Science and Mathematics Education Centre

An Interpretative Journey into Constructivism and Primary Science Curriculum

Lesley Ann Middleton

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ABSTRACT

The principle focus of this study has been a reflection on my planning methodology since 1988. Teachers' planning from 1988–2002 was predominantly individual and was aided by the gradual introduction of State and Commonwealth produced documents. These documents assisted in topic choices and assessment outcomes.

Important influences transformed my planning. The first occurred in 1996 and the second in 2002. In 1996 I was involved in the production of a resource kit for teachers titled, *It's Working – Career and Work Education, Kindergarten to Year 8*. During the compilation of this resource kit my planning incorporated the 1995, *Teaching and Learning in Science Planning Guide*, which resembled constructivism by building knowledge and understanding. In 2002 the curriculum in Tasmanian State Schools was transformed with the introduction of the Essential Learnings Framework 1 and 2. This curriculum innovation had implications on teachers' planning methodology with a strong emphasis on collaborative planning.

Studies and critiques of environmental units were undertaken in 2000, 2003 and 2004 to ascertain the effectiveness of my planning methodology. The underlying principles of constructivism provided a lens to improve perceived deficiencies in my classroom practice. The inclusion of the *Constructivist Learning Environment Survey (CLES)* assisted in making constructivism visible. A strong purpose therefore evolved from the study; a more effective planning methodology.

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CHAPTER 1

INTRODUCTION

1.1   Introduction

This research study is a reflective journey into the development of my classroom pedagogy, which infers lesson and unit planning. It explores how I address the theory of constructivism and I situate myself within it. This journey begins in 1988 when I re-entered the teaching profession after a nine-year absence. My experience in 1988 was that lesson planning and the year's overview was the responsibility of individual teachers with few resources to assist in that planning. In 1989, however, there was a concerted effort to improve this situation with the collaboration of State, Territory and Commonwealth Ministers of Education to endorse agreed and common National Goals for schooling in Australia. As a result of that collaboration, *Statements and National Profiles* in eight broad areas of learning were produced in 1994, providing a framework for curriculum development. The *Statements and National Profiles* were designed to improve teaching and learning outcomes, and to offer common goals and a widespread language for reporting student achievements.

In Tasmania, the beginning of the 21st century saw a redefining of the curriculum provided by government schools and colleges in the publication of the *Essential Learnings Framework 1* (2002) and *2* (2003) documents and supporting resources. The eight broad learning areas of the national curriculum documents (1994) were taken as a basis in developing four Essential Learnings: communications, personal futures, social responsibility and world futures. Each of these Essential Learnings was then subdivided into four key elements. A key element then became the focus for learning thus reducing the problem of a crowded curriculum. This curriculum shift also

meant that a teacher's individual lesson and unit planning became a more thought-provoking exercise. Lesson and unit planning as defined in *The Values and Purposes Statement* (2004) "provides a basis for planning and review of programs and a framework for embedding the values and purposes in practice" (Essential Learnings Framework 1, 2002, p. 8). This radical shift in curriculum was viewed with keen interest in state, national and international educational circles as stated by Bantick (2005), in *The Mercury* newspaper:

> Tasmanian schools will be watched by the rest of the country this year, with educationalists in other states keen to see how the new Essential Learnings curriculum will work. Besides Queensland, where some attempt at individualised learning is under way, no other mainland state education department has undertaken such a personally styled education system. The critical point to grasp is that the Essential Learnings are part of a very big education picture for Tasmanian children. (p. 32)

From 2002 the gradual inclusion of the new curriculum into Tasmanian schools also saw a shift in my unit planning methodology. In the past my planning detailed a selection of activities that related to a unit of work, however, with the introduction of the new curriculum, activities were now more focused, and provided for different levels of thinking and deeper understanding of the introduced concept. Hanlon (2004) states, "It is unashamedly the case that the higher order thinking focus we are taking with our Essential Learnings Framework places understanding and development of thinking above the acquisition of knowledge for knowledge's sake" (p. 1).

Part of the curriculum change also included teachers in collaboration: planning units of work specifically targeting their particular student cohort. During this collaboration teachers had access to a rich collection of resources to support their planning such as, books, departmental personnel, professional learning programs, computer websites, compact discs and manuals. For some

teachers planning now became an overload of information, they did not know where to start or how their planning would evolve. In the *Australian Education Union Reporter* (July, 2004) a survey of 1,340 teachers found that the most frequently cited issue for teachers, when planning using the new curriculum framework, was the time taken to come to terms with the Essential Learnings and the time needed to discuss the framework and to plan collaboratively during the school day. In my present school, the issues of time and understanding the Essential Learnings Framework is a concern and some teachers feel that it now takes longer to plan units.

1.2 Aim of the Study

The fundamental aim of my study is to use effective appraisal practices in my planning methodology. Appraisal includes: unravelling the complexities of the new curriculum and applying it more efficiently into my planning methodology: developing an understanding of constructivism and applying the theory into activity choices, which promotes deeper understanding of a topic for my students: and communicating my understandings of planning methodologies with my colleagues.

1.3 Background to the Study

In 1991 the Tasmanian Department of Education and the Arts outlined current and future thinking in education for Tasmanian schools by publishing a series of five documents, *Our Children: The Future*. These documents explained many issues related to teaching, such as, how children learn, the role of schools in the community and the inclusion of all children. Part of the five document series is the *Teaching and Learning* document (1991), which outlines the theoretical stance of the Tasmanian Department of Education at the time: stating that the acquisition of knowledge is through constructivism However,. the Teaching and Learning document stipulates, that, "there is no

single correct philosophy or psychological theory or educational practice" (p. 3). This document gives a brief definition of the theory of constructivism by stating:

> In its pure form, constructivism has two fundamental tenets: first that knowledge, as a coherent world picture, is actively constructed by the individual subject, not possibly received from the environment; and second, that coming to know is an adaptive process that organises one's experiential world. 'Coming to know' is not to be interpreted as discovering an independent, pre-existing world. (p. 7)

In 1991 I was unfamiliar with the theory of constructivism. I needed to examine it and then decide whether to use this theory in my own practice. In 1996 I undertook a brief analysis of constuctivism as part of my Master's degree, however, my understanding was greatly enhanced in 2002 when I attended a Doctorial Institute designed specifically on the theory of constructivism. During this institute, authors and their papers regarding aspects of constructivist theory were referenced and disseminated.

