the activity and by the theoretical perspective was significant. Jaworski (1994) finds that the "engagement of self" is from the beginning a central and problematic feature of her own research (p. 62). Eventually, the concerns subsided, upon realization that the approach to research chosen acknowledges that research is naturally going to reflect the implicit values of the researcher. It was inevitable to pay attention to some things rather than others. As Furlong and Edwards (1977) claim that it is impossible to separate the data collection and analysis from the researcher's own theories as it is the researcher's standpoint that eventually "determines not only how the "data" are explained, but also what are to count as data in the first place" (p. 71).

5.8 Reflection Journal

These concerns, as well as other reflections and emerging thoughts are recorded in my reflection journal. Erlandson *et al.* (1993) recommend that some record of change is beneficial in this type of research, because for them "the researcher's growth is considered an important product of the research" (p. 108). Apart from helping track personal growth, the journal also helped me generate questions for the conversations and interviews. At other times, journal entries served as elaborations of significant anecdotes and sometimes involved theorizing the identification of patterns and attempts at explanations. Eisenhart (1998) captures the spirit of journal keeping in what she calls "researcher introspection" whereby "the researcher tries to account for the sources of emergent interpretations, insights, feelings, and the reactive effects that occur as the work

proceeds" (p. 65). I came to appreciate the journal entries as an immediate analysis of events as they occurred and as they fed the more formal data analysis stages that followed.

CHAPTER 6

DATA ANALYSIS

6.1 Data Analysis

Cohen, Manion and Morrison (2000) describe the data analysis stage of constructivist-interpretive research as "the organizing, accounting for and explaining of the data and making sense of the data in terms of the respondents' definitions of the situation, noting patterns, themes, categories and regularities" (p. 147). Their description, however, fails to describe the unruly nature of the process. Erlandson *et al.'s* (1993) definition seems to fit more closely with the reality of the situation. They describe data analysis as "a messy, ambiguous, time-consuming, creative and fascinating process that is not expected to proceed in a linear fashion" (p. 111). This description saved me from becoming overwhelmed in the early stages of the data collection and the analysis stage of the research.

6.2 Initial Data Analysis

Using the wide-angle lens perspective suggested by Miles and Huberman (1984) in Cohen, Mannion, and Morrison (2000), I responded to the first available data by forming tentative working hypotheses. Visual wall charts helped keep track of the basic ideas and patterns that emerged which connected with the general theme of the research. These units represented events of significance that had come through the observations of the teacher/respondents' approach to the organization of the learning environment, their handling of knowledge, references to reality and existence during the lessons, their positioning themselves, and their methods of communicating with the students. Mostly, the ideas were selected on a "feels right" or "looks right" basis and the early units and associated patterns facilitated adjustments to interview questions, observational strategies, and to other data collection procedures. In this sense, the collection of the data and the analysis were complementary, on-going and simultaneous processes. Follow-up interviews were shaped by what I had learned from previous interviews and observations, and subsequent periods of data collection were informed by what I was learning through the analysis of data that had been previously collected. Inevitably, as the observations and interviews progressed the number of units of data and their related patterns and concepts grew. Appendix B indicates the selection of tentative concepts and ideas formed after the initial observations.

After this initial collation of ideas, the transcripts of the interviews, observations and reflection summaries were examined to clearly identify and record the units of data. (Appendix C contains a sample of one of the post observation reflection summaries that was examined). Erlandson *et al.* (1993) describe this process of unitizing as "disaggregating the data into the smallest pieces of information that may stand alone as independent thoughts in the absence of additional information other than broad understanding of the context" (p. 114). These units consisted of words, sentences and paragraphs recorded in boldface in the transcripts. The unitizing of the data involved the development of codes: words and concepts still sufficiently close to what they were describing that the meaning could be discerned at a glance. Although Glaser and Straus (1967), in Lincoln and Guba (1985,) suggest that "the coding of incidents may be done in any way that suits the investigator" (p. 340) Cohen, Mannion, and Morrison (2000) recommend that "it is important to be faithful to the data ensuring that the codes are derived from the data responsively rather than being created pre-ordinately" (p. 148).

Keeping this in mind, the coding is shown in pencil on columns to the right of the boldface sections of the printed transcripts of the observations and interviews. At a later stage, the coding was made more explicit and a complex grid was generated. By coding the data in this way it was possible to detect patterns, inconsistencies and contradictions within the codes. The initial codes defined the categories that began to emerge and pulled together the wealth of data into an initial order and structure. I was aware that the categorization that emerged was no more than my analysis and my organization of data. In this sense, the analysis was unique, and I understood that the construction of reality that would emerge would be only one of many possible constructions of the same context. What is pertinent in a constructivist-interpretive research approach is not necessarily the outcome of the research project itself, or the degree of subjectivity expressed, but the manner in which the conceptual categories are derived. Retrospectively, were I to redo this stage, the move to conceptualization would progress more slowly. However, the timeframe required moving on with the processing in order to prepare for the initial interviews.

As the interviews proceeded and the categories emerged it became possible to group some of the categories into themes. Spradley (1979) describes this process as domain analysis; a domain being any symbolic category that includes other categories. These domains, or themes, (my preferred term), paved the way for the generation of the first version of the respondent profiles. Some of the main themes that emerged at this point were perceptions of learners, the role of groups in learning, the organization of classrooms, perceptions of reality, approaches to constructivism, the nature of disciplinary knowledge, and the role of the teacher. At this point in the study the respondents

seemed to have clear ideas about learners and about how learning occurs. What seemed less apparent and in need of more elaboration was how the teachers had come to develop these ideas and who or what might have influenced their approaches and perceptions. What was particularly interesting was the eloquence and ease with which the teachers were able to share and elaborate on their personal ontological and epistemological positions.

The early versions of the teacher profiles were relatively unstructured and the development of the structure and organization of the profiles up to this point had been mostly intuitive. They were also long, loosely framed and heavily infused with classroom snippets and excerpts from the dialogues. It was decided that a framework was needed to structure the profiles so that a comparison of the three respondents could be made. After considering different possibilities, the use of a modified version of a framework developed originally by Banks *et al.* (1999), introduced earlier in the literature review section, was chosen.

6.3 The Organizing Framework

Unlike the questionnaires generally employed to explore ontological and epistemological beliefs, the model was used to organize the data after it had already been collected. It did not determine the data that was to be collected in the first place. Figure 6.1 indicates an adapted and simplified version of the original model put forward by Leach and Moon (2000).

Figure 6.1: A simplified version of the Leach and Moon (2000) Teacher's Knowledge Model
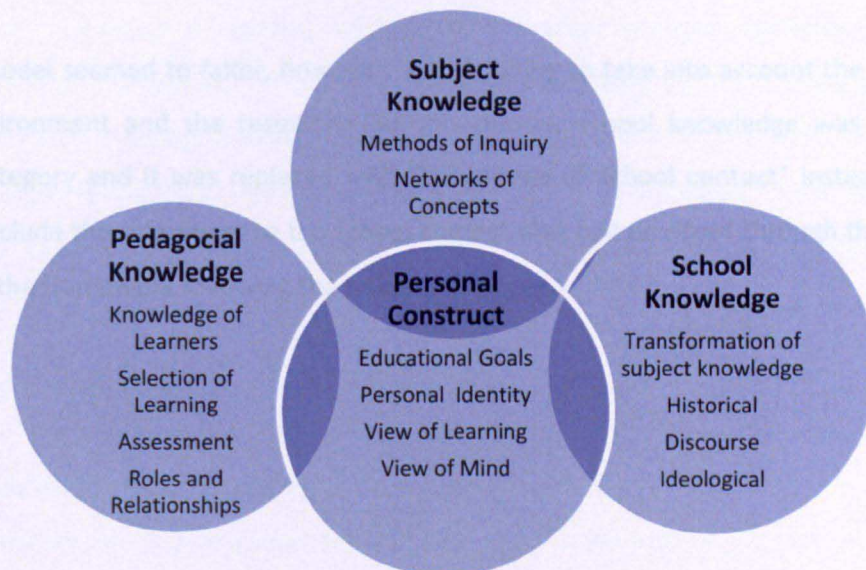
The model brings together different components of teachers' professional knowledge and draws on a number of perspectives in presenting a view of teacher knowledge and beliefs as dynamic and interactive. As mentioned previously, the model is a Venn diagram highlighting significant components of teachers' knowledge: pedagogical knowledge, subject knowledge, school knowledge and personal constructs. By putting the personal construct category at the centre of the model, Leach and Moon (2000) highlight that teachers' professional knowledge is not just multifaceted and complex, but it is may also be influenced by a teacher's ontological beliefs.

6.4 Revisiting and Expanding the Data Analysis Grid

On deciding to use the model to organize the data it was necessary to revisit the original data grids to see if all the relevant data had been taken into consideration before continuing. Revisiting the data again through the lens of the organizing model helped to validate many of the original categories, but it also made it possible to consider additional units of data that now seemed relevant. When applying the model to the concepts and categories emerging from the expanded data grid it became clear where the different concepts and themes best fit within the working framework. Thus, teaching approaches, classroom organization and relationships fit well in the pedagogic knowledge section while significant concepts, the nature of disciplinary knowledge, and methods of inquiry fit suitably into the subject knowledge section; the nature of learning, learners, and reality, as well as background experiences fit properly within the personal construct section. Appendix D provides a segment of the expanded analysis grid for one of John's lessons. It shows the addition of a third column, which did not appear on earlier analysis grids.

Where the model seemed to falter, however, was in failing to take into account the context of the teaching environment and the research. For this reason, school knowledge was dropped as a significant category and it was replaced with "knowledge of school context" instead. It was now possible to include the references to the school context that had emerged through the data. Figure 6.2 indicates the framework following the relevant changes.

Figure 6.2: An adaptation of the Leach and Moon (2000) Teacher's Knowledge Model
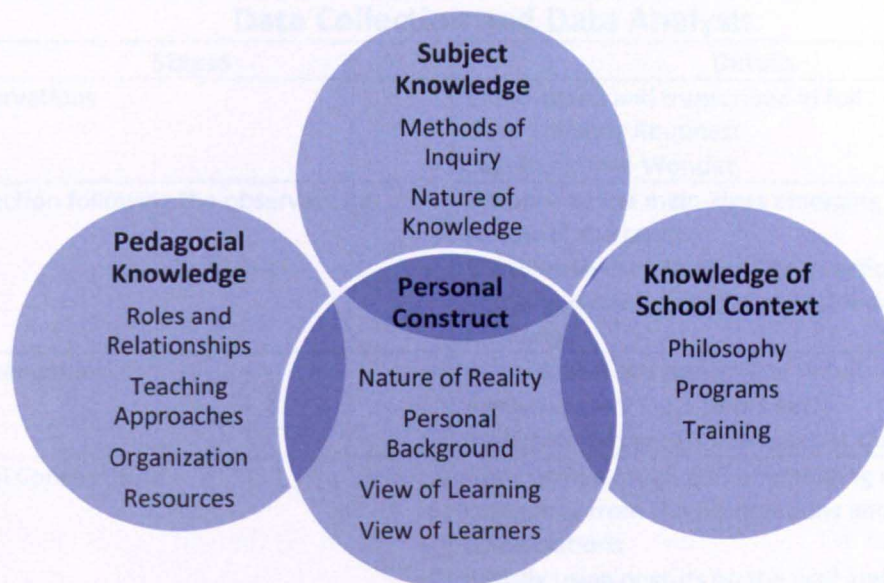
6.5 The Need for Additional Interviews

On considering Banks *et al.'s* (1999) description of teachers' personal constructs as a complex amalgam of past knowledge, experiences and beliefs, I decided that additional information was needed from the respondents. Exploring past experiences seemed relevant at this stage. Therefore, additional interviews were conducted to shed light on personal background experiences that might have impacted the respondents' ontological and epistemological perspectives and their teaching practices. After follow-up interviews, additional categories emerged, including the effect of parentson teaching approaches, the impact of post-graduate level study on personal philosophies, and the influence of ontological assumptions on chosen lifestyles. Included here are the questions that helped guide these final interviews as Appendix E. The questions relate to the personal background of teachers and these are supplemented by additional questions relating to ideas and the nature of reality.

6.6 Overview of the Data Collection and Data Analysis Stages

The following table, Table 6.1, provides a visual overview of the data collection and the analysis of the data. It includes the steps involved, including the order in which each of the steps occurred. The last steps are those involved with the generation and crosschecking of the final versions of the teacher profiles presented in the next section of the report.

Table 6.1: Overview of the Data Collection and Data Analysis Stages

	Data Collection and Data Analysis	
	Stages	**Details**
Initial Data Collection	Observations	Video-taped and transcribed in full Used Thinking Routines: See-Think-Feel-Wonder
	Reflection following the observations	Synopsis of the main ideas emerging from a review of the tapes These were used to generate questions Thinking Routines used: Connect-Extend-Challenge
	Conversations	Audio-taped and transcribed in full Approximately 1-1.5 hours each Highlighted concepts and ideas as they emerged
Initial Analysis and Continued Data Collection	Initial Concept Grid	Generated a rough grid of emerging concepts and categories from the observations and conversations Initially using post-its on the wall and transferred these to a type-written grid
	Semi-structured Interviews	More in-depth dialogue based on the reflections following the observations and the conversations Approximately 1-1.5 hours each Prepared a few questions – and let the others emerge
	Writing the initial drafts of the profiles	Using the emerging categories and themes the initial profiles were generated – they were heavily infused to begin with quotes and excerpts from the transcripts
Introduction of the Planning Framework	Application of the modified Leach and Moon (2000) planning framework to the analysis grids	Revisited the analysis grid and comprehensively checked and expanded it by reviewing all of the transcripts and grids
	Generation of expanded profiles according to the Leach and Moon (2000) planning framework	Using the expanded analysis grids I revisited the profiles and restructured them according to the themes of Personal Construct, Pedagogical Knowledge, Knowledge of Subject and Knowledge of Context
	Generation of Venn diagrams to add to the profiles	This involved picking out the key words that summed up each of the respondents
Follow-up Data Collection & Analysis	Additional semi-structured interviews	In order to supplement sections of the new planning framework additional information was required Each follow-up interview lasted about 1 hour The interviews were more structured than previous ones
	Profiles were updated	The additional information gleaned from the interviews is used to flesh out the Personal Construct section of the profiles
Final Profile	Respondents check the profiles	Each respondent checked over their profile and changes were negotiated
	Final versions of the profiles	The final profiles were updated

CHAPTER 7

THE TEACHER PROFILES

7.1 The Generation of the Profiles

The following profiles were generated during the data analysis stage following the application of a modified version of the Leach & Moon (2000) Teachers' Knowledge organizational framework. The profiles are structured according to the four elements of the framework: personal constructs, pedagogical knowledge, subject knowledge, and knowledge of school context. Synopsized earlier versions of the draft profiles are included as Appendix F. The phrases and concepts included in the earlier drafts stem from the analysis of the transcripts of the observations, conversations and interviews. These earlier drafts were expanded upon to create the final versions of the profiles that appear here.

As mentioned earlier, the names that appear on the profiles are the actual names of the teachers. In accordance with BERA (2004) guidelines, they each signed a letter consenting to involvement in the research study and to the use of their actual names in the thesis document. In addition, in line with the criteria of trustworthiness associated with constructivist-interpretive research, the three respondents John, Corinna and Anna were given the opportunity to review the draft versions and final versions of the profiles so that they could discuss them and comment on them. Following feedback and discussion their comments and suggestions for changes and additions were incorporated into the final versions of the profiles.

7.2 PROFILE FOR JOHN – SCIENCE

Teaching Position: John teaches integrated science in the Middle Years Program and Physics in the Diploma Program.

7.2.1 PERSONAL CONSTRUCT

7.2.1.1 PERSONAL BACKGROUND

John grew up near Auckland in New Zealand. From an early age he was heavily influenced by his father who he considers to have been a socially conscious and ethical man who had strong principles. John spoke specifically of the imprisonment of his father during the Second World War.

His father was against the war and, as a result, he was imprisoned as a conscientious objector. Stories of incidents that happened during and following the imprisonment have had a noticeable effect on John's view of the world. In particular, they have engrained in him a need to be sceptical with regard to believing what people say – and in particular when it comes to paying blind homage to the voices of people in authority. John feels that his own strong sense of ethics and his principals were influenced by his parents' way of life and the interesting and socially engaged people that they associated with – and, in particular, his father's life long service to the legal representation of injured workers.

John chose to become a teacher following favourable experiences tutoring chemistry to younger students as he completed a Bachelor of Science degree. After university he taught science for 25 years in a country school outside of Auckland, but decided to leave when the profile of the school declined. Having previously been on two teaching exchanges to the UK he decided to move overseas again, and this time he chose a position at the International School in Bonn. Here, he found a marked increase in enthusiasm on the part of the students for learning, and he stayed at the school for several years working as a general science teacher, a Physics teacher and as an MYP coordinator. When it came time to consider a change to another school John chose ISA mainly due to the fact that the Netherlands has an agreement with New Zealand regarding retirement benefits.

7.2.1.2 REALITY/EXISTENCE

When it comes to John's perceptions of reality it is clear that all existence and the underlying structure of the universe has energy at its base. Although John mentions that energy is not considered as a material substance, he believes that it forms the base of all that is material. He admits that this is an idea that is difficult for the average person to digest as what appears before us tends to look and feel solid. He acknowledges that being a Physics teacher influences his interpretation of reality, and he is conscious of the fact that his interpretation may not be the actual nature of reality. Due to the physical and conceptual limits of human knowledge he feels that the true knowledge of reality may be beyond our capabilities. Keeping this in mind, he points out that the scientific models he uses are not representative of reality but mere pointers in the direction of reality.

The Decomposition of Matter

When I queried his understanding of the nature of existence, John posited that there were both scientific and philosophical perspectives to this question. In relation to how this question might come to life in his classroom John pointed out that all energy comes from the sun and he moved on to describe the activity related to the Carbon Cycle and the Decomposition of Matter. The intention behind this activity, he explained, was to promote an understanding amongst the students of their place in nature and to help them appreciate what our continued existence depends on. With regard to the nature of existence he explained that, as scientists see it, all matter, both organic and inorganic, is energy. Despite this, we, and everything else, tend to behave as though we are solid in nature.

Interdependent Nature of Existence

He adds that the energy/matter that constitutes living and non-living things is recycled and that the atoms that constitute these substances may at one point have been part of the stars, air, the soil, water, and other living organisms. We are, John believes, formed from the past and are composed of recycled energy/matter. This may not affect us physically, he adds, but it may have a philosophical effect on people considering the interdependent nature of our relationships with our surroundings.

Sceptical of Existence of Souls

John thinks that it is perhaps easier for people to understand how we are formed from the past than it is to consider our current degree of interdependence with that which surrounds us. He suggests, however, that these ideas may affect those who believe in reincarnation or in souls differently. He admits to being sceptical about the existence of souls, but is reluctant to dismiss the idea that there may be other aspects to existence that have not yet been discovered. He believes that the body and thoughts are extinguished when we die. Not being religious, he acknowledges that others may not share his perception. He feels that, similarly to all scientific theories, his ideas are provisional and could one day be overturned in the light of conflicting evidence.

7.2.1.3 VIEWS ON LEARNING

Construction of Conceptual Understanding and Abstraction

As for students' learning John indicates clearly that he draws from a constructivist model of learning. He describes this model of learning as a process that involves the development of procedural and conceptual understanding over time. Learning constructively, he maintains, involves a progressive journey where students move through different developmental stages. The main goal of each of these stages is to initiate students into the practice of science through an understanding of scientific concepts and skills. Regardless of the topic, or practical activity being explored by the students, John acknowledges that there is usually an underlying mental model of a concept or a practical skill that he is trying to get across. He suggests that there are a variety of ways that one might go about engaging a student with concepts, but regardless of the approach, his aim is that each child reaches a demonstrable understanding of these predefined concepts.

John believes that there may be parallels involved between the abstraction of scientific concepts and the processes involved in language learning. He suggests that in language learning you usually start with the concrete nouns and verbs and eventually you move on to more abstract constructions. Abstract constructions are seen as an extension of categorization. John sees these abstractions as visualizations or mental images and he feels that different people will form these abstractions differently. For example, he acknowledges that he has difficulty visualizing equations and that, regardless of the fact that he knows differently, he still visualizes electrons as little spheres even though he knows that they are waves of energy. In the same way, John feels that students may also be able to form conceptual abstractions to varying degrees. He adds that, at different age levels, students are capable of a variety of degrees of understanding of more difficult concepts, such as gravity. When in the adolescent years, he thinks they are quite happy with Newtonian explanations whereas in later years he prefers to engage them with more sophisticated models.

Need for Deeper Engagement with Concepts

At a later stage in the research John developed a keen interest in why science places such a prominent focus on the development of visual models to help explain phenomena. John began to wonder if there is perhaps too much of a focus on *what* concepts the model represents and not enough of a focus on *why* the scientific phenomena happen. He used an example that relates to gravity. We know what happens when something falls from a height but we do not really know why. He feels that the tendency not to engage students with the deeper uncertainties inherent in

scientific ideas may be impinging on his students' abilities to understand scientific concepts in a way that they can apply their understanding in a practical sense. Due to a lack of understanding of the underlying nature of physics, students tend to focus on the math and less on the overall meaning of the concepts and what they tell us about our place in the universe - as would be the focus for a real physicist.

Mismatches in the Understandings of Concepts

John expanded at length on the idea that we all have different and possible incongruous understandings of everyday concepts such as gravity, colour and energy. He then described energy as a mysterious substance that is generally given a circular definition by scientists. He maintains that in the scientific community the concept of energy is generally glossed over because it is unclear to science as to what energy actually is, as it does not possess a material essence in the way that other substances do.

Role of the Brain in Conceptual Abstraction

When given time to ponder where our understanding of abstract concepts such as energy develops, John maintains that the individual brain plays a pivotal role in the storage of knowledge and in conceptual abstraction. He credited Jo Ann Deak, an educational psychologist, who has given a brain-related workshop session at ISA, with helping him to better understand recent brain-related research. John believes that the brain is the locus of mental activity, such as thinking, which he feels arises as the result of electrical impulse but he was unclear as to where other types of understanding and knowledge were developed. In the case of procedural knowledge, for example, he felt that this form of understanding might not be located solely in the brain, but that it may be distributed throughout the body. John shared that he had recently become more interested in research into brain development and its implications for the teaching of adolescents.

In a follow up interview John was reluctant to dismiss the possibility that more than the brain is involved in understanding. He acknowledges that the brain is generally considered to be the control centre, but he admits to being open to the possibility that this idea may change in time. He suggests that our long-term memory and our understanding of different concepts could possibly be distributed throughout the body. He makes reference to the fact that we originally thought that blood was manufactured in our hearts instead of the bone marrow. As such, he maintains that the brain may eventually be considered as a switching station of sorts, but the knowledge itself may be distributed and not localized.

John: My view is that you think with your brain and that knowledge is in your brain because that is the organ that does the organizing. But similarly when the heart was first discovered and the circulations was first discovered they thought that blood was manufactured in the heart – but it wasn't it's made in the bone marrow. So our present view is that knowledge is located in the brain but maybe it's not, maybe it's just a switching station or a control centre. It could perhaps be chemically stored right throughout your body or in some way we do not know of. It doesn't need to be localized.