1.4 Research Questions

My first research question asks: what teaching strategies reflect a constructivist approach? This is partly answered in the paper, *Constructivism as a Referent for Teaching and Learning* by Tobin and Tippin (1993). The authors describe constructivism as, "an intellectual tool that is useful in many educational contexts. Using constructivism as a referent has led to many changes in our roles as teacher educators and researchers" (p. 20). A constructivist referent, which allowed me to examine teaching strategies that reflected constructivism was the revised 1994 *Constructivist Learning Environment Survey (CLES)*. This survey contains five important parameter

scales of constructivism and six items outlining constructivist practice are listed under each scale.

My second research question asks: Does this constructivist approach changes students' perceptions about the environment? Two environmental studies were undertaken in 2000 and in 2003 to determine whether the approaches I used influenced students' perceptions about sun safety, and waste and recycling. Through these studies I discovered that my teaching approaches were influenced significantly by curriculum design, firstly at a school level, and in the second instance at a state education level. Anecdotal vignettes of classroom practice, undertaken during these two studies, provide evidence of constructivism in practise and the introduction of the CLES to my students and their changed perceptions.

My third research question asks: Are these perceptions transferred into the real world? Both the 2000 and 2003 studies included units of study designed to transfer information and understanding at a school level into students' home lives. The media contributed to this via visual texts, such as, television, newspapers, magazines and pamphlets, which bring regular information related to environmental issues into the students' out-of-school lives. In the second study, about waste and recycling, the local municipal council provided a link between information learnt at school and information gained outside school.

1.5 Overview of the Thesis

This thesis describes a reflective journey through my planning methodology, where the main influences have been: my past history of planning: my colleagues: specific teacher references, such as, books, videos, computer programs and software packages: various government curriculum initiatives and their official documents: and professional learning programs. There has also been influence from: outside organisations, like the Cancer Council: the municipal council resources: and the culture of the school and school community.

Chapter 1 provides an introduction to the general content within this thesis. It includes the aims, the research questions and a succinct overview of each chapter.

Chapter 2 describes the history of my planning methodology, commencing in 1988 when I re-entered the teaching profession after a nine-year absence. This historical account includes vignettes of important planning moments that happened during an eight-year period, until 1995 when my planning took on an environmental focus.

Chapter 3 explains how an environmental focus emerged in 1995 and how this focus influenced my planning and my selection of units. An environmental focus provided a link between my personal planning, the school, the community and the students' out-of-school lives.

Chapter 4 describes the evolution of the Essential Learnings, an innovative curriculum design for Tasmanian schools developed in 2002 by the Tasmanian Education Department. The new curriculum was supported by Education Department documents, the most prominent being the *Essential Learnings Framework 1 (2002) and 2 (2003)*: extensive professional learning programs designed to familiarise teachers with the concepts contained within the documents and with current pedagogy, including computer programs and support in planning. Teachers' planning became a very involved process whereby many teachers were overwhelmed by the excess information.

The theory of constructivism is explored in Chapter 5 through an examination of literature regarding this topic. Understanding the fundamental ideas within this theory gave me many insights, especially into the design of activity choices within my planning. Polkinghorne (1992) interpreted psychological and epistemological perspectives in relation to the profession of psychology. Noddings (1984) conceptualised constructivism, and Ernest (1995) addressed popular types of constructivism and their unifying characteristics. Tobin and Tippins (1993) explored constructivism from a social Constructivist

perspective in a classroom situation. Von Glasersfeld (1990) outlined the central principles of radical constructivism, and Solomon (1992) focused on social constructivism and its influence on teaching and learning in science. Cobb, Wood, Yackel and McNeal (1992) examined constructivism through a social constructivist lens within a primary school setting, and Taylor (1996) explored how and why a critical lens has been added to constructivism in order to make sense of cultural constraints. Taylor (in press) defined and delimited the scope of constructivism as a referent for pedagogical reform. Geelan (1997) outlined six forms of constructivism and defined epistemological anarchism and Airasian and Walsh (1997) took a cautionary account of constructivism in terms of what constructivism does and does not entail for teaching and learning.

Chapter 6 describes how teachers can be researchers by adopting various procedures to critique their or other teachers' practice in order to ascertain whether constructivism occurs. Research procedures include: video analysis where colleagues are welcomed as critics, teaching demonstrations from exemplary practitioners, personal reflective journals, student-teacher discussions about a lesson, teacher performance indicators, classroom observational scoring manuals, and instructional rubric grids and questionnaires such as the Constructivist Learning Environment Survey (CLES). I have utilised most of these procedures to reveal the flaws in my pedagogy that need to be addressed in order to achieve better constructs for my students.

Chapter 7 outlines the incorporation of the revised 1994 CLES into classroom practice. The revised CLES included important parameters of constructivism that reflect critical theory perceptions. When introduced into classroom practice, the CLES can provide teachers with an insight into students' perceptions of a teacher's pedagogy and can determine whether that pedagogy embraces constructivism. The parameters of constructivism, which I needed to address, were made visible by the inclusion of the CLES. However, in 2003 this implementation process was limited due to the teaching structure that existed in my classroom. The 1994 revised CLES had been modified both in

language and scoring options to match the younger students for which it was intended.

Chapter 8, describes two environmental research studies undertaken in 2000 and 2003. Both studies used the CLES to ascertain students' perceptions of constructivism in pedagogical practice before the introduction of the unit topic and at the conclusion of the topic. The first study outlined a unit of work introduced to a Grade 3 classroom titled, *Sun Safety*. A teacher colleague was also involved in the planning of this unit and our collective planning methodology determined the suitability of activities for this age group. My planning for this unit was documented in a four stage 1995 Science Curriculum Teaching and Learning Planning Guide, which linked to the National Science Statement and Profile, and to the state documents. This research study began before the introduction of the new curriculum into Tasmanian schools, however the activities listed under the science-planning guide reflected constructivism by the building of students' prior understanding from one stage to the next. This planning methodology continued to influence my planning structure and activity choices until 2002 when planning methodology changed due to initiatives created by the introduction of the Essential Learnings.

The 2003 research study was undertaken in a Grade 1/2 classroom, in a different school with younger students. The environmental unit of study, titled Waste and Recycling, was regrouped into the Essential Learnings of World Futures. Collaborative planning had now become mandatory in Tasmanian state schools, so the planning for this unit involved the collaboration of two other teachers. During this collaborative planning process the teachers' input into activity choices became more varied and increased in volume. The choice of activities was often selected from recommended texts, placing activities in hierarchical order, and where prior knowledge could be ascertained during the tuning-in phase. Other planning phases included, guided inquiry, drawing conclusions and a culminating performance where the activities of each phase built upon understandings gained in previous phases.

Chapters 9 and 10 give an interpretation of how these two units of study evolved and include the effectiveness of constructivist-based teaching in changing students' environmental attitudes. The inclusion of the CLES gave some indication as to whether particular teaching strategies reflect constructivist approaches and where improvements could be made in my teaching practice.

Chapter 11 outlines the limitations of the CLES used in both the 2000 and 2003 studies. In both studies the age of the student cohort was a limiting factor as the language contained in the CLES had different meanings for different students. The timing of when to introduce the CLES was also important. In the second study using younger students, the CLES needed to be introduced after students had a measure of literacy skill. The length of the CLES, which included 30 items proved too long, especially in the 2003 study, where students needed several sessions in order to complete it.

Chapters 12 and 13 analyse both the 2000 and 2003 units. The Safety in the Sun unit closely followed the design of other units I had planned previously. And generally, the activities were ones that my teacher colleague or I had previously done before. When I examined this unit some activities did not achieve maximum benefit, or were worded incorrectly. For example, the brainstorming activity done in the engaging stage could have included a critical thinking component, such as, the positive, minus and interesting (PMI) activity.

The 2003 planning was done collaboratively in a team with two other teachers. For this planning, a collection of resources were available such as, educational personnel, recommended texts and planning proformas, outlining the language needed to plan a unit of work. *The Essential Framework 1 (2002)*, states that, we share our purposes of ensuring our students learn to relate, participate and care. But we had not thought through a purpose for this unit. Also our aims did not always link to the activities listed. The list of activities for the 2003 unit had been mostly reworded from a previous unit, which resulted in many

activities not being completed. Both units failed to include a reflective component, which may have resulted in alternative or fewer activity choices.

As a result of the analysis done in the previous two chapters, Chapters 14 and 15 establish alternative planning models. In the 2000 unit I used the expertise of a critical friend who had previous experience in planning in the Essential Learnings planning. My critical friend was able to critique the Safety in the Sun unit using the methodology of the new curriculum. As a result I then compiled an alternative unit for Safety in the Sun using this new information.

For the 2003 unit, Waste and Recycling, I collaborated with a colleague within my school to redesign this unit in 2004. The unit was renamed Reduce, Reuse, Recycle, Rethink and included students' questions. The inclusion of students' questions linked to ideas from professional learning programs I had attended in 2004 about the *Reggio Emilia* approach.

Chapter 16 outlines the assessment challenge. The inclusion of successful assessment tasks became a fundamental issue in the revised units. Assessment needed to be clarified because in 2005, all teachers would be using assessment to inform parents and students. In the revised 2000 unit assessment tasks were not described adequately and in the 2003 revised unit there was not enough time for a thorough investigation of suitable assessment tasks. It became apparent, after the reflective analysis of the units that there should be a link between the language within a standards to match the understanding goals.

Chapter 17 outlines a critique of unit planning and offers a vision for future planning. After critiquing both units my preference favours the utilisation of a critical friend in the first instance especially a person who already possesses a level of competency in planning and who is able point out any discrepancies, alternatives, or omissions in the planning process. Teachers, therefore, need to come to terms with the language and requirements of planning before engaging in team collaborations.

A vision for future planning would incorporate the following requirements: teachers should have a common understanding of planning methodologies, the inclusion in the first instance of a critical friend, equity and adequate time for planning, the use of easy-to-use proformas, a common understanding of assessment and proven assessment tasks, the inclusion of students in the planning and assessment process, and reflective practices should be built into the planning process.

Chapter 18 the final chapter, delineates the essence of this thesis. It was established that the theory of constructivist epistemology enables teachers to use the principles that, underlie this theory as a referent for their teaching and learning. Constructivism, however is a philosophical explanation about the nature of knowledge and is not prescriptive in the craft of teaching, therefore teachers should examine the choice of activities they provide for their students for them to form deeper levels of understandings to form. This study provides a teacher's perspective of planning models and the suitability of activity choices in that model. It does not delve into the complexities involved in how students learn, the issue of emotional well-being in learning or a teacher's suitability for the complex nature of teaching.

CHAPTER 2

MY STORY, THE BEGINNING

My pedagogical journey begins in late 1987 when after a long absence from teaching, I decided to re-enter the teaching profession. My family and I had just moved from Victoria to Hobart. I then approached the Tasmanian Education Department in late 1987 in anticipation of gaining a teaching position. I was told there were no teaching positions in Southern Tasmania; however, if I contacted the North West regional office there was a possibility of a vacancy in this region. I wrote to the North West regional office to inquire about a teaching position, only to be advised that no vacancies existed until the following year. During this interim period we lived on unemployment benefits and so experienced life as part of the unemployed. A feeling of hopelessness and despair engulfed both my husband and I, we believed that neither of us would gain paid employment in the near future.

My children were enrolled in the local primary in Southern Tasmania, one in Grade 2 and the other in Kindergarten. I undertook the role of parent helper in my childrens' classes and relief teaching whenever possible. At the beginning of 1988 my children's new teachers gave me immense moral and professional support in my relief-teaching role with ideas and documentation on teaching developments. These teachers also advised me that I should re-apply for a teaching position through the North West regional office, as letters often get filed and forgotten. I followed their advice, re-applied and consequently was offered a teaching position at the start of term two, which was in three weeks time. The position was in a remote mining town in North West Tasmania. My new class would be a Grade 3/4 of 23 mixed ability, mostly white, English speaking students, aged between nine and ten years.

A combination of jubilance, reticence, and anxiety crept over me, as I needed to collect useful educational resources and information in this limited time frame. An Education Department information session for parents on how

children acquire literacy skills was offered in this interim period, this provided me with some information on literacy. A presenter of this information session was a former colleague whom I had approached for advice and who had recommended various resources. This colleague strongly recommended a book titled *Books Alive* (1986), in which lesson and unit planning was based on ideas contained within books. My information technology knowledge and skills were non-existent in 1988, which meant I urgently needed instruction on the fundamentals, including how to switch computers on and off. I consequently enrolled in an Adult Education course in basic word processing; this gave me some knowledge and skills about computer operations. From my children's teachers I also obtained written information about the latest Education Department's word processing software package called Edword. I purchased my own basic computer, one that would be similar to those used in Tasmanian schools in 1988 to apply these new word processing skills.