Isolating Prior Knowledge

In order to unearth and make transparent variations in students' conceptions, John believes that it is important to engage students with their prior learning when initiating work on new topics. In this way, students have the opportunity to consider their alternative conceptions before they continue. During each of the lessons he gave students the opportunity to connect their ideas to prior units and lessons although at times these connections seemed contrived as little time was afforded to the development of more than cursory connections. Nevertheless, John feels that it is important for students to make connections as he sees all knowledge as associated and connected. He describes it as a plate of spaghetti in which each stick of spaghetti represents a long chain of understanding that is embedded with and connected to other chains of understanding.

7.2.1.4 VIEW OF LEARNERS

For John a learner is both an independent and an interdependent entity. Independent in the sense that they exist as singular entities, and interdependent in that they form parts of the systems that surround them, such as the environment and the universe. He feels that it is the mind that makes one person distinct from another. John believes that we communicate with each other solely through the use of verbal and body language, and that there is no way to connect with one another outside of these modes. Learners understand others through the practical interpretation of shared constructs, but there is no real way to know whether these interpretations are truly shared, or whether they are just practical approximations that make communication possible.

From an observational perspective, then, learners appear to be cognizing individuals who are busy with the activity of learning established scientific truths. There is a clear lesson format that the students need to follow, and although at times the conversation drifts towards uncharted waters it is usually brought back to the topic so that the lesson can continue. The students are given clear guidance and instruction as to the concepts that they need to develop an understanding of and how

this understanding is expected to develop. John finds that the students are not capable of grasping the provisional nature of scientific knowledge, during adolescence, and he believes they are happy to accept authority when it comes to the validity of scientific knowledge. It is more important, he maintains, to introduce students into the process of experimentation and induction at this age.

It is clear that John expects his students to follow agreed upon protocols and that he expects them to be honest with regard to intellectual property rights. He also points out the responsibility of students to prepare thoroughly for investigations especially when others are dependent on their contributions. At a later stage, John commented that his expectations of the students are grounded in his understanding and appreciation of the attributes of the IB Learner Profile.

7.2.2 PEDAGOGICAL KNOWLEDGE

ORGANIZATION OF LEARNING ENVIRONMENT

Organization of Learning Space

John holds his classes in one of the science labs. These labs each have a seating area and a separate practical work area. At the onset of theory related lessons students are seated in rows in front of the main desk facing the Smart Board and the Whiteboard. At first glance, it appeared that having the desks in rows would act as a barrier to group work. Although this was the case for the majority of students during the Carbon Cycle activity, there were students who managed to work around the rows in order to communicate with and help others. John doesn't really like the rows format as it prevents the quieter students from speaking out. This difficulty disappears, however, when the students are working in the other half of the room during the practical sessions. Here, the students are free to move around and they communicate freely to the point that different groups assist each other when difficulties arise.

Collaboration

This form of collaborative group work is a common feature of John's classroom. Students regularly work in a variety of small group situations to solve problems, as was evident during the molecular modelling activity and during the practical session. His reasoning behind the involvement of students in on-going collaborative activities is that it helps them to move each other forward in their learning, as opposed to when they are working alone. He referred during the interview to research that indicates that students learn more from each other than they do from listening to a teacher. On

several occasions, I observed John encouraging students to take the lead during problem-solving situations.

ROLES AND RELATIONSHIPS

The Role of the Science Teacher in Learning

John sees the teacher as an essential guide who assists students in the construction of the concepts that take them longer to construct and understand without his assistance. Because he aims to provide the students with opportunities to independently understand concepts, he does not like to over-direct the learning process. Teaching for John is an activity that involves coaching.

> *John: Well! It's their learning – it's their education and my basic role is as a coach really – to direct their learning – or help their learning process - to ensure that they can continue to learn and that it will go in useful directions.*

He sees himself as the sports coach who sets up the play for the day by giving students the structure and guidance for what they need to do, but it's up to them to carry through with the activities within the designated time frame. He mentions that his transition to this approach to teaching was influenced by his change to teaching in an international school, where students tend to stay on task. The increased level of student attention gives him the added flexibility he needs in order to vary the pace and to involve students more in the planning and investigative processes.

The Role of the Students in Learning

John commented on his interest in involving students in planning, and I observed that they were responsible for the planning of their bounded investigations. The students' role appears to be that of an apprentice who is inducted into being a scientist. In so doing, John expects the students to work fairly and honestly and he appreciates that they follow agreed upon class protocols. When there are minor disruptions in class John often notices that the students themselves are capable of monitoring the behaviour of others.

7.2.3 NATURE OF SUBJECT KNOWLEDGE

Nature of Scientific Knowledge

John recognizes scientific theories and explanations as provisional in nature and he acknowledges that they are continually open to investigation and to the possibility of being proven wrong as newer and more sophisticated models of understanding emerge. He sees scientific knowledge as the best interpretation of phenomena at this particular point in history. He feels that it is important that older students, in particular, realize the importance of being open to exceptions and to ideas that counteract traditional scientific perceptions. I can appreciate why this modified process becomes problematic and questionable for students once they begin to study Theory of Knowledge. Through Theory of Knowledge older students are confronted with multiple perspectives regarding the generation and validation of knowledge. At this later stage, he realizes that it is acceptable to engage students with the idea that scientific evidence and theories are provisional by nature and that the finding of exceptions in science can lead to the modification of previously held scientific assumptions.

In this sense, John perceives scientific knowledge as something that is continuously evolving. He made reference to the idea that in Victorian England it was thought that science was complete. People thought that everything had been discovered and that everything was known. Today, however, he believes that no matter how much we know there will always be much that is unknown due to the limitations of our senses. John is aware that we all inevitably construct our own versions of the world that are dependent on our own experiences and the descriptions of the world we receive from others.

With the younger students, however, John chooses not to engage them with the provisional nature of scientific inquiry. He feels that at this point it is important not to confuse them. It's best if they just get used to the idea of having to back up their reasoning with quantifiable and/or observable evidence.

> John: ... people at this age are quite happy to accept an authority. This is the way that it is, whereas that is not really part of the scientific method. But they are at an early stage in coming to understand the scientific method and we're trying to encourage them towards looking at evidence. You observe, you describe, then you try and develop a model whether it is a mathematical model or a descriptive model or whatever it might be that hopefully explains why things happen the way they do.

The Limits of Scientific and Non-Scientific Knowledge

During our conversations John was keen to point out that our knowledge of how things are will always have natural limits. In general, he recognizes Physics as being the discipline that is best at recognizing its own limits when it comes to the generation of knowledge. He makes reference to efforts of scientists to investigate into the "point of impact" of the Big Bang and the problems inherent in doing this. He also emphasizes the impassable problems associated with Heisenberg's Uncertainty Principle, which indicates that in experiments carried out at subatomic level the observations of the experimenters directly affect the outcomes of the experiments. This is due to the fact that at a subatomic level particles are not seen as "things" but as inter-relationships.

He also comments on the limits of the human senses in that we are restricted to a limited fraction of the electromagnetic spectrum – namely the visible spectrum. Scientists, he claims, try to circumvent these limitations by inventing technologies that enable us to make measurements beyond the range of the five senses. Although people are generally familiar with the very large and the very small, he acknowledges that the general public may be less familiar with efforts to explore beyond the realm of the five senses into other regions of the electromagnetic spectrum.

When it comes to the generation of knowledge in other areas John maintains that other disciplines probably go about the gathering of knowledge in a way similar to that of the sciences. He differentiates this form of knowledge from unfounded public opinion. There are also areas where he feels that knowledge is accepted on faith as opposed to on the basis of observation and measurement. This can be the case within religion, economics and politics, as well as within other spheres.

John's description of the relationship between knowledge generated within the Arts and within the Sciences was of particular interest. He acknowledged that many of the most significant advances in scientific understanding occurred as the result of inspiration and that these inspired ideas were often followed up over time with what he describes as the "plodding logic" of science. He feels that this order may be reversed in the Arts where it is inspiration and creativity that stands at the forefront.

> *John: I'm just trying to think of some of the main advances in the understanding of science that have been through inspiration. The plodding logic is what the others do after the geniuses thought of the idea. Now in the Arts maybe it's the other way around. Maybe what counts is the creativity and the inspiration that comes up with ideas. And the rest of the*

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world has to just sit back and admire. Whereas in science somebody brilliant dreams a solution to a problem but then it can be followed through and people can understand it in their everyday ways and then suddenly it becomes obvious.

Knowledge through Dreams and Inspiration

The role that brilliant ideas, dreams and inspiration play in the generation of scientific ideas surfaced on several occasions during my conversations with John. It's unclear for John as to how knowledge can spontaneously appear in this way, but it is obviously a fact that interests and intrigues him, and he commented on it at length, giving examples that included Einstein's theory of relativity dreamt up on the Zurich tram system, and Kekule's dreams on the structure of the benzene molecule. He views the role of inspiration as a factor that often differentiates merely competent scientists from truly great ones. When I queried John's understanding of where these inspired ideas or dreams may come from he thought that they may be the result of electrical currents running through the brain within one's subconscious while one was sleeping, but he was not sure.

Method of Inquiry: Scientific Method

John sees it as his role to ensure, through experimentation and the use of the scientific method, that students' understandings of concepts match observations in the real world or that they at least correspond with established understanding of how things work. Although John regularly encourages students to create their own experiments, he sets clear limitations due to the need for the preparation of sufficient resources. He finds that independent planning of experiments is difficult for students, but he feels that it encourages them to realize the difficulties inherent in practical work in the real world where laboratory investigations are not prescribed. Prior to the carrying out of the independent labs, students have been supported through a prescribed lab of a similar nature so at least that some of the procedural scaffolding is already in place.

Figure 7.1 Applying the Framework to John's Profile

Subject Knowledge
Investigation
Scientific Method
Objectivity

Pedagocial Knowledge
Facilitation
Teacher as Expert
Piagetican Constructivism
Modeling

Personal Construct
Reality as Energy
Interdependence
Father: Principled
Non-religious
Individiual Cognition

School Context
Collaboration
Learner Profile
Peer Assessment
Conceptual and Procedural

7.3 Corinna's Profile - English Literature

Teaching Position: Corinna teaches English Literature in the Upper School at ISA.

7.3.1 PERSONAL CONSTRUCT

7.3.1.1 Personal Background

Corinna was born in Germany and she grew up and went to school in Canada. After graduating from college, she studied in the United States and at the same time worked in a variety of places around the world including the Philippines, the US, Korea, Singapore, and Taiwan. Whilst in Korea, Singapore and Taiwan she did workshops and taught graduate classes for Michigan State University. Following a period of time teaching at a College of Education in the US, she moved overseas and taught at international schools in Brazil and Turkey. Having grown up and lived in a variety of countries, Corinna considers herself to be a global citizen and she sees the world as her home. As such, she does not feel aligned to any particular country and feels comfortable living in the Netherlands for now.

Corinna has a broad liberal arts education at undergraduate level and she carried out Master's and Doctoral level work at Michigan State University. She credits advanced study, particularly at the PhD level, with opening her mind to a view of education that is grounded in the construction of meaning. She feels that she is a different person and a different teacher due to these experiences. She also believes that her previous teaching experiences at a small College of Education in the US and at the international school in Turkey have influenced how she relates to students and she feels she is a calmer and more empathetic teacher than previously.

The major influences in Corinna's life have been her mother and books. She admires her mother for being an avid reader, for her intelligence, for her sense of independence and for her analytical mind. She credits her mother for teaching her how to analyse life and literature. Books, she sees as another major impact on her personal, emotional and psychological development. For example, Tolstoy's *The Death of Ivan Ilych* has taught her the importance of living life well, and of striving for happiness, and for love, and for not having any regrets when one dies. Literature, for Corinna, is about uncovering the truths of the human condition and learning how to love life and to live life well.

7.3.1.2 VIEWS ON LEARNING

Dialogue and Digging Deep

Corinna expects all students to dig deep inside themselves in order to bring their most cherished thoughts, beliefs and ideas into the classroom. She encourages students to be aware, reflective, awake, compassionate and above all, present and mindful in her lessons and in their lives. She particularly encourages students to explore beneath the surface of ideas and to consider and engage with multiple perspectives. Corinna expects that engagement with deep concepts and ideas will have a transformative effect on each student and that when they leave her classroom they will continue to contemplate and question their own beliefs. When I queried how these transformations might happen she felt that students develop deeper understandings of abstract concepts through in-depth discussion and the relation of the concepts to their own lives. For example, during one of the observations Leor, one of the students, brought up the idea of connection and disconnection as two concepts that reflected the life of Frankenstein. In connecting to her own life, she commented that in order to have deep connections with others we need to develop a connection to our own deep selves.

> *Corinna: And what about connection and disconnection to oneself? How does that play out in all of this?*
>
> *Leor: Because I think that when you know who you are, you have a sense of who you are. It sounds weird to say that you have a connection with yourself (smiles) …. so I think that when you reach a level when you have that connection only then can you have a true connection with other people.*
>
> *Corinna: I think that is a really important insight.*

On many occasions students came out with ideas that Corinna describes as *rare gems*. On a personal level, I had not anticipated the depth of their ideas and the fluency in the way that they built upon and supported each other's ideas.

Social Construction of Knowledge

Corinna openly uses terms such as the social construction of knowledge with her students and with regard to what is constructed she feels that this differs depending on the past experiences of the individual students. Corinna feels that the personal constructions of abstract concepts that students

develop and change over time through deep dialogical exchanges and personal introspection and reflection, aid in the construction of deep insight that reaches below the surface of things. For Corinna, the social construction of reality is open-ended and shifts in understanding can happen as students' internal scaffolds and schemas change due to discordance with events in the external world. Each individual, she believes, constructs their own versions of events, so internal and external realities can, therefore, differ from one student to another. Although Corinna uses terms such as the social construction of reality with her classes, she wonders about the degree to which students comprehend the meaning of the phrase at this point in their development.

Emotional/Holistic Component of Learning

Corinna feels that learning happens best when you embrace the intellect, the heart, the soul, and the mind. Learning is, therefore, about expression, about taking risks, about feeling safe, about feeling comfortable and about sharing. In this way, she believes that learning involves allowing for the complexity of the full human being. What came through quite strongly in my conversations with Corinna was her belief in the need for space in learning. She describes this as the need for students to feel that they can bring who they are into the classroom. When learners can do this she feels that they open up emotionally, intellectually, and spiritually. For this reason, Corinna suggests that some learners need "open doors" and considerable flexibility in their learning environment. At the same time, she appreciates that too much flexibility may create ambiguity and uncertainty for some students so she provides a certain degree of structure as well. In this way, she appreciates the needs of students to feel acknowledged, appreciated, seen and heard.

Tapping into Prior Knowledge

Corinna highlights the importance of having students tap into their prior knowledge and on many occasions the idea that the human mind is not a *tabula rasa* came into conversations with the students. She acknowledges that students come to the classroom with nascent understandings of abstract concepts that stem from a variety of previous experiences. She wonders if some of that nascent knowledge is metaphysical in nature and if it extends beyond the lifetime of the student.

Mismatch between Understanding of Concepts

Corinna acknowledges that there is usually a mismatch between individual students' understandings of the concepts that are being explored. She believes that although we all think we are hearing the same language we nevertheless keep hearing and understanding things differently. She is

particularly wary of considering the meanings of universal concepts, such as justice, truth, and equality, as she feels that the usual interpretations have been based on the perceptions of white males and those in power, and not on the perceptions of all of those who have contributed over time to the generation of universal concepts.

Range in Abilities of Students to Abstract

Corinna reasons that students have internal scaffolds and schemas into which new concepts are integrated. New ideas being constructed by the students are built into ideas that are already there and these ideas continually shift and change and they inevitably become more sophisticated with time. Corinna feels that certain students are coming to the class with a depth of understanding of abstract concepts that extends beyond what one would expect with this age group. One student in particular, who is known to be philosophically inclined, is creating what she describes as new knowledge, conceptual understanding that extends beyond what would be expected. She refers to him regularly as *an old soul*.

Multiple Intelligences: Different Approaches to Learning

The idea that students have different predispositions when it comes to learning came up on several occasions both through conversations with me and with her students. Corinna exhibited an informed understanding of Multiple Intelligences Theory and she spoke about this theory with her students. She provides regular opportunities for students to explore their preferred learning approaches when they are demonstrating an understanding of abstract concepts. This was the case with an activity through which her students demonstrated their interpretation of *The Meaning of Life* by means of, for example, a collage, a sculpture, ballet, instrumental music, or a song. Although Corinna sees the theory of multiple intelligences as important, she believes that it has limitations and that it does not take into account the complex nature of learning.

The Role of the Brain in Learning

When I queried Corinna's views regarding the role that she felt that the brain plays in learning, it was not a topic that she felt informed enough to discuss. She believes that the brain plays an important role in learning but she sees learning as being inherently more complex than how it is currently being portrayed through brain related research and through workshops. She finds that although the ideas discussed are interesting they have not been illuminating for her.

7.3.1.3 LEARNING AND LEARNERS

The Role of the Collective in Learning

Learning, for Corinna, occurs both at the level of the individual and at the level of the group. Although I began with a description of how Corinna understands individual learning, it is important to add that Corinna's main focus during class and during our conversations appeared to be on what happens within a group-learning situation. Indeed, she finds a focus on the individual within educational discourse as somehow missing the point in relation to how learning happens both within the classroom and within the real world. For Corinna, knowledge is constructed within groups. She feels that the depth of the discourse and knowledge construction that developed in the class that I observed is due to the fact that there is a critical mass of deep thinkers in the class. Corinna believes that this critical mass of students generates a synergy that ends in the collective (the whole) being much greater than the sum of its individual parts. She spoke at length of the magical quality that she feels within this group. She senses as if there is a nebulous entity or collective consciousness that emerges and somehow transcends the individuals that are present.

Emergent Learning

Seeing the collective as a learning entity, Corinna finds it necessary to position herself within the group, where she becomes very much part of the conversation, as opposed to being a director of it. Corinna feels comfortable with this flexible approach, and during the lessons I observed conversation regularly moved in unanticipated directions and often folded back in on itself at different points.

> Corinna: And you see for me that's my joy in teaching – the not knowing where the conversation is going to go.

Although there was some initial structuring in place, this structure did not seem to be constraining the conceptual depth of the dialogue, but supporting it. Afterwards, Corinna and I had conversations about how tightly or loosely one needs to structure these kinds of lessons in order to enable genuine learning to happen. Corinna liked the idea of letting learning *expand into the space of the possible* as she felt that this is what happens in her classes. This is a phrase that she borrowed from a conversation that we had about Brent Davis' ideas on the emergent nature of learning. It was clear that Corinna had been searching for words that would help explain what was happening in groups in a way that made sense to others. Prior to the research project she had had difficulty finding suitable

vocabulary. Following our conversations, she was eager to do some follow-up reading relating to research into emergent learning and the role of the collective in learning.

7.3.1.4 REALITY/EXISTENCE

Perceptions of Existence/Reality

Corinna feels that there is a dialectical and reciprocal relationship between the individual and the environment and that these interactions form individual perceptions of external and internal realities. When I asked her about her personal perception on the nature of reality she acknowledged that this was not an easy thing to describe. Yet, at the same time, she realized that this was in essence what she was asking her students to do through The Meaning of Life unit. She thought about the question for a bit, and then responded that she intuits that we are more than our physical bodies and that we have a metaphysical essence that is connected to everything else.

> *Corinna: ...the older I get the more I see it as a spiritual metaphysical existence - that we are definitely something other than our physical bodies – that we, whether it's energy, or a light (sic) force or a deity. I don't know. I think that at this moment in time we are in these physical shapes in this concrete world. But it's above and beyond and deeper than that. You know the cosmos or universe. We are all part of it and as we get wiser we, at least from my perspective, can see more how we are interconnected with everything whether it is human beings, animals, plants; that we are all part of the same thing.*

Although she cannot easily describe this essence in words, she feels that it is latent in everything living and she believes that it may be beyond the grasp of the average human mind. By extension, she sees all and everything as being connected and interconnected, and that the whole of this interconnectedness is greater than the sum of the individual parts.

An appreciation for the connectedness of all living beings is also the reason for Corinna's choice to pursue a vegan way of living. Veganism involves not eating animal products or the use of products that involve the suffering of other living beings. Through vegan, vegetarian and the deep ecology movements she notices a developing awareness of the concept of interconnectedness and of the need for respect for all living things amongst the general population.

> *Corinna: I truly feel that everything is interconnected, everything, and that is where my veganism comes from. This sense that we are all one.*

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She found, however, that this perception of the nature of existence was a burden for her when she was younger, and, especially, when she lived amongst suffering in Brazil. She found it difficult to remain detached from the suffering of others, but over the years she realized a need to become more pragmatic about her relationship to the suffering of other living beings.

When I asked if her teaching was impacted in any way by her beliefs and how she perceived the nature of reality and existence, her answer was emphatic and simple. She said, "Absolutely!" This perception of reality is reflected in the participatory manner in which she engages with her students and through how she views collectives of learners. She finds that a sense of interconnectedness manifests itself most palpably when there is a critical mass of people of the same ilk gathered together. When this is the case, she notices that a collective consciousness or a collective mind emerges, whereby it is possible to catch glimpses of the interconnected non-physical realm.

> *Corinna: ....the sense that when you have this collective consciousness or when you have all these little consciousnesses that come together there is something that happens. It's greater than the sum of its parts. And it really is something that can be magical.*

The idea that everything is connected came up regularly in the lessons and one of the students even described the individual as a microcosm of the classroom and the classroom as a microcosm of the world as they were discussing Gandhi's quote: *"An eye for an eye and everyone is blind"*. Corinna hopes that, within this microcosm, her students can experience and feel and hopefully catch a glimpse of what that outside world could potentially become. She believes that if each person in the room can be warm, respectful, thoughtful, and kind, then the collective can become so, and if a classroom can become so then there is the potential for the world at large to become so.

Corinna believes that these microcosms are one and the same and they are all nested within a grander unity. This perspective is essentially a spiritual one, and Corinna refers to spirituality as not associated with religion, but with the exploration of one's place in the cosmos, and the asking of big questions. This is what she does in some of her lessons and particularly through the unit, which she had just worked on with the students, related to The Meaning of Life. Indeed, she notices that many of the students in her class are naturally asking many of these questions already. Spirituality, then, is a form of connection with reality and this connection involves deep exploration of the self through the development of awareness and intuition. It essentially involves remembering our true selves as being something more than the physical. She believes that more highly evolved individuals may be able to connect with the interconnected nature of reality directly and, particularly, those who practice extended meditation.

Because of her clear personal and spiritually informed beliefs on the nature of reality, Corinna is keen to point out that we all develop our own personal realities due to the fact that we have all had different experiences, and we all see the world differently.

> Corinna: We see things not as they are but as we are. And just the sense that we may all be in the same room together - we all don't experience the same reality. We perceive things very differently.

She makes a point that the fragmented lenses that humans use to view the world are not really representative of reality in the ways people believe them to be. She does not believe that reality can be categorized and bounded in this way. She adds that there may be no fixed realities and no fixed bodies of knowledge "out there" because in the end we see things, not *as they are,* but *as we are.*

Corinna wonders if there is a change emerging in the way we view and experience reality. She has seen evidence over the years of a softening in people's attitudes towards her veganism and with the emergence of the deep ecology movement. She feels that there is a developing awareness of interconnectedness and of the need to respect for all living beings.

7.3.2 PEDAGOGICAL KNOWELDGE

Holistic Teaching Approach

Corinna aims to teach from a holistic perspective as she recognizes that many of her students are open to discussing the philosophical, the spiritual, the intellectual, and the metaphysical aspects of life. She commented on several occasions that, for her, the whole of the child needs to be educated, and not just the intellect.

When I queried as to how she saw the self she described it as an integrated whole that comprises the heart, the soul, the physical body, the mind, the emotions, and the metaphysical nature of the person. When a student or teacher is really present in the classroom then all these aspects of the self come to the fore and true learning can happen. It is then, she believes, that the true magic happens. This self is in evidence in the classroom through the many modes of presentation open to the students in line with Gardner's theory of Multiple Intelligences. Through encouraging performances of understanding Corinna is keen to make space in her classroom for the whole child and through positive feedback received from students she feels that her efforts are acknowledged and appreciated.

Teacher as Guide and as Dolphin

Corinna sees herself as a guide to the construction of insights and ideas and this can be seen in her classroom in the way she engages with students. She encourages participation and she helps students to make deep connections between ideas. She is very much part of the collective in the classroom and she freely counsels students and encourages them to share their life experiences and beliefs. She appreciates her impact on the lives of students and she sees that she is just sowing seeds for what each child will become later in life. Her role, she feels, extends beyond the walls of the classroom. She acknowledges the importance of not giving up on students and she appreciates the qualities of patience, integrity and presence, which she has developed over the years. She describes herself as a dolphin and she is glad to be teaching in the same way that a dolphin is joyous and exultant to swim through the ocean. Like a dolphin, she explains that, she loves to rise above and dive below the water - the water for her being an ocean of ideas.

The Teacher as Learner

Regularly, throughout our conversations and with the students, Corinna emphasized the fact that she sees herself as a learner, both within and outside of the classroom. She described herself as a guide by the side instead of a sage on the stage. On many occasions, during the lessons, I watched her develop insights that she previously had not considered and she regularly shared those insights with her students and with me. She acknowledges, graciously, that she is fortunate to be able to learn in partnership with her students and she appears genuinely interested in what they have to say. She appreciates how much she can learn from their uniqueness and their depth of insight.

Because she genuinely appreciates and values their insight and opinions, she regularly seeks their feedback and their advice in relation to the lessons and her teaching. She is humbled by much of the complimentary feedback she receives from students. During the community circle feedback sessions, for example, students commented on how accepted they feel in Corinna's class and that they feel that their thoughts and ideas are always valued. They also spoke about how much they appreciated being able to talk openly about their beliefs in a way that they felt that they were not dismissed but openly accepted and embraced.

Corinna pointed out that she acts on feedback that is not complimentary, especially, when it comes from the more thoughtful students. Corinna's not being defensive to feedback is much appreciated by the students. She acknowledges that she has developed in a positive way over the years in this respect. In the past, although she always felt that she listened carefully to students, it was often

more important for her to be right. Now, she sees the futility of letting one's ego get in the way of one's relationship with the students and she accepts thoughtful student feedback graciously.

She comments on how we essentially teach who we are and that what we believe, and how we are, in our essence, comes into each learning experience with us. For Corinna, teaching is about taking the best of ourselves into the classroom so we can become to the class what our consciousness is to ourselves – an essence that orients and guides thoughtfully, without controlling. At one point, during the course of the research, Corinna was enchanted by something that one of her students said to her. The child told her that that Corinna's voice was reflected in the voice of her consciousness.

Organization of the Room

The first thing that struck me when I walked into Corinna's room was the amphitheatre layout of the room. The room was set up in such a way that the maximum number of students could see each other during the lessons. Corinna chose this layout as she regularly had whole group discussions and the amphitheatre format fit this purpose. Ideally, she would prefer if her room was larger so that students could sit in a full circle - as this would be more representative of the kind of communication and collaboration that she was aiming to model within the group. As she spoke, I remembered, and shared, how the communication in the room had woven a complex web-like pattern during lessons involving whole-group dialogue. Corinna explained that this was essentially the kind of communication patterns that she was aiming for as it mimics life in so many ways – the interconnected web of life. She hopes that this kind of organization fosters communication, empathy and a sense of community amongst the students.

Atmosphere in the Room

Being in the room was a comfortable experience for a researcher. The atmosphere was always calm and peaceful yet charged with intellectual curiosity, humour and warmth. I felt at ease each time I entered the room and, somehow, time seemed to slow down during the lessons. The transition time between activities was always smooth and seamless and Corinna managed each group discussion in an unhurried and respectful manner. This was in evidence through a soft encouraging tone and gentle non-verbal communication signs to bring the class to attention or to signal transitions from one activity to another.

During a feedback session one of the prominent members of the class had expressed the need to comment on the degree of calm in the room. This seemed to surprise Corinna at the time, but when

she thought about it she agreed that the atmosphere was indeed peaceful and restful. She wondered if this may have to do with the contemplative nature of literature. For her, the calm and unhurried nature of the class may have to do with the fact that she sees teaching literature as more about exploration and learning than rushing to get through the content.

7.3.3 NATURE OF SUBJECT KNOWELDGE

Purpose of Literature as a Discipline

Through her literature classes Corinna hopes to awaken in her students the desire to engage themselves fully with the meaning of life rather than going blindly through the motions of life.

> *Corinna: Literature is for me about giving meaning – trying to figure out a meaning for life – trying to articulate a meaning for life – we are trying to grapple with these questions – "Why are we here? And what is the meaning?*

As I mentioned earlier, literature for her is about exploring the human condition. It is an avenue to talk about emotions, fears, desires and frustrations. It is, essentially, an exploration of the themes of our lives and these themes, she feels, need to be examined. This is the reason why most great works of literature are written and she is delighted that students in this class, in particular, are naturally exploring these themes already. For Corinna, English is philosophy, yet she recognizes that not all literature teachers approach literature in the way she does. She worries that some reduce the study of literature to the study of *mere plot points* and she has concerns about the effects on students of this overly reductionist approach. For Corinna, engagement with literature involves more than reductionist technique. At the same time, she recognizes that teachers may be at different stages in their personal and professional development and that this may impact their approaches.

Nature of Literary Knowledge

Corinna spoke about how her understanding of the nature of knowledge had changed over the years. She maintains that work on her PhD was illuminating with regard to what it meant to construct knowledge, meaning and understanding. This experience was pivotal in developing her understanding of different perspectives on the origin and generation of knowledge. When it came to the certainty of knowledge explored through literature classes, Corinna felt that considering the nature of the discipline there can be no certainty. Each individual constructs their own interpretation and, therefore, she is careful never to dismiss the perspectives of the students. Instead, she encourages them to bring these interpretations to the table so that they can be discussed and

elaborated upon through group discussion. She recognizes that beyond traditional discussion, there are a variety of other ways to engage students with literary works, and that students have a range of dispositions to draw upon beyond those normally associated with literary analysis. Essentially, they must find their own way to externalize what the works mean to them.

Methods of Inquiry in Literature

Literary analysis, for Corinna, involves looking at themes from different perspectives. Students compare and contrast thematic statements and theses and they make frequent use of analogy and metaphor. An example of a student's Thematic Statement: "Many of us have two sides, which we don't really recognize." Students are expected to reason with evidence when exploring themes using a PEA (Point-Evidence-Analysis) technique. PEA is a strategy for constructing a reasonable argument to validate an interpretation of a theme. Students in Corinna's class also practice journal writing, essay writing, dialogue, and they find quotes to support claims. Corinna points out to students that exploring literature involves perfecting basic literary analysis techniques before moving on to more in-depth techniques.

Figure 7.2 Applying the Planning framework to Corinna's profile
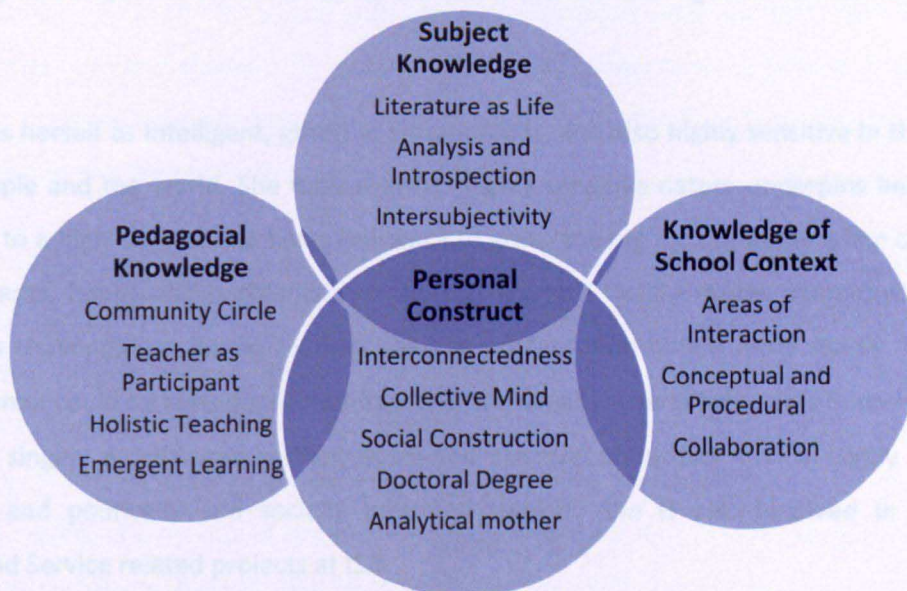
ANNA' S PROFILE – SPANISH LANGUAGE

7.4.1 PERSONAL CONSTRUCT

7.4.1.1 PERSONAL BACKGROUND

Anna grew up in Spain and the Netherlands, in a bi-cultural household. Due to the nature of her parents' complex relationship pattern, Anna needed to move several times in the early years of her life. Possibly, due to the nomadic nature of her early family life, and as a consequence of the regular moving, Anna felt unseen by her parents, and she felt that she was an outsider compared with other students at secondary school. She maintains that she was openly discouraged by her mother from performing publically because she believes that her mother did not want to be embarrassed, should Anna have performed badly.

Anna finds that her early childhood experiences have impacted her teaching in the sense that she has chosen to learn from a lack of positive parenting to become a teacher who makes an effort to encourage, to compliment and to *see* children. And because of her mother's tendency to be overly critical, Anna attempts not to judge others critically as she feels that we cannot possibly ever know what is in the heart of another person. On a positive note, Anna appreciates her mother's tendency to think deeply and to question the world, and the fact that she encouraged Anna and her brother to do the same.

Anna describes herself as intelligent, gifted in certain areas, and also highly sensitive in the way she relates to people and the world. She feels that her highly sensitive nature underpins her ability to conceptualize to a high degree. She has a tendency to grasp the big picture easily when considering complex concepts, issues and problems. She admits that this facility makes communication with linear thinkers challenging as linear thinkers tend to process information more slowly. Indeed, on many levels, Anna could be considered multifaceted: she speaks several languages fluently, she is an accomplished singer, a published author, a trained spiritual counsellor and a highly articulate, independent, and politically and socially informed thinker. She is also involved in numerous Community and Service related projects at ISA.

Anna's interest in teaching developed at university when she was completing a Masters in Applied Linguistics. She had always wanted to be a teacher as a child, but it was later in life, while tutoring students at university, that she was drawn back to this path. Part of her initial teacher training involved time in an international school. She liked the approach to teaching there, and following

graduation, she moved to work at the international school of Amsterdam to teach Mother Tongue Spanish and Spanish as a Second Language.

7.4.1.2 REALITY/EXISTENCE

For Anna, the fundamental nature of reality is love. She believes that the whole physical world is underpinned by this reality, even if it is not always apparent. This love is described by Anna as a drive to survive which is more obvious in humans than in other living beings due to humans' higher level of consciousness. For Anna, this love cannot be seen but it can be felt. She believes that she may sense it in this way because she is highly sensitive and kinaesthetically oriented.

Anna thinks that her perception of reality may have emerged as a result of early experiences with Christianity. Later, however, following disillusionment with the apparent contrast between Christian rhetoric and practices she developed more personal constructs of love. This was after several momentary transcendental experiences as well as through engagement with spiritually oriented teachings. The love that Anna describes is the guiding principle that supports her teaching approach. She feels that it dictates how she engages with the students and she senses that it underpins her personal relationships with them, both within and beyond the classroom.

Apart from a belief in love as the base of reality Anna also believes in the existence of the human souls and in reincarnation. She feels that each soul that inhabits a body has been here before and that a soul may need to pass through life on many occasions in order to learn what it needs to learn. She is not clear on what happens once a soul has learned its lessons, but she is not too concerned about the answer as she feels she will find out eventually.

When asked if it is possible to know the fundamental nature of reality, Anna doubts the full essence of reality can be appreciated by humans as it could be beyond our limited comprehension. Even so, she acknowledges that we may all have our own impressions as to what reality might be composed of and as to what truly exists. This could be different from individual to individual. She believes that through history there have been people who were, and are, able to connect with and link directly to the essence of reality. She mentions Jesus Christ, Joan of Arc, the Buddha as examples. Even then, she feels that each of these may describe the nature of reality differently depending on their unique way of being in the world.

As to how we exist in relation to others, the idea of being linked was a theme that developed during one of the lessons where Anna asked students to think about how their lives affect the lives of those

far away. There was a strong feeling from the discussion of the idea that we are all in it together. The idea of interdependence was highlighted throughout, including the idea that local issues have their roots in faraway places and vice versa. Her lessons seemed to be an avenue to bring the far away near. It was clear during the lesson that students had not considered the degree to which their existence affected the lives of others, and the degree to which the lives of others affected them. Although Anna had not fore-fronted the concept of interdependence during the lesson through conversation, she acknowledged that she regularly aims to ensure that students appreciate that everything is connected. She believes that thinking deeply through the issues helps students come to this awareness.

7.4.1.3 VIEWS ONLEARNING

Language Learning as Language Construction

Anna sees knowledge of language as constructed by individual students. This construction involves deep engagement with both the rudimentary aspects of language as well as additional abstract concepts. She feels that the process of language construction involves the subconscious mind. The learning of language, by the subconscious, depends on rule building through the creation of non-material *grooves*. For Anna, a student only achieves true understanding of grammar, for example, once the grammatical rule has been internalized and laid down in these grooves. The development of the grooves involves repeated encounters with particular constructions. She believes that the brain plays a key role in the development of these grooves and in the construction of language in general.

Anna reasons that, even though we can know something on a conscious level, it may take considerable time and reengagement with material and ideas before this information can become integrated on the subconscious level. When asked to expand on what she may have meant by the subconscious understanding Anna commented that this was difficult to explain. She sees it as an essence that is not of the physical world, and not necessarily brain-based, but an essence that may be distributed throughout the body.

> *Anna: And then the subconscious memory that is – we don't have a comparison for that because it doesn't exist in the physical world.*

> *Mary: And where do you think the subconscious is then?*

Anna: I think it is all over the body. It's actually in the cells themselves for some reason..........Knowledge comes in and it gets stored and it starts seeping down and your subconscious is processing it and it incorporates – and the more it grows the more it incorporates.

As such, she believes that in order to fully understand abstract concepts you need to feel them deeply. She does not mean feel on a sentient, biological level but in a grander sense involving knowing with one's whole being. She used the concept of love as an example of an abstract concept that relies on *whole being knowledge* as opposed to rational and intellectual definition.

Mary:s For example. How is it in you or how do you develop an understanding of a grand universal concept?

Anna: Oh! That's a good one. I don't think you can develop a cognitive understanding I think you have to feel it...real love as I see it I don't see it as an emotion...because an emotion is something localized in a part of your body.

Mary: With a chemical base...

Anna: Yes! But love is bigger than that – it's your whole being. It really involves your whole being. Something, like love, justice, compassion; you can't locate them.

Accessing Prior Knowledge

The degree to which a child feels abstract concepts and can lay down subconscious grooves depends, according to Anna, on their developmental stage, their previous exposure to language, and their innate ability. Much of the students' past exposure to language lays passive and dormant and it, therefore, needs to be activated in a meaningful way. And, so, in line with a student-centred approach to learning, Anna enables the students to access prior knowledge at the onset of a new topic. She chooses to do this in a way that engages students, not just with grammar and vocabulary, but also through the concepts and ideas that will also be explored through the unit. This was particularly evident in the Myths and Stories lesson where students generated ideas about the purpose of myths and stories, and also put forward the questions that were to guide the unit of inquiry.

Holistic Nature of Learning

For Anna, learning is a holistic student-centred endeavour that involves the mind, the body, the brain, the emotions and the spirit. She is keen for each student in her class to have a voice and to feel seen and her interest in the students extends beyond the classroom. She finds that how she engages with each child affects how the students engage with themselves.

> Anna: *You have got to see them and kids know when you see them and what they do. And it's crucial. And if you see them then they can look at themselves. And if you can see the good in them they will be more motivated to see the good in themselves.*

She sees the human being as composed of many different integrated layers and although she focuses primarily on intellectual pursuits through her language teaching she is always aware of the impact of the other facets of one's being on one's ability to learn. Particularly, in an assessment situation she tries to connect with the whole child before deciding what advice or support is either needed or accessible before she gives verbal feedback or before she writes her comments.

A Focus on Thinking Skills

The depth of conceptual understanding that Anna aims for is considerable considering the fact that students in two of the classes are, for the most part, conversing in a language that is not their own. Anna deliberately chooses topics that she feels will be of interest to the students and she encourages the students to develop their own personal understandings of the ideas being discussed. With the more able students she encourages philosophical inquiry centring on abstract concepts such as beauty, freedom, love and the like. She also engages students with concepts that are explored at the same time in other disciplinary areas, such as the Humanities. In the lesson related to philosophical inquiry the students are expected to generate conceptual understanding by themselves. Anna does not seem to be imposing the concepts that the students are extracting from the book.

It is clear from this and the other lessons that student reflection and thinking play an important role in Anna's classroom.

> Student: *If you don't have your own thoughts then we'd all be the same. The world wouldn't have rhythm, characteristics and personality.*

For example, in the assignment related to *The Thinking Game* book, the individual activities that she chose encouraged the students to explore philosophical ideas, as well as the nature of thinking itself. One of the students commented that the girl in the story they were reading was interested in depth and understanding, and not just in exploring the surface of big ideas. And another commented on the fact that an exploration of ideas encourages one to think more deeply. Anna encourages students to talk about what thinking is, and why effective thinking is important for them in their lives.

> *Anna: The question they were exploring was - Why do we think? What do we need to think for? What does thinking do for us? Why should we think? Why don't we just learn or whatever? Writing on the subject and writing their own ideas would help them see that thinking things through they would understand them better and you are going to be able to make more informed decisions.*

She is adept in the language of thinking and she appears to have detailed knowledge of strategies that are beneficial in the fostering of thinking in students. In addition, Anna makes consistent use of phrases such as "considering different viewpoints", "making connections" and "considering multiple perspectives". Interestingly, these are expressions used regularly within literature and strategies related to Harvard's Visible Thinking, a program Anna has participated in over the years.

Consideration of Multiple Perspectives

Because Anna is aware that students and people in general develop alternative realities or pictures of the world, she feels that it is important to engage students in a consideration of multiple worldviews and perspectives. She encourages awareness of the many windows through which the world can be seen. She feels that this kind of openness and awareness is important within an international school environment where the perspectives of the parent-body tend to be grounded in more rational beliefs. In considering different beliefs she hopes that her students will be better able to connect to the larger world beyond their own backgrounds.

> *Anna: ....we live in a society that is mostly rational. And these kids are from highly educated and often economic and scientific backgrounds more than more liberal ones. They often have been taught to think that way. So what I really hope is that by having them explore things from different perspectives and by looking at things from different sides that (they see that) there isn't always a one way answer to things.*

Anna keeps this goal in mind when she is choosing books and topics for her classes. It is clear from the comments given by students following a reading of *The Thinking Game* that this is what the girl in the story is doing with her father: through philosophical inquiry she is becoming more knowledgeable about the world. The students clearly articulated this point during their reflections and they were able to relate the girl's experience to their own situations.

Anna adds that individual perspectives and realities regularly overlap when people come together who have experienced similar backgrounds or if they share similar innate abilities. In society at large, Anna suggests, these shared understandings are usually commonly agreed upon facts.

Multiple Intelligences: Multiple Approaches to Learning

The pace at which one learns, according to Anna is often related to one's particular predispositions and previous exposure to languages. Having a keen understanding of the different kinds of predispositions that students might have, Anna makes an effort to differentiate assignments in a way that students can make use of their natural dispositions to demonstrate their conceptual understanding. She justifies this by referring to the idea that we all have different intelligences and that students need to be given an opportunity to express their understanding of concepts through these intelligences, but that that they also need to "stretch their rubber bands" – meaning that they need to engage with modes of learning that stretch their lesser developed capacities as well.

A good example of this approach was to be seen in the lesson about philosophical inquiry and *The Thinking Game* novel. Here students were encouraged to use multiple modes of presentation in order to demonstrate their understanding of the concepts of thinking, knowledge and freedom. Students used video, posters, music and dance to get their ideas across. All students were given the opportunity to demonstrate understanding through media that they could easily relate to, particularly those who chose to use images and metaphors to explain their thinking.

7.4.1.4 VIEWS ON LEARNERS

Anna sees each student as having both a material and a spiritual essence. For practical reasons, she acts as if the student is a purely physical and mental being when teaching, as she is conscious that her role, at the end of the day, is to teach Spanish. However, she acknowledges that she can read the energies of students and that this information informs how she engages with students, how she assesses and provides feedback, and how she groups individual students. She maintains that she reads the energies by connecting with their auras. She describes this *sensing* as an extra-sensory

experience, one that is a more subtle form than the usual five senses. Anna describes this way of engaging with students as "seeing" and she feels that it gives her the ability to connect with the class in a way that extends beyond what a regular teacher might be consciously aware of.

7.4.2 PEDAGOGICAL KNOWELDGE

APPROACH TO TEACHING

Holistic Approach

Anna believes strongly in a holistic approach to education and her reference to holism was a constant thread through our conversations. She feels that the whole being is involved in each learning experience. She acknowledges that this is not the standard perception of language teaching but she feels that this is what works for her. This is evident in her classroom, in the way it is structured, in how she communicates with the students, and in the concepts she chooses to engage them with.

> *Anna: We make decisions based on what our students need to achieve academically, and in my opinion, as people. I think that educating the whole person also means getting them to see the world in more than one way and to look outside themselves.*

In line with the philosophy of holistic teaching Anna's lessons are primarily student-centred. She engages students with ideas that are important to them but, above all, she wants them to feel good about their learning and about themselves. She feels that this is the key to learning. She provides positive feedback where she can and she makes an effort to connect with students beyond the subject as well, whilst remembering that a key aspect of her role is that they also develop as learners of Spanish.

When asked how her understanding of language development affects her teaching she commented that in general she tries not to meddle when students make verbal mistakes as she believes continuous real-time corrections will have no lasting impact on learning. Learning will happen when the learner is ready to navigate different levels of understanding and when certain experiences have been encountered often enough. This understanding encourages her to let go of controlling the learning so that she can support students in learning at their own pace.