The car travel to this remote mining town in North West Tasmania from Hobart took seven hours with a stop over at a large coastal town along the way. Whilst in this large coastal town we heard on the nightly news that the mining town we were destined for was to close down. I felt that my teaching career had terminated before it had a chance to start. Since hearing that news in 1988 the mine has continued to operate at varying capacities to the present year, 2005. We arrived in the mining town in early June 1988, a week before school commenced.

During that week I needed to visualise how my new classroom would operate. The arrangement of furniture and equipment was important, as well as an audit of classroom resources, I felt that this would support the orderly function of the classroom. When second term commenced in mid June 1988, the first priority was to ascertain student ability levels for class groupings. It became apparent that the skill levels in handwriting, literacy and some areas of numeracy were lower than anticipated. My lesson planning, therefore, was explicit in those areas and I needed to detail every part of the lesson in a way that was similar to what was expected for a novice teacher. Lesson planning was very structured and a sequence of learning areas to be taught during

certain times each day was itemised. Detailed educational curriculum information and requirements had not yet been produced and teachers were given exceptional freedom with their planning. This freedom frustrated me, as I did not know what to teach my students, especially in mathematics. Later I was introduced to a valuable mathematical resource, *The Rigby Maths Program* (1986). From this resource I was able to piece together an outline in mathematics for the Grade 3/4 class. The Rigby program also included a range of stimulus pictures, which helped students to understand concepts especially in measurement, space, number (place value, multiplication, division and regrouping algorithms), time and money. I also relied on my past mathematical texts to supplement the Rigby program, particularly for consolidating the basic operations of addition, subtraction, multiplication and division.

My unit planning in 1988 was based on the ideas presented in *Books Alive* (1986), which focused on literature as the prime motivator for developing the classroom program. Lesson planning was separated into subject areas and documented in a special Tasmanian Education Department's foolscap sized daily planning book. This was a large blue book with double pages divided into five daily sections. The back of these pages was blank for writing overviews for lessons, evaluations of lessons and general comments. The school's senior staff teacher did not require me to submit a year's overview of intended topics or subject scopes or sequences during my first or second year at this school. During my teaching appointment there I found no evidence of either a school or state based-curriculum with outcomes, scopes or sequences. Thus I relied on school textbooks as references and collected activity ideas from colleagues to assist in lesson planning.

Included in my planning was the use of a BBC computer for word processing. This low capacity computer was rostered between five primary classes and had a restricted usage of five hours per week, which could be changed depending on availability. There were a limited number of programs available in 1988 for this type of computer, which meant that students were restricted by what they could do. The introductory course I did through Adult

Education, the purchase of my own basic computer and information about the Education Department's word processing package became invaluable, as few teachers at the school had this level of expertise.

Another curriculum area included in 1988 was drama, using a specialist teacher. Drama often correlated with work done in the classroom and gave an added dimension to students' understanding in an area of study. I also included a cooking roster in my lesson planning, which made use of the school's well-appointed cooking facilities. Student cooking was done in conjunction with a teacher assistant who took groups of five to six students to the school kitchen. Cooking often related to a theme where special food preparations would allow students an understanding into a particular culture.

Swimming was also included in my lesson planning. An indoor heated swimming pool was close to the school; there the school participated in a regular swimming program. I then had to plan for three swimming groups: this had not been part of my previous teaching repertoire. Classroom teachers at this school were expected to have an understanding of swimming and survival techniques and the ability to detail a sequence of swimming lessons. The inclusion of this learning area was an innovation on past practices and often caused stress due to inadequate teacher training and skill level.

All primary school teachers at this school were expected to complete a detailed week's lesson plan, which was submitted each Friday to the senior primary school teacher. Lesson planning included a comprehensive evaluation section written on a double page inside the week's overview in the planning foolscap book. Evaluation incorporated the highs and lows of a lesson and how improvements could be made. The primary school senior teacher would often make comments, correct spelling mistakes and then sign and date this book. After a nine-year absence from teaching, where I was autonomous, I felt I was being treated like one of my students and not the professional I was suppose to be: coming back into teaching was difficult.

During this period I faced a dilemma: (recorded in the evaluation section of my lesson planning book) the structure of my day and my lessons follow a structured sequence. This type of structured planning was similar to past practices, and it made the day very disjointed. I realised the inadequacies of my daily lesson structure and sought help from the senior primary staff teacher approximately one month after commencing. It was suggested that I visit the classrooms of other colleagues to witness lesson demonstrations and obtain lesson planning ideas. One colleague I visited during this period was using a planning tool referred to as a contract system.

The contract system consisted of a teacher-documented list of activities for the students to complete during the week. The contract list of activities was displayed in a prominent position within the classroom and students would tick off an activity when it was completed. Activities were introduced to the students at the beginning of the week and then briefly discussed to give an understanding of what each activity involved. Students in this classroom knew the routine of the contract system and appeared to be working independently. I felt that the contract system eliminated the 'stop, start' procedure adopted in my own classroom and so therefore I was eager to try it out.   After introducing the contract system to my students the day's program seemed to run more efficiently.

The inclusion of a contract system hinted at democratic decision-making. Dewey (1969) asserts in his chapter, *Duties and Responsibilities of the Teaching Profession*,

> The process of democratic co-operation suggests the proposition
> that there is a need that classroom teachers, who have immediate
> contact with pupils, should share to a much greater extent than
> they do at present in the determination of educational objectives
> as well as of processes and materials. (p. 226)

Activities in the contract system during this period were teacher-initiated and closely linked to a main theme. A typical contract list of activities included: a

mathematics, story writing, poetry, grammar and spelling, drama, painting, science and social science. Throughout 1988 the contract system continued during the afternoon session time. The first part of the day was devoted to practicing skills such as, handwriting, editing written work, spelling, reading, grammar and mathematics.

In 1989 I selected a younger cohort of students, aged between 6 and 8 years in a Grade1/2 class to teach. As a result of my experiences with my own two children during their informative years, I felt I had a greater affinity with younger students. I became ill at the beginning of 1989 and was incapacitated until Easter. A relief teacher took my Grade 1/2 class, introducing essential classroom routines and developing basic skills in literacy and mathematics. Literacy and mathematical skills needed to be very basic, as some of the Grade 1 students had come directly from Kindergarten and had not undergone a Preparatory year. Those students who had come from Preparatory had already been introduced to literacy, numeracy and a social skills program.