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ROLES AND RELATIONSHIPS

Teacher as Facilitator

Anna's role in the classroom appears to be that of a facilitator. She does not have a regular place to be and she can be observed weaving between the students in order to support them when they need translations and support. She chooses not to interrupt and correct students when they are speaking as she feels that this will only distract them. Anna appreciates that students need to see the human face of the teacher and, as such, she aims to be herself in the classroom. She acknowledges that if a teacher presents their authentic self to the students they can see beyond the occasional bad mood because they recognize that the teacher genuinely cares about them. She also sees herself as a sower of seeds, meaning that the ideas that she engages the student with have an impact on whom they become as people.

ORGANIZATION OF THE ROOM AND ATMOSPHERE

Café Style

Anna's room is set up in a relaxed café style. There are open couches organized in a large U shape formation. She consciously chose this classroom formation so as to encourage the students to communicate more freely – similarly to how they would in a natural real-world setting. It is clear that the room is set up to encourage collaboration, guided discussion and dialogue. This was in evidence in the way that students worked together during the different lessons.

Linking Within Groups

Anna believes that when students come together in groups they become energetically linked. These groups are entities that change over time and that change depending on the presence or absence of individuals. She describes this linking energy field as web or cloud-like, and says that different energies emanate from different groups. She sees this energy as something that comes together to form a *whole* that then diffuses through the group. Anna finds that there is disparity between men and women's tendencies to be linked, and to energetically connect with others. This was a recurring thread in Anna's responses, and she attributes this difference in abilities to link to the natural ability of women to give birth and to engage with small children. That this linking energy can be felt, but not quantified, is why she believes that most people avoid bringing it up in an academic setting.

7.4.3 NATURE OF SUBJECT KNOWELDGE

Nature of Language Knowledge

Anna maintains that language-based knowledge is complex in nature. It is a physical manifestation supported by a secondary non-physical and sub-conscious base. She is unable to describe the nature of language-based knowledge, and she feels that although the brain and body play a role in language development it is the whole being that processes language. At the same time, she appreciates the cognitive impact of mother tongues on subsequent foreign language learning.

Methods of Inquiry

The teaching of language involves students being in regular real-life conversation with one another. Continual emphasis is placed on the repetition of phrases and grammar and all new vocabulary, and grammar is embedded in contexts that are engaging and at times provocative. Metaphor is frequently used as a literary device as was the case with the symbolism involved in the presentations connected to the *Thinking Game* book. Myths and stories were also in evidence as literary products to teach the past tense.

7.4.4 KNOWLEDGE OF CONTEXT

Anna places significant emphasis on student inquiry and on the exploration of big ideas. She includes multiple references to the Areas of Interaction as was particularly evident in the lesson relating to Myths and Stories, which places an emphasis on Human Ingenuity. Her lessons are grounded in real world ideas and she makes an effort to connect her subject with what is happening in other curricular areas. Through her rhetoric, and through the activities that she engages the students in, it is clear that she is a proponent of Visible Thinking as she consistently emphasises the development of thinking skills.

Figure 7.3 Applying the Framework to Anna's Profile

Subject Knowledge
Conversation
Contextualized
Enigmatic

Pedagocial Knowledge
Philosophy
Holistic Approach
Teacher as Guide
Critical
Constructivism

Personal Construct
Reality as Love
Whole Being
Mother: Critical and Questioner
Applied Linguistics

Knowledge of School Context
Areas of Interaction
Visible Thinking
Collaboration
Big Ideas
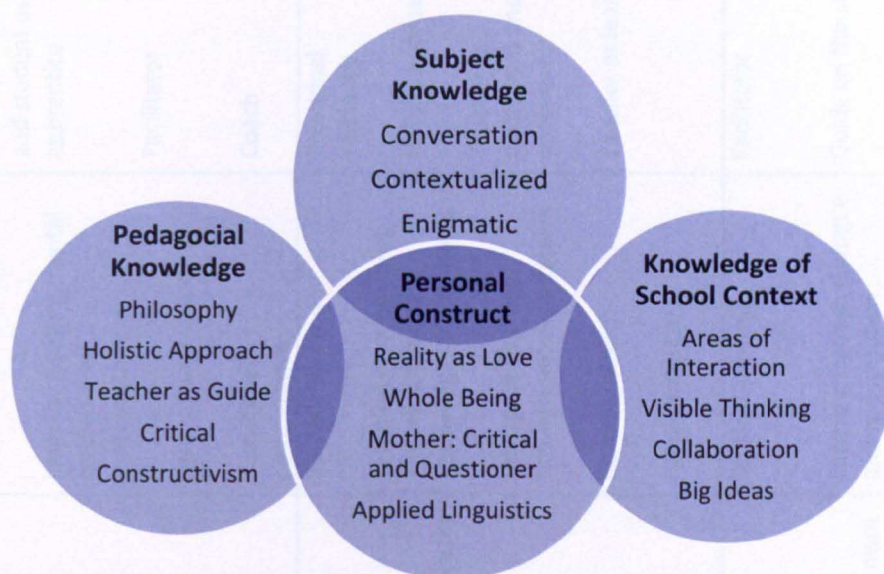
7.5 Overview of the Main Points from the Profiles

Following completion of the main profiles it was possible to isolate some of the main beliefs and practices that had emerged for each of the teachers. They are recorded on Table 7.1 using the same format that was already introduced in Table 3.2 to align potential relationships between approaches to constructivism, ontological and epistemological views, and approaches to teaching. There are a number of similarities and differences that appear between the teachers' beliefs and practices when the main points from the profiles are aligned, and these will all be discussed in detail in the next chapter.

Table 7.1 Overview of the Main Points from the Teachers' Profiles

	Ontology (Reality)	Nature of Learners	Epistemology (Knowledge)	Approach to Constructivism	Learning	Teaching
John	Nature of reality may be unknowable Reality is *Energy* Reality is inside the individual – *subjective* Nature of reality is considered *irrelevant*	Independent cognizing entities Learner as mental and material being	Knowledge is constructed by the individual Knowledge is knowledge when it serves a practical purpose Accumulated by collecting evidence	Piagetian Constructivism Pragmatic Performance Constructivism	Topic and teacher centred Learn by building mental models and representations Semi-inquiry-based Sometimes co-operative	Teacher as mentor and student as apprentice Facilitator Coach
Corinna	Nature of reality may be unknowable Reality is a state of *Inter-connectedness* Reality inheres in the relationships between phenomena and knowledge of phenomena *Intersubjective* *Interobjective*	Independent and group cognizing entities Learners as spiritual and material beings Existence of a collective consciousness	Knowledge is (partially) constructed by the individual Knowledge is relational Knowledge is co-created from within the collective	Piagetian Constructivism Social Constructionism Collective Constructionism	Student centred Learning by connecting knowers, teachers, knowledge, and contexts Emergent learning through self-organization Contextualized Community Circle	Relational pedagogy Holistic approach Teacher as participant and co-constructor Teacher as learner
Anna	Nature of reality may be unknowable Reality is *Love* Reality is between individuals *Intersubjective*	Independent cognizing entities Learners as spiritual and material beings Learners as "linked" through energy cloud	Knowledge is constructed by the individual Knowledge results from common understandings Knowledge needs deconstructing	Piagetian Constructivism Social Constructionism Critical Constructionism	Student centred Learning through dialogue and conversation Involves deconstruction Contextualized	Facilitator Guide on the side Provocateur

CHAPTER 8

COMPARISON AND DISCUSSION OF THE TEACHER PROFILES

8.1 A comparison of the teacher profiles

The following section involves a comparison and discussion of the teacher profiles. Tables provide an initial overview of the main points elaborated upon in subsequent paragraphs. They are discussed, where relevant, with research material introduced through the literature review.

8.2 Personal Constructs

Table 8.1 Comparison of Personal Backgrounds

PERSONAL BACKGROUNDS				
		John	Corinna	Anna
SIMILARITIES	Impact of teachers' parents on teaching approach	John was influenced by his father's ethical way of being	Influenced by her mother's analytical mind, her independent nature and her love of books	Influenced by the critical behaviour of her parents Mother encouraged her to question
	Role of tutoring on choice of teaching as a career	Interested in teaching whilst tutoring at university	-	Interested in teaching whilst tutoring at university
DIFFERENCES	Educational Background	Science Degree Post Graduate Diploma in Education	Liberal Arts degree Masters and PhD in Education	Degree in languages MA in Applied Linguistics

The Impact of Parents

Parents seem to have played a significant role in the development of life-long interests and teaching approaches of the respondents. For example, Corinna's love of reading was fostered by her mother's keen interest in literature, and John's principled and ethical bearing seems to stem from respect for his father's political leanings and social engagement. Anna, by comparison, considers the

less endearing qualities of her parents as an impetus for her to do better, and this is what fuels her attention to the affective needs of her students.

Tutoring at University

Both Anna and John developed an interest in teaching whilst tutoring younger students at university. The act of helping younger students move forward with their studies or keeping them safe around chemicals encouraged them to complete post graduate courses in education.

Impact of Educational Levels

One aspect of the teachers' backgrounds that seems to impact their beliefs and teaching practices is their level of post-graduate education. Corinna, having completed doctoral level research in education, is comfortable with the language of the philosophy of research. Her knowledge of research related vocabulary helps her to articulate her educational philosophies in depth and it helps her to discuss theories of knowledge at an advanced level. With a Masters' degree in linguistics Anna is capable of discussing her philosophy of education confidently and she has a well-developed understanding of language development. John, who has completed science studies at Bachelor degree level, was less inclined to discuss theories of knowledge and he preferred to keep the nature of science learning relatively unproblematic for his students. The question of the degree to which study at advanced degree levels leads to a more sophisticated level of epistemological development is an interesting one and it that seems worthy of further exploration.

8.3 PERSPECTIVES ON THE NATURE OF REALITY (ONTOLOGY)

The following section compares teachers' beliefs regarding the fundamental nature of reality (ontology) and it considers whether the nature of this reality can be known.

Table 8.2 Comparison of Perceptions of Reality

PERSPECTIVES ON REALITY (ONTOLOGAL BELIEFS)				
		John	**Corinna**	**Anna**
SIMILARITIES	**Knowledge of Reality**	Nature of reality is unknowable by conventional means People have personal perceptions of reality		
	Common Attributes	Matter and Interdependence are fundamental attributes of reality Different people experience reality differently – these personal perceptions are difficult to describe to others		
DIFFERENCES	**Fundamental Nature of Reality**	Energy	Interconnectedness	Love
	Knowledge of Reality	Can be improved by the use of technology that extends beyond the five senses	The totality of reality is beyond human comprehension Has possibly been accessed by key spiritual leaders	Engaging with reality is beyond the ability of human minds Some individuals may have accessed reality directly through transcendental experiences

THE FUNDAMENTAL NATURE OF REALITY

There seemed to be a general consensus amongst the respondents that knowledge of the fundamental nature of reality may be beyond the grasp of ordinary humans. They believe that the fundamental nature of reality is unknowable for a variety of reasons, e.g., the limitations of human perception, conceptual limitations and the fact that as we evolve and as our perspectives change we learn to see things differently. Practically speaking though, all three believe that the visible world is

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composed of matter and that we relate to this matter through the five primary senses, although Anna claims to experience an additional sensing ability.

All three believe that people generally live their lives as if the everyday macro world has a predictable cause-and-effect way of behaving. Within this material realm they maintain that all living and non-living elements exist in a state of dynamic interdependence. John, for example, comments on the point that we are all composed of atoms formed inside of stars. Anna built one whole lesson around the idea that what happens to others in faraway places impacts our lives and vice versa. And, for Corinna, the inter-related nature of all living beings is a major thread throughout her lessons and during our conversations.

Although in agreement on the interdependent and/or interconnected nature of existence and reality within the material realm, the teachers differed in their understanding of the fundamental nature of reality. For John, it is clear that a form of energy, which manifests itself in subatomic inter-relationships, is the basis of all that exists. He acknowledges that this is an accepted perspective within Physics, although he appreciates that it is not a mainstream perspective. Energy, John said, is not composed of matter but he is not sure how to describe it. Indeed, he sees the nature of energy as one of the fundamental concepts usually circumvented by science. Nevertheless, energy is the main concept that underpins his year long integrated science course.

Similarly, Corinna found it difficult to describe what she means by interconnectedness as the basis of reality but, putting it simply, she feels that all beings exist in relation to one another on a deeper level than one might normally consider. She sees that this perspective influences her life and her work. In an educational context, for example, she experiences teaching as a state of interconnectedness between herself and her students. Anna also speaks about the interrelated nature of reality and she feels this interrelatedness as a form or love. For her, this love is something akin to the will to survive and she maintains that it needs to be felt deeply. She claims that this perspective affects her personal relationship with her students, and it informs her interest in spirituality and holistic approaches to teaching and counselling.

Knowledge of the Fundamental Nature of Reality

John appreciates science and technology's efforts at going beyond the limits of human perception in order to explore aspects of the reality that lie behind the visible spectrum. Corinna, however, finds that scientific research does not always take into account the complex nature of reality. Although Anna holds a positive regard for scientific inquiry, she demonstrates an equally positive regard for

philosophical and spiritually oriented ways of knowing. Indeed, she feels that a lot of what she does in her classroom is aimed at balancing out the perspectives of students who are born to parents with scientifically oriented worldviews.

Both Anna and Corinna believe that there have always been, and still are, people who are able to tap into the fundamental nature of reality during transcendental experiences. Anna explained that she has directly experienced, what she describes as, the fundamental nature of reality on several occasions as a state of grace. She wonders if this state is similar to the transcendental state described by early Christian contemplatives or Eastern mystics. She questions whether this capacity to connect with the fundamental nature of reality is more common than might be generally realized.

On considering the similarities and differences between teachers' beliefs on the nature of reality, and whether it can be known, it is clear that the teachers' perceptions extend beyond what is currently being explored through the research methods used to assess teachers' ontological beliefs. Schraw & Olafson's (2008) two-dimensional grid, for example, which encourages teachers to identify their beliefs along a continuum from realist to relativist positions, does not seem to account for more personal views on the fundamental nature of reality. If, as Ryan (2006) suggests, it is from our ontological "being" or worldview that we interpret the world and how we see our place in it, and if as Kang (2008) suggests, these beliefs affect our epistemological perspectives then it appears that more personal views are worthy of consideration. The teachers in this study were quite eager to share their beliefs, and interestingly their beliefs seem closely connected to their view of learners and learning, their approaches to teaching and the concepts they choose to engage their students. These points will be raised individually in subsequent sections.

8.4 PERCEPTION OF LEARNERS

The following section compares teachers' views on the nature of learners and considers views of learners as individuals and as groups.

Table 8.3 Comparison of Perceptions of Learners

PERCEPTION OF LEARNERS				
		John	**Corinna**	**Anna**
SIMILARITIES		The individual mind and brain play a role in the learning process. Individuals as cognizing agents		
DIFFERENCES	Nature of the Individual	Learner as mental and material being and the principal locus of cognition	Learners as spiritual and material beings Cognition as distributed	Learners as material and spiritual beings Cognition as distributed
	Role of the Collective	Group Dynamics – Personalities	Collective Mind Collective Consciousness	Collective Energy Cloud

The Role of the Individual in Learning

For each of the teachers the individual plays a significant role in the learning process. Corinna comments, at length on aspects of the deep self, John comments on the role of the individual brain in learning and Anna comments on the need to teach the individual aspects of the person. Where perceptions differ, however, is in how the teachers see the nature of individual learners and how they perceive the nature and learning potential of groups.

The Nature of the Individual

John sees students as intellectual beings composed of matter. He believes that there is no evidence for the existence of a non-material component of being such as a soul and he is, therefore, sceptical as to whether it exists. For John, death extinguishes the life of the individual. Corinna, on the other hand, sees students as complex emotional, intellectual, philosophical, physical, and metaphysical beings. For her, each being has a soul and a spirit and the latent memories and capacities of each person may originate and extend beyond this lifetime. She sees each student as a microcosm of the

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class and she speaks at length of the existence of a deep self. Anna, like Corinna, speaks of the holistic complexity of the individual. Both Corinna and Anna intuit that there may be a dimension to individual selves that we may not be capable of understanding and that we may be connected to others in ways that are difficult to imagine. Their views of learners seem aligned with their views on the interconnected and interrelated nature of living beings.

The Role of the Collective in Learning

The idea of latent connections followed through in Corinna's contemplation of what might be happening with groups of students. She believes that there is a transcendent and magical quality to groups that emerges when a critical mass of students gather, who are capable of thinking deeply about significant concepts and philosophical issues. She believes that this view of groups extends beyond what is generally referred to as group dynamics. She referred to the class as a collective entity that behaves as if it has a collective consciousness.

Anna has similar feelings regarding the complex nature of groups and she referred to their perceived transcendent quality as a "cloud" of energy that diffused through groups to give them a special essence. Anna feels that the essence of groups has to do with what is going on with individual children and when individual children are not centred she feels that they can become disruptive elements that affect the energy of the whole group. For her, disruptive elements might not want to be *seen*. This idea of students needing or not needing to feel seen had come up in conversations with Corinna as well. In contrast to Anna and Corinna's views on the role of groups in learning, John believes that the individual personalities of the students can impact group dynamics and the ability of other students to stay on task.

Clearly there is a difference in the way that groups of learners are perceived by each of the teachers. Corinna was very interested in discussing the point further. Her interest in groups as learning collectives reflects research that is currently unfolding in the area of the complexity sciences. Corinna describes groups as a critical mass of students that generate a synergy that ends in the collective (the whole) being much greater than the sum of the individuals. Research from within the complexity sciences indicates that under certain circumstances individuals can spontaneously group themselves into functional learning collectives where the collectives have integrities and potentialities that are not represented by the individual (Newell, 2010). There are clear overlaps between Corinna's and Newell's descriptions. For Corinna the circumstances that enable groups to learn in this way include critical thinkers coming together to share and discuss their ideas within an environment that is loosely bounded.

8.5 VIEWS ON LEARNING

The following section compares the ways in which teachers view the processes involved in learning. It considers their individual approaches to the construction of conceptual understanding.

Table 8.4 Comparison of Views on Learning

VIEWS ON LEARNING				
		John	**Corinna**	**Anna**
SIMILARITIES		Collaboration is a common pedagogical feature of classrooms Students are given the opportunity to access prior knowledge There are mismatches between individuals' understanding of even basic concepts		
DIFFERENCES	**Influence of Prior Student Knowledge on Unit Planning**	Prior knowledge does not appear to impact planning	Planning is informed by student dialogue	Students' prior learning has a direct impact on planning
	General approaches to constructivism or constructionism	Piagetian Constructivism *Pragmatic (Performance) Constructivism*	Piagetian Constructivism Social Constructivism Collective Constructivism	Piagetian Constructivism Social Constructionism Critical Constructionism

The Role of Collaboration

The research respondents all appreciate the role of student collaboration in learning. In each of the classrooms students were working in pairs, in small groups and in larger groups to brainstorm ideas, to share personal understandings and to construct meaning. In the English class students worked on the *Frankenstein* quotes together to match the thematic statements with quotes from the book. In the Spanish class students created projects together based on concepts from the *Thinking Game Book*. In the science class students worked together to carry out practical investigations and to

construct models of combustion equations. In general, the organization of the rooms facilitated group work, although the row format in half of the science room seemed to impede collaboration.

Accessing Prior Knowledge and Planning

In all classes students were asked to share their personal understandings of ideas before moving forward with activities. For each of the respondents, it was clear that students would inevitably develop their own understandings of concepts depending on their individual past experiences. This point was most evident in Corinna's classroom where both she and the students made continual references to knowledge gained through their lives and the impact that this knowledge had on their understanding of the novel *Frankenstein*. The opinions and initial ideas of the students regularly directed the flow of the dialogue. Corinna urged students to modify or change the nature of particular activities if they felt that they disagreed with her suggestions. Anna also structured her classes according to the responses she received from her students. She did not seem to have preconceived plans as to how the lessons would unfold. In John's classroom students' ideas were solicited at the beginning of each lesson to highlight the focus of the lessons for the day. This helped the students to make connections to prior lessons but it did not appear to have a direct impact on the direction of learning.

Mismatch between Conceptual Understandings

Despite the variations in the teachers' approaches, they all commented on the degree to which students develop different understandings of basic concepts. John commented that given the abstract nature of concepts the best we can hope for is that people have similar internal pictures of these concepts. He cautions that there is no way of telling for sure if one person's interpretation of the concept of energy, for example, is the same as another's. This idea of a mismatch in concepts was also a point of interest for Anna who feels that we all exhibit different degrees of understanding of everyday concepts. Corinna added that this mismatch is particularly evident when it comes to interpretations of grand universal concepts. The respondents often discussed students' knowledge in terms of *compatible* rather than *identical* interpretations.

Construction of Knowledge and Understanding

In the development of conceptual understanding the teachers believed that students' interpretations were personal interpretations. This recognition of the individualistic nature of conception and learning indicates a constructivist approach to learning and it appears that each teacher exhibits their own particular blend of what constructivism looks like. The individual blends of constructivism practiced by each of the teachers seems influenced by their understandings of how

abstract concepts develop over time, by their understanding of the role of the brain in the development of conceptual understanding, and by the nature of their disciplinary areas.

Piagetian Constructivism

The respondents all believe that students' perceptions and conceptions develop through internal conceptual structures called schemata. These schemata, they believe, enable students to construct different kinds of internal representations of concepts with the help of facilitation techniques of the kind suggested by Jean Piaget. According to John, the action schema that develop are grounded in brain and bodily-based cognitive processes and they are represented as a closely knit internal conceptual network that is linked and interdependent. Anna's emphasis is on the development of internal grooves and the stages of adaptation associated with the assimilation of language reflecting Piaget's internal action schema and his idea of developmental stages in learning. Corinna maintains that action schema can change when conflicts emerge between a learner's internal constructs and experiences of the external world. She chose not to elaborate on this view as she believed that learning seemed more complex than this.

Pragmatic (Performance) Constructivism

In addition to a Piagetian view of learning John's notion of learning also seems to reflect the performance approach to constructivism advocated by David Perkins. Perkins' (1998) perspective is influenced by the pragmatic philosophy of John Dewey. The focus during John's science classes is evidently on thinking and doing and on how students are able to apply the knowledge that they have learned in practical investigations and modelling activities. John is not so much concerned with whether what is being learned is a representation of something in the external world as much as whether it enables the students to make use of the information in a practical way. John avoids questions relating to the nature of scientific knowledge by suggesting that students need to learn established scientific ideas and facts so that they can make use of this information for practical purposes. Although John has a developed personal understanding of the epistemology of science he does not think that his beliefs should influence science learning in the adolescent years. In these years he prefers to focus on the empirical nature of science and on the development of students' ability to reason with evidence and to apply their understandings of scientific concepts. In line with Perkins' (1998) views, John sees understanding (learning) as evident in the performance of science. Anna and Corinna were also keen to have students demonstrate their understanding of concepts through a variety of modes but this did not seem to be their principal focus.

Social Constructionism and Collective Constructivism

In addition to a Piagetian view of constructivism, Corinna's approach also seems to relate to the social constructionist writings of Lev Vygotsky. She believes that knowledge is constructed through consensus and dialogue and that it is inhibited by the constraints of language, which she believes is only a pointer towards the ultimate nature of things. On a closer look, however, her approach also echoes recent research relating to a form of constructivism that could be called collective constructivism. Although grounded in Vygotsky's theories relating to the inter-subjective nature of knowledge, a collective constructivist approach suggests that learning is not only an inter-subjective experience, but also an inter-objective one that takes into account the interaction of the knowers, the knowing, the known and the context of learning. As mentioned earlier, Corinna is intrigued by the learning ability of groups, and in line with Sullivan's (2010) observations that new knowledge emerges through groups, Corinna speaks about the ability of her groups to construct new knowledge from within. She feels that this happens best when groups are engaged in meaningful dialogue and when there is room for dialogue to *expand into the space of the possible* (Davis, 2004). When the conversations are not overly restricted she notices that both she and her students have the opportunity to understand topics and issues on a deeper level. She sees herself less as a mentor and more of a participant in the group and she is motivated by the fact that she is not in control of where the learning will go.

Social and Critical Constructionism

Similarly to both John and Corinna, Anna draws her inspiration from a combination of constructivist perspectives. She complements a notably Piagetian view of language construction with an added emphasis on collaborative discussion, conversation and dialogue. These approaches are suggestive of Vygotskian social constructionism. Anna's approach, like Corinna's, reflects an inter-subjective view of knowledge and with a background in linguistics it is perhaps not surprising that she has a developed understanding of the role played by language in forming students' interpretations of the world. She plans her programs to engage students with provocative ideas that are designed to deconstruct their linguistically bound interpretations. Reflecting a critical constructionist's view of learning she sees education as an avenue to critique and transform social realities. She finds it important that her students question the worldviews of their parents so that they can connect to the worlds that lie beyond their backgrounds. This critical approach to constructionism did not seem to be as prevalent in the other two classrooms.

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8.6 VIEWS ON KNOWLEDGE (EPISTEMOLOGICAL BELIEFS)

According to the range of research studies explored in the literature review, teachers' approaches to constructivism are often linked to the level of sophistication of their epistemological beliefs, these being ideas about the certainty of knowledge, the process of knowing, and the sources and justification of knowledge claims (Hofer & Pintrich, 1997). As explained earlier, epistemological beliefs are generally thought to emerge along a trajectory from naïve to more the sophisticated, with naïve beliefs being those with the certainty of knowledge and the notion that knowledge can be received from outside. Higher levels of epistemological development are generally associated with constructivist approaches to teaching and learning.

The following table, Table 8.5, provides an overview of the similarities and differences between teachers' epistemological views. Comparisons and discussion relating to Table 8.5 will be supplemented by referring to sections of Table 3.1 that was introduced earlier in the literature review to compare different epistemological belief models.

Table 8.5: Comparison of Views of Knowledge and Knowledge of Subject

		John	Corinna	Anna
VIEWS ON KNOWLEDGE, AND KNOWLEDGE OF SUBJECT				
SIMILARITIES	**Knowledge as provisional**	Scientific knowledge is regularly updated	All literary constructs are time-bound and dynamic	Language acuity and fluency develops over time
	Knowledge by Inquiry	Students need to carry out an independent investigation – with help	Students need to research examples for *This I Believe* essays.	Students need to apply research learned in other contexts, e.g., humanities
	Knowledge validated through reasoning with evidence	Validation of investigation approach	Supporting claims with quotes from the book	Justifying techniques used on the posters for the Thinking Game book
	Knowledge beyond the five senses	Knowledge from dreams and inspiration	Knowledge involves the whole being	Knowledge involves the whole being
	Contextualization of Knowledge	Students are inducted into the practices of a scientist	Themes and activities connect to students' lives and beliefs	Themes and topics relate to students' experiences and what they would like to know
DIFFERENCES	**Methods of Inquiry**	Scientific Method Investigation Modelling Diagrams	Dialogue Reflection Introspection Analysis	Discussion Conversation
	Specific Nature of Subject Knowledge	Objective Evidence-based	Inter-subjective Inter-objective	Inter-subjective Kinaesthetic

Certainty of Knowledge

None of the teachers adhered to an objective view of the nature of knowledge of the kind indicative of the lower end of epistemological beliefs development as displayed in Table 8.6. Their perspectives contrast with a view of reality as knowable, absolute and certain. They each believe that it is up to the students to construct their own personal understanding of the main concepts. They acknowledge, however, that certain practical rules and procedures need to be learned in order to guide inquiry and conceptual construction. These included the steps of the scientific method, approaches to literary analysis and grammar and sentence constructions.

Table 8.6: Lower Levels of Epistemological Development

Epistemological Model	The Perry Scheme	Ways of Knowing	Epistemological Reflection Model	The Reflective Judgment Model	Argumentative Reasoning Model
Researchers	Perry (1970)	Belenky *et al.* (1986/1997)	Baxter-Magolda (2001)	King & Kitchener (2002)	Kuhn & Weinstock (2002)
Low Level of Epistemological Development		Silence			
	Dualistic	**Received Knowing**	**Absolute**	**Pre-reflective**	**Realism**
	Truth can be known Right and Wrong Views Certainty of Knowledge	Knowledge comes from an external source and not from within	Knowledge is certain	Knowledge can be known with certainty Cognition involves rote memorization	Assertions are copies of reality Reality is knowable

Knowledge as Provisional

Regarding the certainty of knowledge, all teachers see general concepts and subject specific knowledge as provisional. From an English literature perspective Corinna claims that all knowledge is tied to personal experience and as a person changes, one's interpretations of texts changes. Anna also acknowledged the transitory nature of language structures. However, she stressed the relative short-term stability of grammatical expressions. John, like Anna and Corinna, acknowledges the provisional nature of scientific laws and theories but he thought it important not to overly confuse students with the epistemology of science until they were older, whereas Corinna and Anna were comfortable discussing the criteria of knowing with students.

On comparing the teachers' views on knowledge and knowledge construction to the epistemological models reviewed earlier, it appears that their beliefs and practices reflect the higher end of the epistemological beliefs continuum as they seem to rest between Perry's (1970) *relativist* and *commitment to relativism* categories. As can be seen in Table 8.7, at this developmental stage, individuals appreciate that knowledge is uncertain and that there can be many different interpretations of the same events. Baxter-Magolda (2001) describes this same stage as the *independent knowing* stage, and Kuhn & Weinstock (2002) describe it as the *multiplistic* stage in the development of epistemological beliefs. It was clear in each of the classrooms that the teachers structure activities to enable their students to consider a variety of perspectives and viewpoints. This was particularly apparent in Anna's and Corinna's classrooms but less so in John's.

What seemed less obvious, at least in the lessons that I observed, was whether there was sufficient time allowed for the critical evaluation of the students' perspectives. At Perry's "commitment to relativism stage"of epistemological development, individuals learn to appreciate that some beliefs and opinions are more valuable than others. Baxter-Magolda (2001) describes this stage as the *contextual knowing* level, where, although still multiplistic and uncertain, knowledge is judged by the evidence that appears within a given context. Although Anna, and John to a lesser extent, encourages students to share their ideas publically, these ideas were not always critiqued and challenged by the group in order to consider which ideas might be most valuable. Corinna, however, encouraged a significant degree of dialogue and discussion during which students challenged each other's findings and perspectives.

Contextualization of Knowledge

More advanced epistemological perspectives are also related to the contextualization of knowledge, not just in relation to the context of the inquiry, but also in the context of the students' lives (King & Kitchener, 2002). In the literature class students experience literature as an insight into their own lives, and in the Spanish class Anna engages students with topics and ideas that connect them to their own cultural myths and legends and with ideas that highlight their complex relationships to those living in other parts of the world. Science classes involve students' exploring the carbon cycle but there appears to be a missed opportunity for the students to explore the implications of the cycle from personal perspectives. At times it felt that an increased amount of discussion and dialogue would have enabled the students in the science class to connect on a deeper level to the concepts.

Table 8.7: Higher Levels of Epistemological Development

Epistemological Model	The Perry Scheme	Ways of Knowing	Epistemological Reflection Model	The Reflective Judgement Model	Argumentative Reasoning Model
Researchers	Perry (1970)	Belenky *et al.* (1986/1997)	Baxter-Magolda (2001)	King & Kitchener (2002)	Kuhn & Weinstock (2002)
Levels of Epistemological Development	**Multiplism**	**Procedural Knowing**	**Transitional**	**Quasi-reflective**	**Multiplism**
	Diverse view-points exist Uncertainly possible	Knowledge is seen to be gained by either separate or connected means	Degrees of uncertainty depend on the discipline	Knowledge has a certain degree of uncertainty. Meta-cognition is required to sort through knowledge	Assertions are opinions Knowledge is created and uncertain Reality is not directly knowable
	Relativism		**Independent Knowing**		
	Different views exist - the views are equally valid Truth does not exist		Knowledge is uncertain		
	Commitment to Relativism	**Constructed Knowing**	**Context Knowing**	**Reflective**	**Evaluativist**
	There is a need to analyse viewpoints and choose one that is most valid.	Knowledge making involves the personal construction of meaning	Knowledge judged on evidence in a given context	Knowledge claims are uncertain Solutions depend on best fit for the context and referring to beliefs. Criteria of knowing	Assertions are judgments that can be compared and evaluated Reality is not directly knowable

Nature of Disciplinary Knowledge and Methods of Inquiry

As might be expected, fundamental epistemological differences seem to exist between science and literature. Given the nature of the discipline that he teaches, John favours a positivist approach to the generation of knowledge. Positivism, as mentioned earlier, can be described as a philosophy "characterized by an extremely positive evaluation of science and the scientific method" (Reese, 1990, p. 450). John describes science as based on the objective accumulation of observable and

quantifiable evidence over time. For him, it is the most reliable understanding of how the world works. Although John acknowledges that scientific knowledge is ultimately provisional he believes that it is important to induct middle school students into the use of the scientific method as a tested and reliable way of knowing.

John's beliefs contradict research findings by Hasweh (1996) who explores the relationship between science teachers' epistemological beliefs and their approaches to teaching. Hasweh finds that science teachers with a more empirical view of science were less likely to hold sophisticated epistemological views. John promotes an empirical view of science amongst his students but he seems to have a sophisticated understanding of the history and epistemology of science. It is curious that he chooses not to engage students with these perspectives, especially given the fact that research literature recommends the explicit teaching of the epistemology of science (Matthews 1994; Mathews 1997) and the integration of epistemological ideas into normal teaching (Driver *et al.*, 1994; Leach *et al.*, 2000). However, it is worth mentioning that during our conversations John began to question whether a lack of awareness of ontology and the epistemology of science amongst his older students might be impeding their understanding of complex concepts in Physics.

Corinna sees literature as a field of study that relies on the subjective and inter-subjective interpretation of meaning through dialogue, reflection and introspection. She presents it as a subject that helps people find individual and collective meaning and purpose in their lives. She maintains that great works of literature are written in an attempt to explore philosophical ideas that connect to deep, significant, and life-transforming experiences. Essentially, for Corinna, an exploration of literature is an exploration of our own deep selves and our relationships to all that exists. Literature has no major boundaries, as opposed to science, which John feels might be one of the few the subjects that is capable of acknowledging its own limits.

These disciplinary perspectives reflect the findings of research studies carried out to explore the domain specific nature of epistemological beliefs among students. Research carried out by Hofer (2000), for example, found that first year college students held different epistemological beliefs about the natural sciences and the social sciences. The study of science was seen as certain and the study of the social sciences was seen as more uncertain. These beliefs were seen to influence their choices of college courses (Jehng *et al.*, 1993), with those who viewed knowledge as certain choosing natural science courses and engineering and those who viewed knowledge as uncertain choosing the social sciences. These research findings suggest that epistemological perspectives run

deeper than the disciplines themselves and the discipline one is drawn to may reflect different levels of epistemological beliefs and/or perhaps a personal need for either certainty or uncertainty.

8.7 PEDAGOGICAL KNOWLEDGE

According to Chan (2008) there exist clear relations between teachers' epistemological beliefs and their conceptions of what constitutes effective teaching. The following section compares teachers' pedagogical preferences and considers how they relate to their epistemological beliefs, their approaches to constructivism and their relationships with students.

Table 8.8 Comparison of Pedagogical Knowledge

PEDAGOGICAL KNOWLEDGE			John	Corinna	Anna
Teachers' Approach to Facilitation	**Similarities**		Teachers as facilitators of learning Teaching involves well-timed guidance and support Teaching involves the use of Smart Boards and ICT		
	Differences	**Teacher direction**	Considerable direction.	Moderated direction	Minimal direction
		Role of Planning	Lessons are pre-planned by teacher and students	Students' questions direct the topic	Students and teachers collaborate
		Main Focus	Focus is on the subject and the students	Focus is on the students and the subject	Focus is on the students and the subject
Relationships		**Role of the Teacher**	Teacher as Coach	Teacher as Participant	Teacher as Guide on the Side
Organization of Classroom		**Layout**	Rows and Hexagonal Pods	Community of Learners - Amphitheatre	Relaxed Café Style
		Placement of Teacher	At the front and mixed in	Part of the circle or learners	Mixed in or to the side

Teachers' Approach to Facilitation

During the observations all teachers adopted the roles of facilitators of student learning. John's approach to facilitation involved direct instruction to begin followed by guidance and corrections that kept the students on track. John managed the direction of the class and although he was responsive to the general needs and questions of the students, it appeared that the lessons had been planned with clear objectives in mind. John came across as a knowledgeable expert who knew how the learning might best be approached. This strategy aligns well with Perkins' (1998) view of the teacher as mentor taking students through tasks that are well structured. This approach differed from Anna's, in the sense that she employed a more student-centred approach. There was clearly a guiding framework for the lesson but the direction of the topic was guided by the questions of the students. Anna was present to offer advice, translation and assistance but it was clear that she did not control the direction of their learning. Similarly, in Corinna's classes the students played a role in the direction that the lessons took. The classes were loosely structured and this made it possible for discussion and learning to flow into unanticipated directions.

Impact of Epistemological Beliefs on Teaching

In research literature there appears to be connections between the personal epistemologies of teachers and whether they conduct student-centred or content-oriented classrooms. For example, research carried out by Brownlee (2000, 2001) and Sing & Khine (2008) found that teachers who hold sophisticated personal epistemologies are more likely to employ student-centred approaches to teaching whereas teachers with lesser developed personal epistemologies are more likely to direct student learning. Anna and Corinna's approaches, therefore, seem oriented by more sophisticated epistemological beliefs. Their classes involve considerable student involvement in the direction of the lessons, loosely guided inquiry and the evaluation of perspectives. John's approach, however, involves a considerable degree of teacher direction particularly at the beginning of lessons; there is little room for whole group dialogue and discussion, and inquiry is clearly bounded. The question remains as to whether these approaches are a reflection of John's epistemological beliefs or whether it is a reflection of the level of structure that may be considered necessary when teaching science to adolescents.

Approach to Inquiry and Epistemological Beliefs

The teacher's approach to inquiry has been highlighted as an aspect of teaching that may impact students' epistemological beliefs (Khishe & Abd-El-Khalick, 2002; Tabak & Weinstock, 2011). One of

the reasons pointed out as to why certain approaches to inquiry are less effective than others in developing sophisticated beliefs is that inquiry-based learning often focuses on students' individual constructions. As a result, the process can neglect the final stage of the comparison and evaluation of competing findings and perspectives. Tabak & Weinstock (2011) recommend that in order to cultivate evaluativist positions in students, and thereby more sophisticated epistemological beliefs, it is necessary for teachers to highlight the constructed nature of knowledge and to provide individual students with the possibility to articulate their own explanations, while also engaging in critical comparison and judgement of the explanations. Although there is a degree of evaluation and reflection in evidence in John's science classes, competing perspectives are not obviously evaluated. In Anna's classroom there is a degree of evaluation in evidence during the Myths and Legends activity and in Corinna's there is a notable amount of discussion and negotiation involved in analysis of quotes from *Frankenstein*. In general, the approach to inquiry seems to reflect the approaches to constructivism preferred by the teachers, with John's focus on the learning of individual students diminishing the need for a focus on evaluation, and Anna's and Corinna's approach to the social and collective construction of knowledge suggesting a need for critique and negotiation within the group.

Weak and Strong Approaches to Constructivism

It could be that the teachers' exhibit what Windschitl (2002) describes as weak and strong approaches to constructivism. Windschitl posits that teachers who promote weak approaches to constructivism create learning environments that encourage students to construct understanding but they are not given the opportunity to make deep connections to their own experiences and they are not encouraged to critique or evaluate their findings collaboratively. By comparison, teachers who promote strong acts of constructivism encourage students to collaboratively weigh up different types of evidence and to connect personally with the material through dialogue and discussion. From this perspective it could be suggested that John employs a weaker approach to constructivism than Anna and Corinna. However, when research considers that scientific knowledge is generally perceived as more certain by students (and perhaps science teachers) compared with other forms of knowledge, then it stands to reason that the approach to constructivism in a science classroom will take more of a pragmatic and performance based approach, although this approach does not exclude the need for dialogue and the evaluation of findings.

Dialogue and Epistemological Beliefs

As with the approach to constructivism, Johnson *et al.* (2001) found that the level of dialogue that occurs in classrooms impacts the development of epistemological beliefs. They found that teachers with naïve epistemological beliefs incorporate dialogue that is less complex than the dialogue in classrooms of teachers with more sophisticated beliefs. Corinna made on-going use of complex dialogue to explore concepts, to discuss perspectives, to construct meaning, and to evaluate findings during her classes. Anna made frequent use of dialogue and conversation during each of her lessons to discuss myths and legends, the concept of thinking and global interdependence. Small group dialogue was a feature of the science classes when students were carrying out investigations, but it was not employed in whole group settings to explore perspectives or as a means of connecting students to each other and the topic.

Relationship with Students

All teachers appeared to have positive and respectful relationships with the students in their classes. With John, for example, there was a motivated atmosphere in the science classroom as well as a respectful master-apprentice relationship between John and his students. Anna seemed comfortably aware of the learners in her classroom and she spoke about individual students freely during our conversations. Her lessons seemed to be as much about getting the students to speak about their lives and personal experiences through Spanish as it is about learning the language. Her main aim, as a teacher, was to help them expand their thinking in order to survive responsibly in a complex world. Corinna demonstrated a particularly close relationship with her students. She spoke warmly, and at length, about each of them during our conversations and she engaged eagerly with them during the lessons. Before the end of the second lesson I knew each of her students by name.

The more complex and holistic the teachers' views on the nature of learners, the deeper and warmer their relationships seemed to be with them. John explained that he is comfortable with a view of students as physical cognizing entities with psychological and emotional layers to their existence and he has a clear mentor-apprenticeship relationship with them. Corinna and Anna, on the other hand, approach humans as complex existential entities who have physical, emotional, cultural, social, and spiritual layers. Although Anna prefers not to emphasise her spiritually ground perspectives in class, Corinna is very comfortable in doing so and she encourages the students to express their own beliefs openly. For Corinna there is ample space to consider the role that the soul and the spirit play in life and to explore how the subject material connects with the students and how they are connected through literature to her, to each other and to the largeness of life.

Connected Ways of Knowing, Connect Ways of Teaching

Anna wondered on several occasions during conversations whether women might naturally favour a connected way of knowing and teaching. She thought that connections might develop due to maternal bonding and a natural biological pre-disposition amongst women to nurture children. Her thoughts relate to research carried out by Belenky *et al.* (1986) who posit that there are two different ways of approaching knowing – *connected knowing* and *separate knowing*. They describe connected knowing as an inter-individualistic, and dependent on the in-depth understanding of perspectives and they describe separate knowing as dependent on a more objectivist approach to teaching. Although Belenky *et al.* made no gender related claims, Galotti *et al.* (1999) posit that connected knowing is observed more in women and separate knowing more in men. This may explain the differences in how John, Corinna and Anna appear to relate to the students.

Baxter-Magolda (2002) suggests that the perceived differences in how males and females connect to knowledge and knowing may also relate to the point that women appear relatively comfortable with uncertainty whereas men are more comfortable with certainty. The ability to be comfortable with uncertainty was raised in conversation by Corinna, who suggested that a teacher's epistemological stance and approach to constructivism may be a reflection of how comfortable they feel with not knowing the answers. She believes that a teacher comfortable with uncertainty will naturally be more open to connecting with and exploring the perspectives of others. It appears that Corinna is the teacher who is most comfortable with uncertainty. This was reflected in her open-ended approach to lesson planning and her ability to let conversations flow into unanticipated directions. John, by comparison, favoured more of a structured approach to lesson planning with each lesson having clear outcomes, and dialogue that diverged from the main focus of the lesson was avoided.

Although it appears that there are differences in the way that John, Corrina and Anna relate to and connect with the students, the content and the learning environments, it is difficult to say without further exploration whether this has more to do with genders, spiritual leanings, epistemological stances or comfort levels with certainty. These points are important, but the reasons may be more complex than this, with the disciplinary areas and the personalities of the teachers also playing significant roles.

Organization of the Rooms

Palmer & Marra (2008) suggest that a relationship exists between teachers' choices regarding the set-up of an instructional environment and their epistemological beliefs. From what I observed, the organization of the rooms seemed to reflect the teachers' approaches to teaching, and how they view the construction of knowledge. For example, John's classes always started with the tables in rows in front of his desk. This was where John usually positioned himself at the beginning of each class. During the first lesson it was clear that the row format inhibited student communication and connection although the students tried to work around this by turning around to speak to those behind them. The following two lessons were held around hexagonal work stations that promoted and facilitated student collaboration. During these activities communication flowed more smoothly and John was able to move between groups to offer assistance as required. Anna's classes were held in an open café style format, using couches to encourage connection, conversation and discussion amongst the students. Anna did not appear to have a set place to be. In Corinna's classroom students were usually seated in an amphitheatre format so that the maximum number of students could see and communicate with each other effectively. At one point Corinna drew this format as a web-like structure to emphasize the interconnected nature of groups.

8.8 Knowledge of Context

Table 8.9: Comparison of Knowledge of Context

KNOWLEDGE OF CONTEXT				
		John	**Corinna**	**Anna**
SIMILARITIES	**Focus on Conceptual Understanding**	Main concepts include energy, decomposition, and combustion	Main concepts include connectedness, fear, altruism, alienation	Main concepts include thinking, myths, stories and inter-dependence
	Focus on Procedural Understanding	Skills include modelling and investigation	Skills include literary analysis techniques and dialogue	Skills included grammatical construction, and presentations
	Reference to the Areas of Interaction	Lessons were grounded in the Environments AOI	References were made to the Human Ingenuity AOI	The lesson was explicitly grounded in the Human Ingenuity AOI
	Reference to Visible Thinking terms	Frequent reference to reasoning with evidence	Reference to reasoning with evidence, considering perspectives, capturing the heart of ideas	Multiple references were Visible Thinking related terms throughout all of the lessons and the conversations
DIFFERENCES	**Degree of Student involvement in the generation of the concepts**	Students have minimal input as the concepts are specified in MYP literature	Students have input with some concepts and less with others – depending on the activity	Students are expected to extract the main concepts themselves
	Reference to the IB Learner Profile	Reference to being principled	No direct reference	No direct reference
	Views on Assessment	Enabled students to carry out structured peer assessments	Students provided constructive feedback during essay writing Finds assessment restrictive	Tries to take the whole child into account when assessing work. Finds assessment restrictive

Focus on Conceptual and Procedural Understanding

In all classrooms the overall emphasis was on both procedural and conceptual understanding. Given the requirements of MYP unit planning, this is not surprising. Some of the main procedures practiced in science were modelling and practical investigation and the concepts included energy, inter-dependence, and combustion. In literature, the emphasis was on dialogue and literary analysis, and some of the main concepts were connection, fear, and alienation. For Spanish, the emphasis was on grammatical constructions and philosophical reasoning and some of the concepts explored included thinking, inter-dependence, and myths. The concepts that teachers chose to engage the students with seemed to resonate with their fundamental impressions of reality.