As I lacked the teaching experiences with this younger age group, my lesson planning took on a structured approach again. Lesson planning became more detailed; I had to plan for shorter activity periods to cater for the reduced attention span of younger students. One week after returning from illness the senior primary teacher suggested, in the evaluation section of my lesson planning book that I have a dress up box, home corner, shop or telephone for free play activities, rather than planning activity situations. Two weeks later I introduced the contract system once again. The senior primary teacher then remarked "*I am pleased that you have begun contract work.*"

A daily contract for this Grade 1/2 class consisted of spelling, story writing and mathematics. Activities introduced a week later into the contract system included, play dough, home corner, shoelace tying and games. A contract chart was displayed in a prominent location within the classroom for student reference and marking. By July 1989 my evaluations on activities became less detailed, as I felt that there was no longer the need to detail each and every minor event that occurred during the course of the day. I had become

more confident with my class program and pedagogy especially in relation to this student cohort.

In 1990, the third year of my teaching appointment to this remote mining town, I consolidated my pedagogy by taking Grade1/2 again continuing to use the contract system. In 1990 I attempted a rudimentary whole year's planning overview of important topics or themes that could be covered during a four-week period. At the start of the year I did a whole year's planning overview, which indicated how the year would develop and when and what to teach. A year's planning overview now also became a staff requirement. Themes inspired from books were superseded to a topics approach. Colleagues mostly informed the selection of topics, which related to particular understandings students should acquire at certain ages. Topics, which provided understandings for the Grade 1/2 included; learning about themselves, their address, phone numbers, road, sun and home safety, emergency services, seasons of the year, Easter, Christmas, Mother's Father's Days, Anzac Day, space and nutrition.

Specific daily planning details were not listed in the year's overview of these topics. Some topics evolved unexpectedly such as, Life Education and Book Week. A travelling van containing details of life education arrived at our school in late March 1990. It was imperative that teachers adapt their programs to cater for the important understandings life education had to offer. Book Week in late July, was another example of an unexpected addition to my planning. Older students worked in collaboration with my students to plan projects related to a book.

Curriculum profiles or outcomes in 1990 were not detailed in education department documents. Support for lesson and unit planning came from a scant school based professional learning program, ideas collected from colleagues and reference books purchased or borrowed from the school's library. In August 1990 I applied for a transfer to southern Tasmania and in November I was instructed that my new placement would be in a small rural town 60 kilometres south of Hobart.

The class I had in 1991 was a composite Kindergarten/Preparatory/Grade 1 consisting of 26 students. Students ranged in age between 5 to 7 years. I had no previous experience with the younger Kindergarten aged students and consequently had to become familiar with their social and curriculum needs. I undertook a rigorous collection of activities prior to commencing my new assignment from colleagues who had experience with this student age cohort. During the summer vacation of 1990, I detailed a sequence of topics to be undertaken in my new class. Early in 1991, the principal of my new school viewed my planning book and his comments were very complimentary regarding the sequence and detail of my planning.

Although my lesson and unit planning was detailed and accommodated for the mixed ability levels in my new class, putting this into practice was horrendous. The nine Kindergarten students with a range of abilities came for three full days a week, however there was no provision for a teacher assistant to support these Kindergarten students. One Kindergarten student was able to read and write and had travelled extensively overseas, however, other students had not travelled out of the local district and had limited social and language experiences. Two Kindergarten students could not name local farm animals such as cows, sheep or horses although these animals were accessible to these students.

Lesson planning was modified to include basic understandings for these younger students and focused on play activities. Play activities included; painting, drawing, cutting and pasting, cooking, tricycle riding, interacting with other students through construction games, puzzles, listening to stories and the inclusion of music and dance to assist language development. Many of these play activities were designed to recognise the alphabet, shapes, numbers, patterns, and colours. The inclusion of simple computer software programs assisted students with word and sentence recognition. Continuous application of these important understandings was necessary for further development in reading, writing and numeracy.

In early 1991 I asked to visit other schools in the region to ascertain how they managed and structured their lesson planning for this particular grade group. Unfortunately there were no other schools in the region, which had the same grade group or the absence of a teacher assistant. I was on my own. There was one class that had a large number of students in a Kindergarten/Preparatory with a teacher assistant. The teacher assistant prepared and helped students with their activities and mostly managed the Kindergarten students. These students attended school for two full days a week compared to my Kindergarten students who attended for three full days.

The emerging literacy skills in my class meant that a written contract system was inappropriate. I therefore used verbal instructions to indicate the activity choices. Activity choices were usually selected from tables or activity centres.

The following year, 1992, I had a Kindergarten/Preparatory class. In this class I had a student with severe disabilities. During this year as part my professional learning program I was introduced to a sequence of augmentative communication techniques. This allows students to choose activities using mostly visual cues. Visual cues included, real objects such as a ball or skipping rope, photographs, Makaton signing when verbal communication was limited and compic pictures. The use of compic pictures was also later introduced into a contract system for these younger students. A variety of compics or teacher made pictures were displayed and described activity choices for students to complete. Activity choices included; play dough, commercial games, skipping with a rope, listening to stories, reading, computer games, jigsaw puzzles, painting, cutting and pasting, dress ups and number work.

In the four years since re-entering the teaching profession it became necessary for me to address the innovations that were becoming apparent in teaching. These innovations were highlighted in the school's professional learning programs and conversations with key Education Department personnel. In 1992 I enrolled in the professional learning programs offered by the University of Tasmania to advance my three-year teaching diploma into a

Degree of Education. Most professional learning units were done during Summer Schools. Summer School units consisted of one or two weeks occurring in January. The Education Degree progressed in 1994-6 into a Master of Education Degree.

Literature for Children was the first of these units and went over a two-week period. This unit provided me with knowledge and understandings I could transfer to my students using various picture books as the focus. Book features were highlighted such as, parts of a book, location, quantity and conventions of text and illustrations. Author studies also became a fundamental component of the course and were transferred into my teaching practice.