Reference to MYP Specific Terminology

During the observations, conversations and interviews, teachers made a variety of specific references to MYP terminology. Anna's lesson was about exploring myths and stories through the Human Ingenuity Area of Interaction (AOI). Using a student-centred scaffolding approach she helped the students isolate the guiding questions for the unit. Anna contextualized these AOI based lessons in real world ideas and she encouraged students to make connections between the AOIs and their own lives. Corrina also made reference to the AOI Human Ingenuity and she enabled the students to build connections to what they are studying in other disciplinary areas during reflection sessions. Another aspect of MYP related terminology that surfaced was the IB Learner Profile. John saw the profile as an effective means of telling students what was important with regard to behaviour. He paid particular attention to the need for students to be principled and honest.

Assessment Procedures

John encouraged his students to carry out peer-based assessments on each other by observing their partners during the practical investigations. Corinna also structured her lessons in such a way that students provided each other with a considerable amount of constructive feedback as they were drafting their *This I Believe* essays. Following the presentations at the end of *The Meaning of Life* unit, students gave each other feedback that resulted in deep reflections and considerable discussion surrounding the concept of performance related fear and anxiety. Likewise, in one of Anna's classes the students gave detailed and reflective feedback following their presentations on the nature of thinking. It was clear in all three learning environments that student feedback was considered a valuable source of formative assessment.

Use of the Language of Thinking

All three teachers placed an emphasis on the building of higher order thinking skills. Students were encouraged to actively think through tasks, to carry out reflections and to reason with evidence. In one of Anna's classes they went as far as to contemplate the nature of thinking itself through their multimedia projects based on *The Thinking Game* book. In addition, throughout her lessons Anna made frequent reference to the importance of considering multiple perspectives and of capturing the heart of reasoning with evidence. These are terms frequently used by teachers trained in Harvard's Teaching for Understanding and Visible Thinking approaches. The repeated focus on the development of thinking skills is significant as higher order thinking skills are associated with sophisticated epistemological beliefs (King & Kitchener, 2002).

8.9 Overview of the Similarities and Differences

Table 8.10 provides an overview of the main similarities and differences between the beliefs and practices of the three respondents. Similarly to the profiles, the table is organized according to the components of Leach and Moon's (2000) Teachers' Knowledge organizing framework.

8.10 Usefulness of Leach and Moon's Organizing Framework

It is worth considering the usefulness of Leach and Moon's model in the structuring of and the comparison of the profiles. Overall, I found that the Venn diagram of the model offered a concise overview of each teacher's beliefs and approaches and it served to indicate aspects of their beliefs and practices that stood out following observations and discussions. At a glance it was possible to develop a visual overview of each teacher's beliefs and approaches and to see how they aligned and differed. Using the model also helped to highlight the key areas that needed to be expanded upon when drafting the final versions of the profiles. In addition, placing the personal construct section of the model at the centre helped to keep the focus on teacher's ontological beliefs throughout the drafting process. This was important considering that the aim of the research study was to explore whether teachers' ontological beliefs might impact their epistemological beliefs and their approaches to teaching.

Table 8.10 Overview of Comparison of Teachers Beliefs and Practices

			John – Science	Corinna – English Literature	Anna – Spanish Language
PERSONAL CONSTRUCTS					
Backgrounds	Similarities		Significant impact of parents on approaches and beliefs.		
	Differences		B.Sc. + Education	PhD in Education	M.Sc. in Applied Linguistics
View of Reality	Similarities		Matter and Interdependence play a role in the macro world		
(ONTOLOGY)	Differences	Fundamental Nature of Reality	Energy	Interconnectedness	Love
Learning	Similarities		Collaboration is a common pedagogical feature of classrooms Students given the opportunity to access prior knowledge There is a mismatch between individual's understanding of even basic concepts		
	Differences	Prior Knowledge and Unit Planning	Prior knowledge does not appear to affect planning	Planning is informed by student dialogue	Students' prior learning has a clear impact on planning
		Construction of Conceptual Understanding	Piagetian Constructivism Pragmatic Constructivism	Social Constructionism Collective Constructivism Piagetian Constructivism	Piagetian Constructivism Social Constructionism Critical Constructionism
Learners	Similarities		The individual mind and brain play a role in the learning process, individuals as cognizing agents		
	Differences	Nature of the Individual	Learner as material being and the principal locus of cognition	Learners as spiritual and material beings, plus distributed cognition	Learners as material and spiritual beings, plus distributed cognition
		Role of Collective	Group Dynamics	Collective Mind/Entity	Collective Energy Cloud
NATURE OF KNOWLEDGE (EPISTEMOLOGY) AND KNOWLEDGE OF SUBJECT					
Nature of Knowledge	Similarities		Knowledge as contextual, provisional, and arrived at through inquiry		
Nature of Knowledge	Differences		Objective	Inter-subjective, Inter-objective	Enigmatic quality, Whole Being
Method of Inquiry			Scientific Method	Dialogue, Reflection, Introspection, Analysis	Contextualized discussion and conversation
PEDAGOGICAL KNOWLEDGE					
Approach	Similarities		Teachers as facilitators of learning: well-timed guidance and support		
	Differences	Degree of Direction	Considerable direction.	Moderated direction	Moderated direction
		Planning	Lessons are pre-planned	Students Qs direct the topic	Students and teachers collaborate
		Main Focus	Subject/Teacher Centered	Student Centered	Student Centered
Relationships		Metaphors	Teacher as Coach/Expert	Teacher as Participant/Learner	Teacher as Guide on the Side
Organization		Layout	Rows and Hexagonal Pods	Community of Learners	Relaxed Café Style

CHAPTER 9

SUMMARY OF TEACHER REFLECTIONS

9.1 Reflecting on the Profiles and Involvement in the Research

Prior to drafting the general and final conclusions, I met with the respondents John, Corinna and Anna to ascertain how they felt about their involvement with the research and to consider whether their involvement had encouraged them to contemplate further any of the ideas that had been discussed during our conversations. These final feedback sessions were important as one of the objectives of the research was to estimate whether an exploration of teachers' ideas regarding the nature of reality and knowledge could play a beneficial role in the continuing professional development of experienced IBMYP teachers. In line with the criteria of trustworthiness these conversations helped to take into account the respondents' views prior to a consideration of the final conclusions and the potential implications of the study.

9.2 Anna's Reflection

For Anna the resulting profile was confirmation for her that she was doing what she hoped to do. She felt that the generation of the profile had given her the opportunity to talk about her teaching in a way that rarely happens for her. She enjoyed sharing her personal philosophy and talking about why she chooses to teach in the way that she does. She appreciated that she had a voice in how everything appears on paper, and that reading her profile brought her teaching style alive for her. She felt that the process differed from formal evaluations in the sense that it was more about who she was as a whole person and not about the kinds of specific details usually focused on during an evaluation process.

She chose to elaborate on certain aspects of her teaching. For example, she reiterated that teaching through philosophy is a natural way for her as she is oriented towards the world in a philosophical way. She believes that if she is personally engaged with world issues and ideas, her students might feed off her enthusiasm in a positive way. She commented on how fortunate her students are to have the opportunity to formulate their own opinions and to question the world through the topics that are chosen in class.

Anna also reiterated that it is important for students to be seen and for teachers to show who they are in classrooms so that students may see them. She is still curious as to what is happening with

students who she believes do not want to be seen and who are, therefore, disruptive in class. She has begun videotaping lessons with the intention of deconstructing them with the class in order to better understand what is going on with the few students who choose to be disruptive.

9.3 John's Reflection

John found the initial observations interesting as they gave him a "bird's eye view" of what was going on in his classroom. He noticed habits that he had been conscious of and others he had been unaware of. He appreciated the opportunity to consider why he does what he does in the classroom. At the same time, he was curious as to how much of his teaching might be natural and ingrained and how much was conscious at the time of teaching. He appreciated having an insight into how students were communicating and learning when he was working with other groups.

John appreciated the opportunity to speak of the impact of his family's social and intellectual characteristics on his upbringing. He felt that the fact that his father had been a great influence on him had always been at the back of his mind, but involvement in the research had brought it to the forefront. Apart from appreciating the opportunity to speak about his family, John commented that the research raised an interest in how understandings of fundamental scientific concepts can affect student learning. He spoke about the fact that students are expected to know certain scientific concepts and accept them on faith. This does not sit well with him. For this reason over the summer he has put together a booklet that explains the concepts differently and which points out that there is no way of knowing for sure what these concepts are. He added, for example, that nobody knows what electric charge is. We know what it can do, and how it behaves but not what it really is. He feels the same applies to other concepts like mass, temperature, gravity and magnetism. He hopes that his booklet will highlight the nebulous nature of concepts for students so that they are free to develop their own personal mental images of concepts in a way that helps them to understand.

Also, following conversations during the research project John feels encouraged to try out a new unit on magnetism in a way that incorporates more independent and open-ended exploration on the part of the students. He aims to keep it free from assessment so that students have the opportunity to suggest and attempt more flexible and alternative approaches to inquiry.

9.4 Corinna's Reflection

Corinna acknowledged that my coming into her classroom was an emotional experience. She appreciated the opportunity to be able to discuss ideas about teaching in depth in a way that she

feels rarely happens within the school environment. Being able to talk openly, and at length, about what she is passionate about is what she believes the overall purpose of education should be. Corinna was comfortable being observed as she saw the observations as being as much about the collaborative sense making endeavours of her students as they were about her. Indeed, throughout the reflection session Corinna spoke about her students at length and she remembered feeling proud of her students and how they were thinking, communicating and sharing during the lessons that were observed.

Corinna raised the idea of the learning collective on several occasions during our reflection session. She mentioned a student from a previous year group who said that the class was like one big collective mind and she spoke in an animated way of the magical quality that this collective mind or learning collective can have. She describes these learning groups as locales where the intellectual, social and spiritual is so strong that people are energized and invigorated by it. It was obvious that she had been thinking a lot about the nature of learning groups since our previous conversations. She had begun to notice that the more cohesive groups welcome new students and new opinions easily and they were comfortable with uncertainty and having their opinions challenged. She also noticed that a critical number of students in strong collectives had a shared educational history as several in the group that I observed had been at ISA for a number of years. Corrina now wonders how students in less cohesive groups can become more open to others in a meaningful way so that a deeper level of connectedness can emerge within the groups.

Corinna believes that involvement with the research project helped her to move forward toward a much deeper understanding of her own teaching practice and how she sees herself and her students. She suggested the need for more in-depth conversations of this kind in continuing professional development and in teacher education programs. Her hope is that conversations in education begin to move beyond discussions relating to teaching strategies and techniques towards conversations and professional development opportunities that are transformational. She maintains that these conversations need to start with some of the questions that guided this project, including a consideration of how reality and knowledge are perceived and how the concepts of teaching and learning are understood by teachers. In addition, she believes that it is important acknowledge the impact of metaphysical beliefs on personal pedagogies.

9.5 Teachers' Independent Exploration

A key point that emerged from these conversations was that involvement in the research project encouraged the teachers to explore aspects of their beliefs and their teaching approaches in more

depth. For John, his students' understanding of fundamental concepts became an interest as well as the impact of ontological perspectives on these concepts. He has also become keen to incorporate more open-ended inquiry into his lessons. Corinna has continued to think about the learning nature of groups and Anna is still curious as to why individual students do not connect to her and to others. As a result, all three teachers have independently either read up on their interest areas, observed their students more carefully, and/or have created curricular materials aimed at helping students.

CHAPTER 10

CONCLUSIONS

10.1 GENERAL CONCLUSIONS

The following section provides an overview of the general conclusions drawn from the comparison and discussion section, and the final reflection session. These general conclusions are followed by the final conclusion.

10.1.1 The teachers have clear personal conceptions of the nature of reality (ontology)

Each teacher seems to have developed a clear personal impression of the fundamental nature of reality. These impressions are identified as a form of energy, interconnectedness or love. The personal impressions resonate closely with the respondents' views on the nature of learners and their teaching approaches.

10.1.2 The teachers' choice of concepts resonate with their impressions of reality

Some of the concepts that the teachers engaged with during the lessons reflected their personal impressions of reality. John's whole course for the year follows the theme of energy. With Corinna the concept of interconnectedness came up on a multitude of occasions through our conversations and through class dialogue, and in one of Anna's classes the central theme of the legend was the transcendent nature of love.

10.1.3 Teaching approaches relate to beliefs on the physical and the metaphysical

The teachers exhibited teaching approaches that reflect beliefs in the physical and metaphysical aspects of reality. John's ideas are grounded in the physical with a focus on the practical and pragmatic generation and application of knowledge. Corinna's approach is philosophically and metaphysically oriented and it involves the holistic engagement of individuals and collectives with existential themes. For Anna, language construction involves both physical and metaphysical aspects and she expresses a need to connect with her students beyond a focus on the physical and mental.

10.1.4 The teachers' perceptions of students, as learners, is informed by their physical and metaphysical beliefs and their perceptions of being

Corinna's concept of interconnectedness and her belief in the transcendent qualities of existence resonate with her idea that the class can be seen as an inter-connected learning entity with transcendent qualities. In a similar fashion, Anna's engagement with the immaterial aspects of her students informs how she groups them and the assessment strategies that she employs with each student. In contrast, John's pragmatic attachment to the observable aspects of reality results in a view of learners as individual cognizant individuals.

10.1.5 The teachers exhibit developed levels of epistemological beliefs

The teachers have well developed epistemological beliefs that reflect the middle to higher end of the epistemological beliefs models used in research. They view concepts and procedures as human constructs: uncertain, provisional, and dependent on perception, life experiences and context. They favour constructivist approaches to teaching and they make obvious efforts to contextualize the learning in the lives of their students. However, the teachers varied in the degree to which they enabled students to evaluate and critique their findings and to consider the criteria of knowing. These are the practices that are usually evident in teachers with more sophisticated epistemological beliefs.

10.1.6 Each teacher is drawn to a distinctive blend of constructivist approaches

Although each teacher advocates a constructivist approach to teaching there are differences in the blends of constructivism that they are drawn to whether this be a blend of cognitive constructivism, performance constructivism, social constructionism, critical constructionism, or collective constructivism. It appears that these approaches to constructivism or constructionism are influenced by each of the teacher's ways of being, how they see students, and how they perceive knowledge and the disciplines they teach. John appreciates the individual, the visible, and that which can be measured. He is, therefore, drawn to a blend of cognitive and performance constructivism. Corinna likes to engage individuals and groups with issues of the spirit and themes of existential importance and she is drawn to a blend of cognitive, social and collective constructivism. Anna believes that it is important for students to think deeply to see themselves clearly, and to question and transform social realities. She is drawn to a blend of cognitive constructivism, and social and critical constructionism.

10.1.7 The teachers' approaches are influenced by the nature of the disciplines.

The constructivist approaches used by the teachers relate to their disciplines. Science is by its nature a subject that demands a significant amount of practical work and modelling as well as some initial orientation by the teacher, literature depends on significant degrees of collective philosophizing and deconstruction, and learning Spanish involves conversation and dialogue.

10.1.8 There can be a connection or disconnection between epistemological beliefs and practice

The teachers' personal epistemological beliefs were not always in evidence through their teaching. Anna's approach to teaching generally matched her beliefs but she did not engage her students directly with conversations relating to the nature of language learning. John's approach to teaching reflected an empirical view of science although he has a well-developed understanding of the epistemology of science. Corinna's beliefs matched well with her teaching approach and she also engaged students with conversations surrounding the socially constructed nature of knowledge.

10.1.9 Teachers with a holistic view of students seem to develop close relationships with them

The level of connection between students and teachers seems to relate to teachers' views on the nature of students. Corinna and Anna, see students as complex and multi-layered physical and metaphysical beings and as a result they aim to develop personal connections with their students.

10.1.10 The level of post graduate education appears to impact beliefs about the nature of reality and knowledge

The ease with which the teachers were able to discuss their perceptions of reality, their epistemological beliefs and their approaches to constructivist teaching and learning seemed to reflect their levels of postgraduate study. With a doctorate in education, Corinna has a well-developed understanding of the philosophical nature of educational research. She highlighted, in particular, the effect that further education has had on her epistemological beliefs.

10.1.11 Involvement in the research project has encouraged teachers' interest in exploring aspects of their teaching or of student learning

Each of the teachers has chosen to explore aspects of their teaching that they became curious about during the research project. John is exploring ways to help students realize the vague nature of scientific concepts, Anna is exploring why some students find it difficult to connect with others and Corrina is exploring the nature of learning in groups.

10.2 FINAL CONCLUSION

There are apparent connections between teachers' personal beliefs on the fundamental nature of reality (ontology), the way they view learners (being), and the concepts and disciplines that they choose to teach. The respondents' beliefs manifest themselves in different ways and impact their views on knowledge (epistemology), their individual approaches to constructivism and constructionism, and the ways they interact with students and disciplinary material. More sophisticated epistemological beliefs appear to be associated with more open-ended approaches to inquiry, a considerable degree of student involvement in the direction of the lessons, and the collective evaluation of findings. A teachers' belief in the metaphysical aspects of reality appears to positively impact relationships with students and a belief in the metaphysical also affects teachers' perspectives regarding the ability of groups to form learning collectives. Although disciplines appear to affect beliefs and teaching approaches, it is unclear without further exploration whether this is the case, as individual teachers' beliefs were not always enacted in practice.

CHAPTER 11

IMPLICATIONS OF THE RESEARCH STUDY

11.1 IMPLICATIONS

This section examines some implications of the research study and considers the ways in which the findings might be beneficial to the context of the research study and beyond.

11.1.1 An emergent approach to teacher evaluation and professional development

It became evident that teachers enjoy talking about their practice when they feel that they can influence the direction of the conversations and interviews. Anna commented at one point that the emergent design approach to observations and discussions left room for her as a teacher, and as a whole person, to emerge. Although I appreciate that an approach similar to this would be quite time-consuming, I wonder if a modified version could be incorporated into the teacher evaluation program at ISA. A more teacher-centred approach than the current one might yield the kind of insights and information that would be valuable to teachers on both personal and professional levels. Evaluation experiences tied more closely to the personal beliefs and the professional development of the individual teacher, could, as was the case during this project, encourage teachers to pursue areas of interest in more depth. As Corinna commented, this does not generally happen following the top-down evaluation process.

11.1.2 More in-depth exploration of teachers' ontological beliefs

The respondents appreciated the opportunity to consider how their ontological beliefs could consciously or unconsciously impact their personal pedagogies and their relationships with students and they highlighted the need for more conversations of this kind in education. It seems that there is a need within research to extend current studies that explore ontological beliefs to take teachers' personal perspectives into account. Current research approaches are narrowly structured and do not provide teachers with opportunities to discuss their personal ontological perspectives in depth. As teachers in this study found it beneficial to consider the impact of ontological beliefs on their views of learners and their teaching approaches it might be professionally valuable for other teachers to do the same. An exploration of these beliefs could become part of an in-house professional

development opportunity at ISA whereby teachers are given the opportunity to connect personal beliefs and theories to practice.

11.1.3 Differentiation between multiplistic and evaluativistic epistemological positions

There appears to be a need amongst teachers to emphasise the difference between multiplistic and evaluativistic epistemological positions and to raise awareness of the different ways in which learners can attend to evidence. Brownlee & Bertelsen (2008) suggest that an emphasis on epistemology during lessons could increase students' understanding that even when knowledge is constructed it is still subject to evaluation. Tabak & Weinstock (2011) suggest that an effective means of moving teachers to focus on the evaluation of evidence is to enable them to become aware of their own beliefs and to encourage them to teach epistemology explicitly during lessons. As with ontological beliefs, these beliefs could be explored as part of an in-house professional development program.

11.1.4 Exploration of gaps between teachers' epistemological beliefs and practices

If I had focussed exclusively on teachers' epistemological beliefs during the research study I would have missed the fact that teachers' beliefs are not necessarily enacted in practice. To explore the possible gaps between beliefs and practices Sing & Khine (2008) suggest that it is necessary to conduct more research in this area through observations in order to verify teachers' self-reported data. I think this is advisable especially given that John was very clear on why he chose not to engage his students with the epistemology of science but when given the opportunity to speak about his beliefs he began to wonder if students were having difficulty with concepts due to a lack of understanding of the nature of scientific models.

11.1.5 Exploration of teachers' beliefs and approaches across the disciplines

It would be valuable to explore the beliefs of additional teachers within similar disciplinary areas to see how their beliefs and practices might compare with those of the research respondents. Would another science teacher's ideas be similar to John's? Being a science teacher myself I was surprised to find that my personal ontological and epistemological beliefs and approaches aligned more with Corinna's than with John's. Then, too, Corinna acknowledged that other literature teachers did not necessarily approach literature in the same way that she does. A comparative exploration of enacted beliefs could shed light on the nature of domain specific and more general epistemological beliefs. In addition, it could be particularly interesting to explore the beliefs and practices of teachers who

teach ICT, as well as those who have an in-depth appreciation of the impact that technology is having on impressions of reality.

11.1.6 More detailed IB literature on approaches to constructivism and constructionism

Given the apparent connections between one's approach to constructivism and one's ontological and epistemological beliefs, it stands to reason that beliefs and practices could benefit from being explored in tandem. The concept of constructivism is brushed over in IB literature and particularly in Principles into Practice, the instructional guide. The study indicates a need for IB literature to consider the concept of constructivism and constructionism more carefully, and to pay attention to the variety of interpretations and approaches that are developed by teachers.

11.1.7 The extension of the study to other teaching contexts

This study took place in a non-denominational IB environment where all three respondents professed non-religious beliefs. It would be valuable to explore how their ideas would compare with those of teachers working in other types of schools: a convent school similar to the one that I attended, a school in West Africa, a local school in Myanmar or other international school environments. It would be intriguing to explore teachers' ontological and epistemological perspectives in these contexts and to consider the impact of their perspectives on views of knowledge and approaches to teaching.

11.1.8 Relational pedagogy and sophisticated epistemological beliefs

It was clear from the study that the teachers who expressed an interest in the building of relationships between themselves and the students, between the students, and between the students and the focus of inquiry exhibited more sophisticated epistemological beliefs in practice. They practice a relational form of pedagogy. According to Brownlee & Bertelsen (2008) relational pedagogy happens best when teachers focus on connected ways of knowing, when the affective aspects of learning are seen as inseparable to knowledge construction, and when learning is situated in students' experiences. This is an important point and one that deserves to be emphasised and explored during professional development workshops.

11.1.9 Examination of epistemological beliefs during the transition phase for new IBMYP teachers

New teachers joining the IBMYP program are expected to switch from teaching approaches that may not have been inquiry-based to an inquiry-based approach without having the opportunity to assess

how this shift effects their epistemological beliefs or their understanding of constructivism. An exploration of epistemological beliefs and practices might be beneficial during the transition phase. The point that some teachers new to the MYP initially continue with content-oriented approaches as opposed to inquiry must be confusing both for them and for their students who are used to more open-ended approaches.

11.1.10 Mentoring of new teachers by those with advanced degrees

It appears that teachers who study at advanced educational degree levels have more sophisticated epistemological beliefs and their personal pedagogies exhibit strong approaches to constructivism. For this reason efforts could be made through professional development workshops to engage teachers who have studied to advanced levels with teachers who are new to the MYP. Observations of the kind that I carried out could be a valuable source for discussion among the mentors and the new teachers.

11.1.11 A focus on how groups learn

A point of interest that emerged during the study was how teachers' viewed learning in groups. Anna and Corinna in particular stressed the importance of paying more attention to the complex nature of groups within educational settings. Corinna's approaches to group management, for example, reflect research in the area of the complexity sciences. There may be value in introducing the ideas on the self-organization of complex adaptive systems to teachers through mainstream professional development opportunities. Similarly to Corinna, I have found the implementation of complexity science based strategies beneficial when working with groups of students to the point that I have introduced the concepts to my students through ATL (Approaches to Learning) classes. I imagine that there are other teachers who are curious about how learning could be happening in groups. Discussions on this topic could be introduced as an optional professional development opportunity for interested teachers.

11.2 Limitations of the Study

The limitations of the study centre on the usefulness of the study within the realm of constructivist-interpretive inquiry. Considered from outside the constructivist-interpretive paradigm it may seem of little value. It is a single case study that explores the views of only three respondents and the context could never be replicated or generalized. However, within a constructivist-interpretive paradigm no attempt to generalize is made (Lincoln & Guba 1985; Erlandson et al. 1993). The study

presents a "slice of life" (Lincoln and Guba, 1985 p.155), and readers are invited to draw their own conclusions. The transferability of these findings to other settings should be made only with due consideration of their appropriateness.

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Appendix A: The Thinking Routines Used During Observations

John: Observed: Monday 1st March: In-depth Reviewed: Tuesday 2nd March 2010

Viewing of the Recording of Observation #3: John Charters (1=1/2 hours)

Tape/ Time	See/Not See	Hear	Feel	Think	Wonder
0:00	John is at the front of the room behind the main desk. He chooses the experiments that are that are faced upside down. He then chooses the helpers and calls out those names. There is discussion and exclamations as the names are called out. They move down to the back of the room and begin to set up.	JC: You were supposed to be ready today. And I will draw the names magically. JC: The next experimenter will be … Students: Yell! Excitedly JC: The next is Ryo Student: Ryo yells. Teacher continues to choose the main experimenters and the helpers. A student has come without her investigation prepared. They discuss volunteers But no one comes forward. JC: The discussion is closed. Student: But how am I supposed to do it? JC: It's not fair to give you three extra days when others have prepared their work for today. It's not fair to push somebody else to do it when your name was drawn. That was the deal. Everyone was supposed to be ready. Then he calls out the helpers. JC: The person who you are helping today will not be the person you will be working with the next day. Scientists need to work with mix of people.	The students are more comfortable with the camera now. They seem to be ignoring me – for the most part.	This is a good idea. To draw the names so they do not know whom they are working with in advance.	What preparation have the students done in order to be able to plan their own investigations?

05:22		JC: Experimenters and partners please choose a place down the back.			
7:52	**Renana and Tyler** **There is a lot of activity with lots of students choosing places getting ready and moving around.** Renana goes and gets the materials that she needs: Bunsen Burner, tripod etc., She is trying to work out what to do and asks her partner and JC for help to work it out.	Student: Ok....so what stuff do we need? I'm going to look at your diagram. A beaker? Student: Yes a beaker and a thermometer. .... Renana: Apparently we don't need the Bunsen burner. There is a light thingy. **Renana: I need to work out how to use this. Is it like that?** **Tyler: I don't know. I think so (he sniffs it).** **Renana: Don't sniff it.** **Renana: So will this go on fire or what? And you just light that? Isn't it going to be a big flame? But this isn't a good amount. We need to measure what we want. What if you need a certain amount?** **Tyler: We also need height. We need a measurement thingy.** **Renana: A measurement thingy? (He leaves)** **JC: Where are you going?** **Renana: Do we literally put a Bunsen burner here?** **JC: That provides the heat.** **Renana: What if we need a certain amount?** **JC: You need to weigh it before and then you weigh it after and then you work out how much you used.**	**This feels a bit different. I am having difficulty working out what I'm going to do as there is a lot of movement.**	The students are well behaved. They are purposeful and seem to know what to do. They walk around purposefully and they ask each other when they need some help.	Do they know already what criteria they are being assessed upon?

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Corinna: Observed: Friday 19th March 2010: Reviewed: Sunday 21st April 2010

Viewing of the Recording of Observation #2: Corinna Hasbach - Grade 9 English (continuation of analysis of *Frankenstein*)

Tape	See/Not See	Hear	Feel	Think	Wonder
00:02	Starting of the class. Continuation of the last lesson. Students are journaling related to themes from the novel and how they reflect themes in their lives.	Pencil cases being opened. Remy: Would you consider confusion a theme? CH: If you consider it a theme then you should go for it. Silence	I came in quite rattled but before long I feel calm in this setting. There is space to relax in the room and with the group.	I need to find ways for my own students and myself to relax more.	I wonder how the themes in *Frankenstein* are reflected in my own life?
08:05	Corinna watches the group and then slowly calls them to attention	**CH: Can you start wrapping up please.** .... **CH: Finish up the last sentence please.** .... **CH: Finish up your last words please.** .... **CH: Ok! Let's come back together as a large class. Who would be willing to share their ideas? Anybody?**	Slowly and calmly the students come back to attention.	That's a very relaxing way to be drawn back to the fold. It's not abrupt and gives students a chance to finish slowly.	
08:49	Sharing of ideas. Elena brings up the idea of bonding between parent and child and then the discussion flows to the nature and nurture debate and	Elena: Well – I chose parents and children. Cause I think that the relationship that parents and children have is like no other. It's kind of hard to explain but no one can really understand it except for the parents and the children. CH: Why do you think that is? Why do you think that no one else from the other side can understand the relationship between the parents and the children? Elena: Well – because maybe it's like really that they share a telepathic	This is very interesting. I feel myself being drawn into the conversation. I come from a	These are interesting themes for younger students to be discussing. The point that we often begin to imitate	How would you describe your own relationship with you parents? Do you ever share your own

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	then to the point that we often end up looking or behaving like our parents.	connection…the biological bond …DNA….has something to do with it. For example I've begun to notice that my personality is like my mum's. It's hard to explain. It's sort of …(struggles)…well because you've known your parents longer than you have known anybody else. They are the people that know you the best. CH: And what happens when children are adopted. How does that factor into it? Elena: Probably they can still recreate that bond even though it is not physical …not DNA…more like something in the mind. **CH: What's interesting is that we are talking about nature and nurture and that is an age old controversy. How much is nature, how much is nurture. Who we are and who we become and what's fascinating is that even with kids who are adopted with no biological link between them and their parents end up in some cases becoming very like one or both parents.** Elena: One of my cousins, she was …….My dad's brother married her mum so they are not actually related. They work in the same office now and their colleagues always tell them that they look alike which we think is really funny. It's kind of impossible. People do look alike even when they are not related. **CH: What's fascinating is that they say that spouses after years and years together look more like each other. How is that possible? It's a really interesting…we've talked in the past about dialectical and reciprocal relationships. The environment creates the individual, and the individual creates the environment. So you are so close with somebody and after a while even physically you tend to be more similar. Lara?** Lara: It's funny that not only is it like that with spouse and people that are not related but if you hang out with a certain friend a lot you say the same things, your expressions are the same automatically. I can tell for example when Chelsea's and Jordan's facial expressions look like one another. And then also I think that the relationship between a parent and a child is very complicated to understand that any other relationship between two human beings. It's impossible for an outside human being.	large and relatively chaotic family and it's interesting to think about it in these terms.	the expressions and behaviors of others. So to what degree are you really yourself? And to what degree are you a culmination of that which goes on around you in your immediate environment.	personal experiences with the students? What do you feel is the nature of the mother child bond?

| 12:23 | | CH: And often this is where secrecy and lies come in. We often hear of couples for example breaking up after 5 years or something. From the outside they seemed wonderful but we never know what is going on between people behind closed doors and in families it's the same thing. I think that's what's so amazing about this book too is that we see a parent child relationship but it's the worst of all possible.

Remy: A dysfunctional family.

CH: Right ...in the extreme. But I wanted to say something when you were talking Elena ...when you are young a lot of the time you go - I am never going to be like my mother or my father. I'm not going to do what they would do. The older you get ...you sorta go ...my goodness I sound just like my mother. And that can be a very good thing but it can also be. Oh! My goodness I can't believe I've turned into my mother or my father. And that we resist certain tendencies that they have, we also internalize them in a lot of ways . Right? It's fascinating. Leor? | | | When you say we internalize tendencies – what do you mean? |

Anna: Reviewed: Sunday 28th February 2010

Viewing of the Recording of Observation #1: Anna Lopez Dekker (35 min) – Concepts from the book The Thinking Game

00:00	Anna sits down and tells the students what they are going to do.	ALD: Now – what you are going to do is to begin with – **introduce your concept.** OK. Then you will show your video, the poster and then you will explain your idea. And then **we will discuss everything.**	Anna has the floor here. She has a strong voice. The students are all seated around tables grouped together so the atmosphere is like that of a collective.	Oops! Am I going to be able to understand all of this?	Talk to me about the seating arrangement in the room	
00:49 **01:13**	Students from one of the groups are getting ready to present a poster presentation. Two students stand up in front of the class to present their ideas to the others. They are guided by leading comments and questions coming from ALD. The girls take turns in	ALD: A little loud please… Students: Knowledge and Learning ALD: That's the slogan Students: Yes! Students: **(The girl in the book) wanted to know more about the depth of things and not just about the superficial aspects of things. The more you know, then the more you can learn and the more you can think about things more deeply. You are exercising your mind. You are more mature and if you study more then you know more things. The more you know the more you want to know and the more you want to investigate, especially when you have the opportunity – like now when you are young.** You need to use it an to have fun … (and they laugh) ALD: Laughs and then "That's the text"….And the images? Students: One of the pictures is a brain in two halves. This means that the world is very free and **you can use**	All of the students are listening quietly. The students presenting appear confident of their ideas.	The girls seem to have a clear grasp of the idea that they have chosen. And they see a link between knowledge and learning and the fact that the more one knows the more one can	From where did the students choose the concepts? What were some of your guiding questions? What do the responses tell you about the students developing understanding and relationship to knowledge and understanding?	

3:00	speaking and they finish each other's ideas when necessary.	**your imagination or** you can use the other half and have no ideas of your own. ALD: It seems like you are talking about the right side of your brain ...as they are different. One is more logical, more rational, and the other is more free. Students: And here we have the statue of the Thinking Man. ALD: Oh Yes! **The Thinker** Students: Because he thinks about things a lot and he thinks about things many times. Student: And here this image means "put your thinking cap on" (and they laugh). ALD: And the colors and the organization – what do they mean? Students: We tried to make clouds. The point that the sky is open and free like your mind. ALD: How is that connected to thinking? Students: Well…trails off.		understand life more deeply.		
05:43	**ALD gets up and gets the main Smart Board ready for the presentation of a video. The first video starts.**	ALD: Girls and boys - you need to listen carefully now. **Video:** Student is exercising with a big picture of a brain on her T Shirt. Slogan: The ideas in this brain ...after exercise. (3 sentences here) Student: Exercise you brain…(she's funny so they all	Good atmosphere…supplied by the comic actions of the student on video and the bouncy music. "Here comes the sun". They were all into it as was seen by the laughing, the clapping and the positive comments.	This is a great way to get the message across. The students are obviously engaged by the idea and listening carefully.	What modes do you usually encourage when it comes to the presentation of the understanding of a concept?	

	The video is short and shows a young girl exercising for her brain. It's short and comical.	laugh and clap) **ALD: Could you explain the concept.** **Students: Well…people are not aware that they need to exercise their brains. Otherwise they just get older faster.** **ALD: That's true the people who have problems of memory are those who don't exercise their brains. Those that do have a better memory.** Student: And the three ideas are related to the idea of exercising your brain. I wanted to put them in speech bubbles … ALD: And what do the rest of you think? What effect does it have? Student: It was well thought through. Putting the big brain on her T Shirt. ALD: If you saw this add on the TV what effect would it have? Student: It would entertain you. And it would grab you attention. ALD: The image makes you pay attention. Student: It's not like someone is sitting and talking about it. It's active and entertaining. ALD: What has stayed in your brain after watching it? Student: Exercise your brain…the slogan. Student: Thinking and Learning	**The students are sitting around a big table. The style is conversational and relaxed.**		

10:00		**ALD: I also like the connection between the brain as a muscle that needs exercise like other muscles. That it is very natural.** ALD: How does this connect to what you have learned from the book? **Student: It connects to the curiosity that the girl in the book has for philosophy. She wants to learn and to know things. She wants greater knowledge of things. She's expanding her ideas.** ALD: Did reading the book help you with your ideas? **Student: Yes! It helped us to understand what is philosophy and how you know about things..**		**Anna makes some connections explicit and requests that the students make some additional connections of their own.** This is important and a key point in making thinking visible to others.	

Appendix B: INITIAL EXTRACTION OF POSSIBLE CONCEPTS FROM THE TRANSCRIPTS AND CONVERSATIONS

25th May 2010: Prior to the Semi-Structured Interviews

	Corinna - Literature	Anna – Spanish	John – Science	Guiding Questions
Knowledge	Newly constructed knowledge Themes and concepts Construction of knowledge Social construction of knowledge Discussion and dialogue Variety of media Unaware of later effects of teaching Complex ideas Young person can be very knowledgeable Multiple perspectives Words as pointers Knowledge can be dangerous	Accumulative - over time Involves healthy brain A young person can be knowledgeable Knowledge via stories and myths Experiential Constructed by students Connects to life Interconnected Dependent on perspective Subconscious vs. conscious knowing	Knowledge appears to be known Knowledge located in the brain No reference to the nature of knowledge Manipulation of models helps builds mental models There are limits to what can be known We hope that individual descriptions of concepts match up New planets "not known yet". Knowledge comes from external authority Best interpretation of the evidence at hand There are limits beyond which we cannot go Difficult concepts are glossed over by people in general Physics best at understanding the limits of what can be known We need to be aware of limitations Some subjects are more dogmatic with relation to others with regard to what is true and what is not Reluctance to have students consider the provisional nature of scientific concepts	What do you understand knowledge to mean? Where do you believe that knowledge comes from? When we know something then where is this knowledge located? When we say that knowledge is constructed – what do we mean?

Learning	Takes time Individuals and groups learn Collaborative Construction of ideas Some more capable than others Ongoing/sowing seeds Concepts teased out Involves introspection Connects to students' lives Multiple intelligences Depends on environment (past voices and behaviors) Affected by the group Involves elaboration of ideas Not about assessment	Multiple modes of presentation Differentiated Collaborative Discussion and dialogue Hampered by vocabulary Constructive criticism Engaged with deep ideas connect to lives Conceptions/misconceptions Responsibility on group Takes time Not about assessment Expanding worldview and viewpoints Thinking is important Dependent on ability Males an females learn differently Conceptual earning leaves "tracks" in the brain over time	Learning connects to prior learning Learning is about looking for evidence to create models to help predict new information In stages – no jumping ahead No direct connections to students own lives Modeling aids in abstraction Students encouraged to "take the lead" during modeling activity "Remembering is the lowest level of thinking" Cooperation Students also plan and work independently Individual learners Aiming at outcomes "People become less creative as they become more evaluative" Different sides of the brain involved in different learning Learning is matching understanding to the real world Balance between creation and evaluation Assessment shows progression towards goals Reluctance to have students consider the provisional nature of scientific concepts	When students in a class learn – how and where does that learning happen? How do you see the minds of learners in relation to each other? What for you are the main concepts that a student needs to learn in your subject area?
Teaching Approach	"You teach who you are" Good rapport Kind	Importance of "seeing" Creates own materials Letting go of control	Prepared and structured Directs and facilitates Encourages and guides	How would you describe your general approach as a teacher?

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	Personable Well-prepared Connects with students Orients when needed Creates own materials Models the construction of new thoughts Part of collective Gives space to ideas Sees a need for a loving space Other teachers "not seeing beyond the material" Subject is a medium to discuss philosophical ideas	Multiple media Draws out ideas Helps make deep connections Asks good questions Encourages reasoning Structured Student centered Other teachers not having capacity to see beyond their subjects Students generate questions AOI lens evident Different "entity" with different classes/grades Timely translations "Sowing seeds" Subject =medium for philosophical and political ideas Intuitive dimension – reading energies The need for love	Has control of where the lesson goes The questions guide Concepts are front-loaded Students can make suggestions Established patterns for type of work Units connected Some loosening of control during conversation Seems to be about the content/material Constructivist model – misconceptions and prior knowledge	What teaching strategies do you find that you make regular use of? Why? How do you see your place in relation to a class of students?
Nature of Existence	Exploration of Self Intuition – "little voice" Humanity – single entity Predestination "Magic" energy in groups Interconnectedness Newly constructed class Collective consciousness The whole is "greater than the sum of the parts" Complexity Class as microcosm of the world Words seen as pointers	Subconscious does not exist in the material world Tapping into flows of energy Intuitive dimension to relationships Fantasy – stories that have alternative views on reality Interconnectedness Interdependence Bringing far away near Web of relationships Cause and effect Teaching is connecting with	Not sure where "unconscious" procedural knowledge is stored Life extinguished at death Energy is not a material substance "You can't link brains together" Interconnectedness of all living matter (implicit but not explicit) Life changes and evolves over time Mental models are not real – they are just representations Possibility that there is something beyond the material world	What is the basic nature of all that exists? What do you believe exists besides the material realm? What impressions might your lessons give as to the nature of reality? Do you feel that your beliefs consciously impact

		other souls Teacher is a teaching entity (self) that changes with different classes Difficult to connect with child who does not want to be "seen"	Science = Understanding that matches the observations in the real world and established understandings of how the world works	how and what you teach? Might these beliefs impact how you would describe knowledge in any way?
Concepts/Themes that are emerging in relation to the teachers and the classes	**Main Ideas** Collective Consciousness The Self Education of the soul World as interconnected entity Social Construction of reality Love Energy Dialogue Intuition Sowing seeds Classroom as a microcosm Magic Multiple Intelligences Holistic Different capacity of teachers New Knowledge Connects to lives Wisdom Stories create our reality	**Main Ideas** Personality vs. Identity Education of souls Interconnectedness and Interdependence Social Construction Love Energy Dialogue Intuition Sowing Seeds Thinking is important "Seeing" is the key Diff. capacity of teachers to plan for conceptual learning Thoughtfulness New knowledge Teacher as changeable entity Stories create our reality Connects to lives Wisdom	**Main Ideas** Death and Decomposition Interconnected Cycle (Carbon) Knowledge located in brain Construction of ideas Collaborative Learner as individual entity "Can't link brains" Energy Process Method Abstraction Conceptual limits to knowledge Presumed understanding of concepts Energy not a material substance Creativity Evaluation Models Control of direction of learning Brain plays central role in learning	What major concepts and/or through lines do you choose to directly and indirectly engage your students with? Why?

Appendix C: Sample Reflection Following Lessons

Corinna Hasbach: <u>Observation #1</u> Reflection : Ob: March 17th 2010 - Review: April 18th 2010

Reflection following the immediate viewing:

Very Interesting and engaging lesson. Corinna has a great rapport with this class and she engages them effortlessly in discussions centered around their fears relating to presentations and they then move smoothly onto the discussion of themes in *Frankenstein*. She points out that the themes in literature are the themes in our own lives.

Corinna's style is conversational and respectful. She gives students time to respond and provides support where needed. Her demeanour is calm and collected and she speaks with a kind and unaffected tone. She also steps back in the conversation and enables the students' room to engage directly with each other without being led. The students are respectful and polite and supportive when they engage with each other. They counter each other's points without being dismissive or overly critical of the points and ideas of others.

Because I found the content of the lesson so engaging and comfortable it was difficult to remain aloof and detached from what was going on. I was genuinely impressed by the depth of many of the discussions. The students seemed quite introspective and most appeared comfortable sharing their ideas in a group setting. I had taught several of the students when they were younger and it was a treat to see the degree to which they have matured and the degree to which they were capable of articulating independent and complex ideas.

Corinna makes it clear that the students are constructing their own knowledge and that they are free to counter argue any of the themes that she has suggested - suggesting that there are no set themes as such but only guidelines for further discussion on the novel.

I like the set up of the room. Each student has their own space but they can all see each other student at all times. The set-up facilitates easy conversation.

Questions:

Had you anticipated that fear would come up as an area of interest?

What do you feel the little warning voice is – that you talked about?

How would you describe this group of learners?

How would you describe your relationship with the students?

Talk to me about the set up of the room?

What learning do you feel is happening in the classroom?

How would you compare this class compared with other classes that you teach?

Additional Reflection and Questions (following in-depth viewing)

How the lesson relates to the research:

How does the lesson connect with the focus of the research?

How does it extend/conflict with my assumptions?

What challenges/questions are popping up?

Connect	Extend	Challenge/Wonder
Existence: Corinna encourages the students to explore their own internal worlds - the deeper self as she calls it. She also makes several references to 'the little voice' that speaks intuitively to us to alert us, for example, to potential danger. Knowledge Knowledge seems to be something that is constructed within the group through dialogue and through a variety of means and media. Knowledge within a literature perspective is seen as something that connects with our own lives and the lives of those who write the material. The themes are constructed and are valid as long as they can be justified with evidence that supports the suggested themes.	The depth of the conversation at this level is surprising. It appears that many of the students are endowed with existentialist intelligence. It's fascinating to see these students again years later in a different setting – now more mature and knowledgeable about the world. It helped put in perspective the fact that in sixth grade teachers are only just a small fraction of the influences that these students will have in their school experiences. Corinna is knowledgeable in relation to different intelligences and engages the students with this conversation. It's clear that students have a range of	Have the students delved deeply into an examination of life itself? What has happened prior to this lesson? Why is it that some students are not participating freely? Have they discussed the concept of life? What are their feelings in relation to where life comes from and how the wretch may have come to life? Were there references to the act of creation previously? So – when reading a novel – what are you hoping that

Learning Learning is seen very much as a collaborative process, and as an internal process. Students reflected internally following the presentation and then worked in a whole group setting to discuss their reflections following their presentation. There is a lot of discussion and the building of points together. Corinna makes references to Gardner's multiple intelligences and the students are familiar with the concepts. **Teaching Approach** Corinna's style is personal. She includes references to her own life experiences. She has an easy way about her and she is polite and kind. Her directions are clear and she is open to contradiction and alternative suggestions. She enables the students to work independently, in a large group and in pairs. They are always sharing and constructing ideas and statements. There is a certain degree of instruction and orientation but no direct instruction as such – it is up to the students to formulate their own ideas. She is well prepared and thoughtful in her approach.	modes available to them when they are required to demonstrate their conceptual understanding. A student who I know to be struggling socially is so alive and responsive in the class. It seems that there is space for everyone – to be verbal and communicative or to be more reserved yet engaged. Corinna's tone is always appropriate. She never appears stressed or out of sync with the students	the students will get out of it? What do you do if they have different perspectives or they take something for the novel that you hadn't anticipated or that you don't feel is intended via the novel? Was it your hope that the concept of fear would be raised in relation to the presentations? Explain the classroom arrangement? Would you personally choose to engage the students with this novel? Why have you chosen "The Meaning of Life" as the major focus for the unit?