The Education Department's inclusion policy, that assimilated students with disabilities into mainstream schooling, required teachers to have an understanding of students with special needs. In 1992-3 I had two students with Down syndrome and therefore, needed to undertake courses in special education. School based professional learning programs supplemented the course and also provided teachers with information and techniques to assist in the classroom. Visits to other schools to view learning programs were invaluable, as I was able to transfer these ideas into my own lesson planning.

In 1991 the Tasmanian Department of Education and the Arts (D.E.A.) introduced a departmental policy guide, *Our Children: The Future*. The policy guide outlined a vision for effective teaching and learning. The D.E.A. also introduced a series of five statements, Yesterday, Today and Tomorrow, Teaching and Learning, A Curriculum for Children, Successful Schools and Monitoring and Assessing Children's Learning that intended to guide learning programs. It stated that learning should be guided by the principles derived from *constructivism*. This was the first occasion the word *constructivism* had been encountered in my teaching profession. The Teaching and Learning Statement (1991) defined constructivism as:

In its pure form, constructivism has two fundamental tenets: first that knowledge, as a coherent world picture is actively constructed by the individual subject, not possibly received from the environment; and second, that coming to know is an adaptive process that organises one's experiential world. 'Coming to know' is not to be interpreted as discovering an independent, pre-existing world (p. 7).

In 1992, following the five statements, the D.E.A introduced *Learning to Read and Write- from Theory into Practice: Critical Principals for Teachers* document. This document determined how teachers could improve reading and writing capabilities.

The Curriculum Services Branch, Tasmania, also produced guidelines in 1992 on Mathematics from Kindergarten to Grade 8. This introductory document was accompanied by five packs of support materials for each of the mathematical strands. These mathematical strands included; Number, Pattern and Algebra Chance and Data, Space and Measurement. The activities included in the support packs provided teachers with starting points for teaching mathematics. Many of the activities in these support packs were consequently transferred into my own planning and have continued to be endorsed into the twenty first century. In the Mathematics Guidelines K-8 (1992) it stated:

The view of learning adopted in this document is one that is now widely accepted in Australia and other western countries: learning is regarded as the construction of personal meaning….. Learning constructively involves: individual learners actively engaging in constructing understandings, by interacting with others – not just passively receiving 'knowledge'. Learners apply their understandings and generalising their ideas into new situations. Learners making connections between new ideas and existing beliefs and understandings (p. 13).

In 1993 a series of performance indicators were introduced that supported the Learning to Read and Write (1992) document. The performance indicators assisted teachers to track literacy outcomes for their students. The literacy performance indicators, referred to as the Key Intended Literacy Outcomes (KILOs), were first used with Kindergarten-Preparatory students in 1993.

In an endeavour to improve literacy levels for early childhood students, the Tasmanian Government introduced in May 1994, the Preparatory Literacy Support Program. This program grew from a 1992 report of the House of Representatives Committee on Employment, Education and Training referred to as, *The Literacy Challenge (1992)*. The report stressed the importance of an early intervention in literacy learning for younger students. The House of Representatives Standing Committee, 1.2 stated:

> That unless children learn the basis of reading and writing, listening and using spoken language by the end of Year 3, they will probably be disadvantaged for the rest of their lives. (p. 1)

The Preparatory (Prep.) Literacy Support Program provided an additional support teacher to assist students aged between five and six years. The support teacher worked in collaboration with the classroom teacher to improve literacy outcomes by working with smaller groups of students. A designated literacy time was timetabled four days per week for the support teacher. Parents were informed via newsletters about this program and how it would improve their child's literacy outcomes. Information sessions were held regularly within the district and also at school to inform parents and encourage them to support their child at home.

Timetabled 30 minute planning sessions were allocated once a week for the support and classroom teachers to plan collaboratively specific literacy activities. This was the first time provision had been made for a collaborative team approach in planning. District cluster meetings were also a feature of this program where support teachers, classroom teachers and district liaison

officers shared exemplary teaching practice and also addressed problems identified in the program. These planning and evaluation sessions proved to be a valuable part of the program where new ideas were shared and trialled. Problems identified at the commencement of this program were the arrangements of student groups and my additional workload including planning for suitable activities.

The forum at the first district support meeting made recommendations, which would support my planning dilemmas. Their recommendations included, grouping the slower Kindergarten students together, the support teacher to work with the more advanced students and the special needs student to work exclusively with his aid. Grouping students accordingly, allowed the Kindergarten aid to provide appropriate activities for younger students, and the support teacher to plan and work exclusively with the advanced students. These recommendations were implemented immediately, however we needed to monitor the groups and make adjustments if necessary. Later observations revealed that the classroom program became more manageable. My preparation time had been reduced, due to planning for fewer activities and my student group was more homogeneous.

The inclusion of specific literacy outcomes provided teachers with a literacy focus in their teaching and planning. In the past teachers had found via books, professional learning programs or in conversation with colleagues their repertoire of activities. However these activities were not always matched to specific learning outcomes. Important current references in literacy and dossiers of support materials were disseminated and fully discussed by support and classroom teachers, teachers involved in group clusters and district liaison officers. The Prep. Literacy Support Program expanded later to incorporate all early childhood classes and involved other curriculum areas such as technology, social skills and mathematics. The extended program became known as, *Flying Start*. The new program still retained the same support network that existed in the Prep. Literacy Support Program, however, the inclusion of technology, social skills and mathematics now included additional ideas and information for these learning areas.

In 1993 the Tasmanian Department of Education and the Arts released their Framework for Curriculum Provision, K-12, which became a planning guide for schools and colleges. The Tasmanian Curriculum Framework attempted to ensure all students achieve outcomes outlined in the National Profiles to be released the following year. The 1993 framework stipulated that schools and colleges must provide:

> appropriate education programs for all students and ensure that all students are acknowledged, valued and respected. This means providing programs to meet the needs of each student and carefully monitoring their educational experiences (section A, p. 2).

The framework explained how schools and colleges should meet the requirements:

> Schools and colleges are required to show how their programs provide for progression of student learning from Kindergarten to Year twelve. This includes providing evidence on how their programs, courses, units of study and classroom experiences address the description of capabilities and learning areas in this Framework for Curriculum Provision, K-12, and meet the needs of students (section A, p. 7).