Appendix D: Sample Analysis Grid

John-Science: (PC: Personal Construct, PK: Pedagogical Knowledge, SK: Subject Knowledge, SC: School Context)

Observation #1 Death and Decomposition/Carbon Cycle

Approx Time	Extract/Unit	Broad Tagging	Concepts to Categories	Banks, Leach and Moon Model
54:00	Teacher: While you are working on your assignment at home and while we are waiting for the test we need to keep working in class. So now we will start a new unit of work that follows on from what we have just done.	Making a point that the next unit runs on from the one that was covered before	Making connections	PK: Connecting units together PC: Learning involves test taking.
54:45	Teacher: This is a good time to check where we are. Who can remember what we were working on at the beginning of the year? Student: Energy –Solar Energy Teacher: Where does it come from? Student: Sunlight Teacher: But how does it originate? Student: The reactions inside the sun Teacher: What kind of reactions?	Solicitation of responses from students to capture where the class is now	Connecting to previous units via teachers directed short answer questions.	PK: Use of direct short-answer questioning Concepts: Solar energy, nuclear energy, chemical energy, EM radiation

	Student: Chemical reactions Teacher: Physical reactions? Student: Nuclear reactions. Discussion continues for a while relating to the different kinds of electromagnetic radiation.			
58:00	T: To summarize then Energy is produced in the sun by nuclear reactions. It travels through space to the earth. When it reaches the surface of the earth some of it is absorbed by plants and used in the process of photosynthesis to produce food. Ok? T: This is as far as we got. We're looking for what happens now but before we go any further I want to put together the big picture. Today's task is to look at happens – the big picture from there.	Summarizes where they have gotten to up to now	The journey metaphor – following a prescribed path Teacher as guide	PC: Learning is like a journey PK: Roles: Teacher as guide to destination
59:00	T: Energy from the sun is used by plants for photosynthesis. That's what we have just agreed. Isn't it? They convert the radiant energy from the sun into potential chemical energy. This process converts carbon dioxide from the atmosphere into sugars, which starts to make up the biomass of living organisms. Everybody happy about that? S: Yes. T: Now a thing to watch out for – the energy is going in one	A lot to talking time in the beginning is taken up by the teacher. He reads from the Smart Board. Significant amount of	Teacher has the store of knowledge to get things started	PK: Roles: Significant teacher talking time at the beginning/Storer of knowledge PK: Tech: Use of Smart Board as a presentation

	direction – from the sun to the plants and were going to use it up and eventually it will get spread out. But there is only a limited supply of co2. It may be converted into food substances but that's not a one way process – it's part of a big cycle and it goes around and round and round and it gets recycled and this is called The Carbon Cycle – pretty obvious name isn't it?	text is distributed via the Smart Board.	Use of Smart Board technology	device
Tape 2 11:58	**Placing of labels on carbon cycle diagram** There is a lot of conversation going on as some students work together to complete the diagram. S: Is the green plant here? S2: I don't know I haven't done it yet. S: This is all making sense to me now... S: So what do we have to do now...fossilization? S: Hey... does anyone know where fossilization goes?	Students work collaboratively to try and place the labels. They are working things out for themselves.	Collaboration amongst students	PK: Roles: Use of collaboration PC: Learning involves collaborative problem solving Concept: Carbon Cycle

Appendix E: The Final Interview Questions

Follow-up Questions

Personal Background

Could you give a brief summary of your background life history?

Who or what has/have been some of the major influences in your life? Why?

Why did you decide to become a Science/Literature/Spanish teacher?

What have been some of the major influences on your approach to teaching Science/Literature/

Spanish?

What have been some of the major influences on your understanding of how students learn?

The Nature/Essence of Reality

You mentioned that for you the essence of reality is a form of Energy/Love/Interconnectedness.

How would you describe this essence?

How do you think that you developed this understanding?

What, by extension, is your understanding of the essence of a human being?

Do you feel that your view of the essence of reality or humans influences your life in any way?

Do you feel that it impacts you as a teacher?

A Parting Question

If we all construct our own interpretations of the nature/essence of reality (and learners) then what implications does this have for our individual understandings of the concepts of teaching and learning?

Appendix F: The Raw Versions of the Profiles following the application of the planning framework

Raw Version of Corinna's Profile

Personal Construct
Personal Background: Corinna grew up, studied and worked in multiple countries worldwide. She sees herself as a Global Citizen. Liberal Arts degree. Influenced by her mother's analytical mind and love of literature. Also influenced by books as she grew up. Masters in Curriculum and Instruction from Michigan State University. The Masters and later PHD related studies had a positive and monumental impact on her understanding of knowledge. Taught at a Liberal College and University in the Teacher Education Departments. Previous experiences in Turkey have helped her to cultivate patience and value good schools and not taking anything for granted. She has chosen a Vegan way of being the world. Corinna believes that life and education should merge – that is, literature is about life and literature can help construct life.   **Learning:** Learning involves digging deep – exploring beneath the surface. Learning involves introspection and reflection on the impact of activities on the Self and one's own life. Learning involves exploring the meaning of life and the human condition. Learning involves sharing deep insights. Learning involves building on each other's insights and ideas. Learning involves acknowledging the beliefs of others. Learning involves listening to one's inner voice. Learning involves the social construction of understanding, concepts and reality through dialogue and reflection. Conceptual understanding comes from different sources - and different senses over time. Learning happens via internal scaffolds and schemas – shifted by discordance. Constructivist approach is open-ended. Learning involves prior knowledge of abstract concepts. Multiple sources and influences to abstract concepts. Different people understand concepts differently. Constructs grow and change through dialogue. Learning possibly not locked in this lifetime (old soul). Learning involves reasoning with evidence. Learning involves contradiction and the questioning of themes. Learning is a collaborative process. Learning involves a collective mind that includes teachers and students reaching for understanding what it means to be human. Learning happens when you embrace the intellect, the heart, the soul, and the mind. Learning involves allowing for the complexity of the full human being. Learning has an emotional and personal component. Learning is about expression, about taking risks, about feeling safe, about feeling comfortable. Learning involves sharing human emotions. Learning involves making independent connections on the part of students to other disciplinary areas – the Arts, and Peer Support. Learning is dependent on the energy and nature of the class on any given day. Learning can happen in loose organic environments. Learning involves the organic flow of ideas. Learning involves not knowing where the conversation is going. Learning involves expanding fully into the space of the possible. Web-like dialogue and interconnected nature of conversations. Learning is magical if there is a critical mass of reflective thinkers present. Learning involves a collective mind or entity – that transcends the mental capacities of the individuals.   **Reality**: The whole is greater than the sum of the parts. World as a connected entity. Interconnected nature of reality. Classroom being a microcosm of the world. Person being a microcosm of the classroom. Dialectical and reciprocal relationship between individual and environment. Vegan way of being in the world. We see things as we are and not as they are (Anais Nin). We all perceive our own reality – even when in the same room. There is no fixed body of knowledge. There is no fixed reality out there but there are some caveats to this admission. Connection to reality involves deep exploration of self and an awareness of intuition. Reality is not bounded or categorized. It can disappear from view by naming it. Metaphysical aspect to knowledge. Knowledge and remembering our true selves as something beyond the physical – the metaphysical. Some people can connect with reality – those who meditate. Knowledge of reality has been accumulated by scientists in in trying to emulate God (student comment). Reference to Jung's collective unconscious. Predestination. Telepathic connection between people who have been together a long time.   **Learners:** Learners will open up emotionally, intellectually, spiritually, metaphysical, if the space is open for them. Students are capable of engaging with more than the intellect - extends to metaphysical, philosophical, spiritual, emotional, psychological. Learners communicate through a variety of modes. Learners need to be

reflective, introspective, and thoughtful, aware, and *awake*. Learners have unique perspectives – the need to be acknowledged and seen. Some learners need open doors and flexibility. Aware and being awake. Learners as having souls. Fractured nature of unaware Self. We are an accumulation of our experiences and possibly of the past experiences of our ancestors. Learners can have contradictory beliefs. Learners with predispositions to philosophy. Learners at different conceptual levels. Learners can be disposed to existential intelligence. Learners construct a new class every day. Transcendental quality of groups of learners. Different students have different realities. Learners as a collective consciousness – magical.

Pedagogical Knowledge

Roles and Relationships: We teach who we are (Parker Palmer). The class is seen as a Community of Learners. Teacher is a member of the class who shares own personal perspectives and insights. Teacher is learning along with the class and from the students. Partnership between teacher and student. Teacher acts as facilitator and guide. The teacher is open to contradiction and to alternative ideas from the students. Teacher encourages participation. Teacher makes good connections. Helps students to appreciate life lessons and encourages students to share personal beliefs. Teacher as counselor. Teacher as part of the collective. Role of a teacher extends beyond the classroom. The whole is greater than the sum of the parts. Teacher as Sower. Teaching as impacting lives. Teacher as a Dolphin. Teacher as being present. Presence involves the Integrated Self. Teacher as consciousness of the classroom. Teacher as passionate and caring. Teacher as patient and endowed with integrity. Teacher as not giving up on students. Teacher as authentic self. While working towards the ideal one must also be pragmatic; otherwise, one cannot survive emotionally. Here the idea of below:

Organization of Classroom/Learning: Amphitheater layout of the class. Agreed upon signs to bring class to attention. T sign with hands for silence. Soft calls to attention following reflection. Using cards or popsicles to pair people up. Organization designed to foster communication, empathy and a sense of community.

Teaching Approach:
Teacher raises issues, gives counterpoint and encourages students to think in new ways. Asks questions that illicit deep insights and responses. Flexible approach to where conversations go. Encouraging students' creativity. MI Theory: music, dance, sculpture, song and art to convey understanding of concepts. Acknowledges students' ideas. Smooth transitions between activities. Sees trust as an important aspect of teaching. Encourages the interplay of the students in the generation of new knowledge. The excitement of teaching is going into the unknown. Teaching involves passion and care for child and subject. Teaching involves learning through student feedback. Worried about not doing enough "literature".

Assessment: Essay Test Mentioned. Assessment involves rubrics and grades – Corinna is at odds with student's interest in grades. Most important assessment is self-assessment. Ultimately in life this is what counts.

Technology: Smart Board: Use of Technology for presentation purposes

Subject Knowledge

Concepts: Heroes and Monsters, The Meaning of Life, Isolation, Oneness, Microcosm, Connectedness, Alienation, Being Loved, Being Rejected, Being Alone, Rejection, Passion, Thirst for Knowledge, Choices of Beauty, Life and Death, Pain. Kindness, Altruism, Fear , Inner Voice, Bravery, Courage, Isolation, Monstrosity, Humanity, Doppelganger, Dangerous Knowledge, Playing God, Honesty, Lies, Birth, Creation, Connection, Playing God, Offering Help, Inner Strength, Flexibility.

Method of Inquiry: Literary analysis involves looking at things from different perspectives.
Thematic statements vs. Thesis. Theme as a literary device. Frequent use of analogy and metaphor. Student's Thematic Statement: "Many of us have two sides, which we don't really recognize." PEA: (Point -Evidence - Analysis). Strategy for constructing an argument: Reasoning with Evidence. Learning involves honing basic literary analysis techniques before moving on. Journal writing, reflection, essay writing, dialogue, finding quotes to support claims.

Knowledge through Literature:

English is more than technique – it's about the meaning of life and the human condition.

Exploration of the Big Questions. English is philosophy. In literature there is not a correct interpretation. Good questions have no answers. Literature as an avenue to talk about human emotions - fears and desires and desperations. The themes in literature are the themes in our lives - they need to be examined. Themes can have many possible interpretations. Consideration of opposing themes. Themes are often interconnected. Literature involves painting a picture of what is happening so we can visualize. The need for humans to think carefully as to how they use the knowledge they have.

Knowledge of Context

Reference to AOIs – Human Ingenuity – consequences of creation and knowledge

The shape and design of the building have an impact on the organization of the classroom. Students making independent connections to other disciplinary areas

Appreciates the Kids, Resources, Building, Colleagues

Focus on The Big Picture: Capturing the heart of one's life and what one has learned

Disciplinary knowledge is a constructed concept

PD access to buy materials – books – DVDs

Different Disciplines are different ways of seeing the world

ISA promotes children who are analytical, reflective and decent human beings.

Need to talk about matters of importance in meaningful ways – meetings need to be about student learning

Raw Version of John's Profile

Personal Construct
Personal Background: Grew up in New Zealand. Speaks highly of this father. His father was a principled and ethical man. Father was a lawyer who protested against the war and was imprisoned. Influenced by his father's sense of social responsibility. Skeptical of those in authority. John considers himself non-religious. He studied science at university. Following tutoring experience he became interested in teaching. John taught in a country school for 25 years. Changed to an international school environment later. The move has impacted present day approaches to teaching. The international school environment allows for a greater degree of flexibility with investigations.
Reality: Ideas on reality are influenced by a life in Physics. Life comes from the stars. Energy is the underlying structure of the universe. Energy is the base of what exists. Energy manifests itself through different forms. Energy is not a material substance. Things behave differently on the sub atomic and macro planes. All life is dependent on the energy of the sun. All life and matter is interdependent. Existence of humans interdependent with natural environment. Energy may not be what we make it to be. Physical and conceptual limitations to knowledge of reality. Models are not a real representation of how things are. The real world can be approximated for practical purposes through observation and experimentation. We are only operating with the realizations we have to date. Real nature of the world may be beyond our grasp. Limitations of accuracy of evidence. Observation can impact outcome. Heisenberg's Uncertainty Principle. No evidence for existence of souls. Thoughts may travel out from the brain. Open to new ideas about the nature of reality.
Learning: Learning involves the construction of knowledge. Every person constructs his or her own understanding of the world. Learning involves using models that do not reflect reality but help us to understand it. Learning involves the development of mental models of concepts. During learning there is not enough of a focus on *why* scientific phenomena happen. There is a need for less of a focus on the math and more on the understanding. The brain is the main store of knowledge. Mental activity such as thinking arises from the physical. Thinking happens in the brain – as a result of electric currents. Learning involves having a mental picture of abstract concepts. Learning involves moving from concrete modeling to abstract understanding. Abstraction is extension of categorization. Abstraction could be like learning languages. Learning progresses through developmental stages. Learning is like a journey. Learning science involves making connections between different concepts. Learning involves building long chains of understandings. Involves building links between concepts. Learning involves collaborative problem solving. Learning involves explanation and guidance. Learning does not seem to involve impromptu conversation. Learning sometimes involves finding the correct answer. Learning involves following examples. Learning involves working through conflicting opinions and ideas as to how things work. Learning involves paying attention to prior knowledge.
Learners: For John a learner is both an independent and an interdependent entity. Independent in the sense that we exist as singular entities and interdependent in the sense that we form parts of the systems that surround us such as the environment and the universe. Learners are apprentices learning established scientific truths. Different ages of students are capable of different levels of interpretation of the same concepts. Younger students have less interest in uncertainty. Learners can abstract to different degrees. Students sometimes need to be prompted or pushed to learn. Learners need breaks and exercise. Learners need to honest, fair and they need to follow agreed protocols.

The mind is what makes a person distinct from another. Communication happens through the use of verbal language and body only. We depend on the practical interpretation of shared constructs to understand others. No way to interpret closely whether our interpretations are truly shared or whether they are no more than practical approximations that make communication possible.

Pedagogical Knowledge

Roles and Relationships: Teacher as a guide to destination. Teacher as a Coach who directs learning. Group dynamics the result of personalities of the students. Class sometimes regulates the behavior itself. Collaboration in evidence. Ongoing facilitation and correction of mistakes by John. Facilitation to a point- encourages students to step up to the plate and take the lead. Learning involves being prepared to work with all students. Teacher as tactician – decides the best play. Teacher as librarian. Teacher as the authority. Important to stick to protocols.

Organization of Classroom/Learning: Course is structured so that students can build the big picture. Program is designed to build connections between the concepts. Important to have free movement. Medium term planning – sequence of events. Some room for flexibility.

Teaching Approach: Teaching involves providing guidance and structure prior to letting students plan for themselves. Different approaches to the teaching of conceptual understanding. Front loading or discovery approach. Prior knowledge is important to learning. Misconceptions need to be unearthed. It's ok to simplify complex concepts until students are older and better able to grasp complex ideas. Demonstrate using multiple modeling devices. Clear teacher directed introductions and summarizing is important. Significant teacher talking time at the beginning. Teacher led group construction of the Carbon Cycle. Recording of new vocabulary.

Assessment: Assessment in science as reaching preset targets. Ongoing direct feedback. Learning involves test taking. Use of direct short-answer questioning. Learning involves immediate feedback through collaboration. Connecting to previous units via teachers directed short answer questions. Learning involves students reaching different levels of achievements.

Subject Knowledge

Concepts: Energy, Systems, Solar energy, nuclear energy, chemical energy, EM radiation, Carbon Cycle Concepts: Respiration, Photosynthesis, Carbon Compounds, Death and Decomposition, Biosphere, Fossilization, Evolution. Ecological responsibility to future generations. We all may have different understandings of the same concepts. New concepts may emerge in time that we have not thought about yet. It's ok to simplify complex concepts until students are older and better able to grasp complex ideas.

Method of Inquiry: Scientific Method. Science involves observation, modeling, predicting new ideas, providing evidence. Science investigations involve the inclusion of variables. Safety Procedures.

Scientific Knowledge: Science is pragmatic. Mind works out scientific ideas – sometimes following inspiration. Dreams are an important source of knowledge of the real world e.g. Einstein. Science knowledge reflects established understanding of how the world works. Scientific knowledge is accumulative. There are some things that scientist do not know yet. Science is provisional. John shows solid understanding of science concepts through the variety of responses he can give to complex questions. Learning involves trial and error during experimentation. Science involves planning investigation and carrying them out. Limitations of accuracy of evidence. Physics

recognizes its own limits. Exploration is bounded in school science. Knowledge from brilliant ideas. Science knowledge is more complex and less certain than students are led to believe. Models help understand science. Science has been unable to measure or tell whether there is anything in existence other than the material essence of our bodies. Use of Science and Technology to extend beyond 5 senses. Use of technology to extend knowledge of the world to beyond normal range of vision. What is true is a becoming diluted by opinion.

Knowledge of School Context

Follows the MYP guide. Refers to the list of MYP science concepts. MYP encourages connections to be drawn. Unit relates to the AOI – environments. IB learner profile. Learner Profile and Integrity and Honesty –mentions intellectual property rights. Learners need to be inquiring, thoughtful and reflective. Integrity and honesty with information. Interdisciplinary connections to Humanities

Raw Version of Anna's Profile

Personal Construct

Personal Background: Grew up in Spain and the Netherlands. Complex family relations. Speaks multiple languages fluently. Masters in Applied Linguistics. This helps her to teach conceptually. Enjoyed tutoring at university. Highly sensitive nature. Felt unseen and criticized as a child. Conceptual thinker. Trained spiritual counselor. Wide areas of interest: Singing. Writing. Capable of reading energy auras. Interest in Philosophy and World Affairs. NLP experience.

Reality: Love forms the basis of existence for Anna. Love is a latent drive to survive. It can be felt but not seen. Reality is perceived differently by everybody. Some people may be able to access reality directly. Reality is complex, Interdependent and Interconnected. May be essentially unknowable for most humans. Anna believes in reincarnation, and the existence of souls and spirits.

Learning: Learning is seen as a process that is challenging and holistic in nature involving mind, body, brain, emotions and spirit. Process involves the laying down/construction of language in subconscious non-material grooves. Learning is dependent on subconscious rule building, access to prior knowledge, readiness, developmental stage, innate ability, student energy and group energy. Learning involves conceptual understanding and collaboration. Learning involves the consideration of multiple perspectives. Learning involves philosophical discussion, conversation and dialogue. Learning involves the development of thinking skills. Goes beyond the rational and includes intuition and imagination.

Learners: Seen as involved, curious and inquiring participants with both spiritual and physical dimensions. They need to be seen and listened to so that they can see themselves and connect with others.

Pedagogical Knowledge

Roles and Relationships: Students work collaboratively, in small groups through discussion and conversation. They also take the lead and collate ideas and assist each other. Anna acts mostly as a moderator/facilitator. She chooses not to meddle when student are speaking. She feels it's important for students to see the human face of the teacher. Believes that female teachers may connect more easily. Teacher as a Sower of seeds. Energy of groups can change. Energies of individuals can come together to form a collective cloud of new energy that diffuses the group.

Organization of Classroom: The set up of the room is Café style to aid with the free flow of conversation. Ann a positions herself within and to the edge of the groups.

Differentiation: Reference to MI Theory. Students use multiple modes of presentation to explain understanding of concepts

Feedback: Provides Positive and Constructive feedback

Technology: Frequent and fluent use of a variety of technology tools for real-time processing of students ideas.

Subject Knowledge

Focus on the use of Spanish grammar (past tense and conditional) embedded in context
Emphasis placed on constant repetition of constructions and reinforcement
The use of the conditional tense combined with personal effects on global issues
The frequent use of metaphor by students indicates facility with literature devices
Myths and stories as a means to teach the past tense

Knowledge of Context

Focus on conceptual understanding and big ideas
Focus on student inquiry and exploration
Learning is contextualized in real world activities
Significant focus on interdisciplinary learning: multitude of Humanities and TOK concepts
Multiple references to the VT Thinking Moves: making connections, expanding viewpoints, considering multiple perspectives, uncovering complexity, conclusions, building explanations
Thinking is presented as important cognitive skill
Direct reference to the Areas of Interaction: Human ingenuity and Health and Social Ed.
Continual reference to cultural relativism

Appendix G: Participant Consent Form

PARTICIPANT CONSENT FORM

As part of my Professional Doctorate (EdD) in Teacher Education programme with the University of Nottingham, I will be completing a research study that explores the relationships between teachers' beliefs regarding the nature of knowledge, the nature of reality and how these relate to their conceptions of teaching and learning.

Project Title: An exploration of teachers' beliefs regarding the nature of knowledge and reality and how they relate to their conceptions of teaching and learning within an IBMYP international school environment.

Researcher's Name: Mary Kelly

Supervisors' Names: Dr. Roger Firth and Dr. Peter Gates at the School of Education, Nottingham University.

- I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.

- I understand the purpose of the research project and my involvement in it.

- I understand that I will be observed, videotaped and interviewed during the research.

- I understand that I may withdraw from the research project at any stage.

- I understand that my real name will be used in the current study. Should the study be published at a later point in time, I understand that a pseudonym will be used.

- I understand that all data will be stored on a laptop and a hard drive belonging to Mary Kelly and that only she and her supervisors will have access to the raw and processed data. Paper print outs of the raw data will be stored securely at the home of Mary Kelly.

- I understand that I may contact the researcher or supervisor if I require further information about the research, and that I may contact the Research Ethics Coordinator of the School of Education, University of Nottingham, if I wish to make a complaint relating to my involvement in the research.

Signed ....

Print name .... Date ....

Contact details
Researcher: *Mary Kelly : mkelly@isa.nl Tel: 00 31 6 2533 8853*
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