In 1994 the Curriculum Corporation, Victoria, published a series of 16 documents, a statement and profile in each of the 8 learning areas of, English, mathematics, studies of society and the environment, science, technology, the arts, health and physical education and languages other than English. Each of these curriculum areas was then subdivided into strands to reflect major areas of learning. The statements provided teachers with a framework for curriculum development and the profiles were designed to assist teaching and learning. These National Curriculum documents provided teachers with a benchmark for observations and a common language for reporting students'

learning outcomes. The documents represented a significant shift in Australian education as they were designed as a National Curriculum developed in collaboration between States, Territories and the Commonwealth. This was my first experience of planning documents that provided an observational focus, a common language for reporting students' learning and tangible suggestions to assist teachers in their lesson and unit planning.

During a 1994 Summer School, Helen McGrath the author of many educational publications spoke about incorporating Bloom's Taxonomy into planning. Bloom's Taxonomy was developed by a group of psychologists who met between 1949-1953 at American Psychological Association conventions. The psychologists were interested in a frame of reference to meet the lack of clear educational evaluation. The frame arranged educational behaviours from simple to complex. The simple behaviours could be integrated with other simple behaviours to form more complex behaviours. Described http://www.youngstown.k12.oh.us/pyett/thinking/knowledge.htm on this website.

The Taxonomy is divided into six major classes of:

1. Knowledge, (knowing and remembering facts)
2. Comprehension (understanding)
3. Application (making sense of what is known)
4. Analysis (explaining what is known – breaking whole into parts)
5. Synthesis (putting together the known into something new)
6. Evaluation (judging the outcome)   (pp. 1-12)

The incorporation of Bloom's Taxonomy was then transferred into my planning. This provided ideas for teaching approaches in a particular level of the Bloom's Taxonomy. I was also able to make adjustments if necessary if activities were too difficult or easy.

In 1995 my planning underwent a transformation with the inclusion of an environmental ethos.

CHAPTER 3

ENVIRONMENTAL FOCUS

An environmental ethos commenced with two Summer Schools at the University of Tasmania in 1995. Additional professional learning programs in 1995 consolidated information already gained through these Summer Schools.

The foci for these environmental studies were landcare for teachers, and catchments, corridors and coasts. Part of the Summer School requirement was to demonstrate special action programs both in the classroom and in a whole school environment. In 1995 my school became part of the National School's Network. Due to the involvement in the National School's Network I attended a Spring School in Sydney in September 1995. The Spring School sanctioned teachers to design their own programs to focus on teaching and learning through the environment.

My planning during this period became totally focused on the environment and issues associated with the environment. My planning could be described as developing a sense of eros or completeness. Hall (1982) described eros as:

> The single principle of Good is the source and goal of that eros which grounds the search for completeness of understanding. He elaborates; that philosophers wish through the activity of thinking, to realize the sense of eros, which serves as the dynamic of thought itself   (p. 56).

This total absorption in a subject area allowed my planning to connect with my own sense of urgency and also link the school to the community. The first environmental action program introduced in my Grades 1/2/3 class in 1995 was a worm enterprise, referred to as, 'The House of Worms'. A grant of $330 from North Forest Products was used to buy essential equipment to start this enterprise. The enterprise proved to be a valuable learning experience for these

students. It engaged them in rearing worms, acquiring some understanding about recycling, money management, using publicity to promote the enterprise and some understandings about running a small business. The proceeds from the worm enterprise were used to fund a lunch at a local McDonald's restaurant.

This enterprise along with 19 other student enterprises was entered into the International Business Week Awards at the end of 1995. The theme for the 1995 business week was, '*Meet the Export Challenge*'. Our enterprise received a special commendation, an excellent achievement considering the other entries were from high school students.

Early in 1995, I undertook a re-development project of our school grounds. During the first Summer School two videos were shown to participants. These videos showed how school playgrounds could be transformed into vibrant learning environments. The videos postulated the creation of learning activities through playground improvements especially in the key learning areas of science, English, mathematics, the arts, studies of society and the environment. These videos provided a catalyst for teachers and parents to re-design our own school playgrounds. After the video presentation a meeting was instigated for interested staff, students and parent representatives.

After the initial meetings a list of aims, objectives and a seven-stage outline for our school grounds was compiled. The aims and objectives included:

Aims
1. The school grounds will be a varied and flexible landscape that will encourage opportunities for exploration play and learning.
2. The school site will appeal to the senses of sight, sound, smell, and touch and provide for a range of personal preferences for enclosed and open spaces, for active and passive users and for formal, structured and wild unstructured areas.
3. The grounds will be stimulating and welcoming.

4. The school grounds will express an individual identity based on the character of the local environment. Every locality is unique as a result of its geology, soils, landforms and vegetation. The school site should express this individual identity and instil a sense of belonging.

Objectives

1. Provide a diverse and stimulating environment that offers the broadest possible range of opportunities for educational use, with the flexibility to accommodate changing demands for outdoor resources.
2. Develop a landscape setting of quality that is in harmony with, and makes a positive contribution to its surroundings.
3. Make outdoor teaching spaces safe and secure.
4. Provide space and facilities for a range of play and social interaction during the school day, including both active and passive pursuits for groups and individuals.
5. Encourage, working partnership of teachers, parents, students, landscaped professionals and landscape staff in schools to achieve these ends and provide sustained support for change and development.
6. Formulate plans to provide for the phased and long termed development of the school landscape. These will be available to the school community.

Long and short-term goals for the school grounds were also discussed. Short-term goals included, the construction of two sand pits, shade areas and seating. Long-term goals included, the creation of a wetlands and planting of endemic plant species especially those, which would attract native fauna.

Students' ideas were important as they spent up to a quarter of their school day in our school grounds. Activities to stimulate students' creativity involved, making books about the ideal playground, surveys, brainstorming and illustrations of their ideas. In mid 1995 a landscape architect was appointed by our parent representatives to compile a whole school ground plan using the ideas collected from staff and students. The landscape architect, who had experience in designing playgrounds in other educational settings, incorporated these design features for our school grounds. The plan also included the

establishment of a wetland in a section of the school grounds that was a disused quagmire.

The landscape architect suggested we involve the South East Aboriginal Corporation (SETAC) in our playground design. This involvement would establish a cultural link for our numerous indigenous students. A representative from SETAC undertook research on plants that grew in the locality, and were used by Aboriginals for medicinal, food or basket making. Money was later given to the school by SETAC to purchase the required plants. The school grounds person and students had a planting day where plants were planted in sections indicated on the landscape architect's map.

In 1996 I established a community link through the local council. The local council involved our school in a revegetation and water-testing program for a section of river adjacent to the school. The river had been infested with crack willow and other weed species, which needed to be removed due to flooding. After the removal of these weed species a replanting of endemic species commenced. Students were involved in planting these endemic species and older students were responsible for testing water in sections of the river. A pathway was also constructed alongside the bank of the river to give the local community access to this scenic site. This community link included professionals from various government agencies such as, botanists from Parks and Wildlife, Waterwatch personnel, and representatives from Forestry Tasmania. These representatives also offered advise for our school's wetlands project.

From 1996-9, a departmental priority became a focus on work education from Kindergarten to Grade twelve. Due to my past initiatives such as, the success of the worm enterprise and the re-development of the school grounds, I was invited to become a participant to develop an Education Department teacher's resource kit. A focus for the teacher's resource kit would be to create an understanding of work and include an Asian perspective into a unit of study. An Asian perspective was incorporated into the design of the kit due to a donation from the Asian Education Foundation to help produce the kit. The

development of a teacher's resource kit that linked work perspectives into the curriculum could be used as a valuable reference for teachers in their lesson or unit planning.

Participants in these meetings were referred to as, the *Works Future Team*. Participants involvement was due to prior experience in their schools using work education or having expertise in science, Asian studies and studies of society and the environment. The Works Future Team consisted of, the Principal Science Curriculum Officer, the studies of society and the environment (SOSE) Implementation Officer, the Implementation Officer for Asian studies and teachers. A series of meetings were held during 1996 to reach a consensus on a title for the kit, units of study participants would undertake, how work and an Asian perspective would link to these units and the format of these units.

The engaging dialogue at these meetings gave an understanding on how I could link the school wetlands, the community river project, work, the strands of the National Curriculum Profiles and an Asian perspective to form a unit of study. It appeared my proposed unit referred to as, Wetlands/Community River Re-vegetation, would have links to the National Curriculum Profiles. The SOSE link included the strands of, ecological sustainability, civics and citizenship, career and work education, Australia's global connection, gender and Aboriginal and Torres Strait Islanders. The science link included the strands of, earth and beyond, energy and change, life and living, natural and processed materials and working scientifically.

Participants suggested that I include key questions in my proposed unit of study that could initiate an activity. Key questions could include, 'What organisms or vegetation are usually found in wetlands'? Or 'Who is responsible for studying these organisms or seeing to their welfare'? The Principal Science Curriculum Officer asserted that students learn more effectively by inquiry and questioning is a way to develop inquiry. Questioning also enables students to make connections with subject elements and is an important component of a constructivist classroom. The overall aim

of any curriculum is to allow students to become effective and responsible citizens in a democratic society. John Dewey (1966) described the active involvement of students in their learning as being:

> The active occupations in which appliances are brought to bear upon physical things with the intention of effecting useful changes is the most vital introduction to the experimental method. He further states, …. The final educational importance of such occupations in play and work is that they afford the most direct instrumentalities for such extension of meaning. Set going under adequate conditions they are magnets for gathering and retaining an indefinitely wide scope of intellectual considerations (p. 202).

The rich dialogue emanating from these consultations gave a new direction and meaning to my lesson and unit planning. My unit, Wetlands/Community River Re-vegetation linked to the strands of the National Curriculum Profiles in science and SOSE, used the Department's capabilities, Bloom's Taxonomy, questioning, raising issues, included an Asian perspective and incorporated work. My planning contained six levels of Bloom's Taxonomy and commenced at the lower levels of the taxonomy with activities that included, knowledge, comprehension and application. Students progressed to higher levels of thinking to involve analysis, synthesis and evaluation. Students would work through all levels of the taxonomy, however, those with poor cognitive attainment would spend more time on the first three levels.

The inclusion of Bloom's Taxonomy (1956) six levels of understanding, unfortunately posed a problem when formulating activities as it made my planning unwieldy and unworkable. In subsequent meetings I discussed my planning dilemma and it was suggested I use a recently produced proforma referred to as, the *Teaching for Learning in Science Cycle* (1995). This science proforma linked to the National Science Statement and Profiles and state documents. This document produced by the Tasmanian Department of Education was based on constructivist learning principles as each learning

cycle built on understandings from proceeding learning cycles. The teaching and learning cycle contained four areas of understanding, which consisted of, engaging, refining questions, extending and reflecting. The use of four learning cycles was more manageable than the six levels of thinking described in Bloom's Taxonomy. It therefore became necessary for me to condense the activities originally incorporated in the Wetlands/Community River Re-vegetation unit into four sections as described in the teaching and learning cycle.

During the initial meetings, brainstorming helped me to reflect on how I intended students to develop an understanding about the unit on Wetlands/Community River Re-vegetation project. The Principal Science Curriculum Officer suggested students developed an understanding when they acted responsibly. This was fundamental to science and studies of society and the environment learning. To be able to acquire this skill, students would need to go into a wetlands or river system with their gumboots and experience first hand what it is like in these environments. This would involve excursions to other wetlands or river systems where discussions pertained to issues of wetlands and river systems. Students would engage their sense by immersion into a wetlands and river system. This would hopefully lead to a deeper level of understanding of wetlands and river systems. The use of De Bono's Six Hat Thinking (1985) or Think-Pair-Share activities would expand students' thinking on the key issues of, pollution, weed management, flood control, re-vegetation, dams, water quality, sewage treatment plants, erosion, stream flow and agricultural sprays. Different modes of thinking as experienced through Six-Hat Thinking, would be useful to encourage students to act responsibly. Other activities to encourage thinking could include, graphs, reports, diagrams, counting objects, written records, guest speakers and the inclusion of Asian and Aboriginal perspectives.

The title and format for my unit was revised to Wetlands/River System. The following headings included:
1. Product.
2. Unit

3. Description

4. Learning Areas

5. Cross Curricular Perspectives

6. Level, Year Group

7. Strand or Substrands/Band.

8. Context

9. Aims and Objectives (outcomes)

10. Reflection

11. Resources

12. Work Samples

The new unit contained activities that allowed students to observe organisms, biodiversity, change and continuity. This new unit was also shared with my school principal in June 1996 for his appraisal. His description of the unit included:

> *A great piece of work, I found nothing to alter in the slightest. Your students obviously like the work and responded well. I was pleased to see the de Bono section because these ideas do extend student's thinking in a similar way to higher order Bloom type questioning of the analysis, evaluation, judgement type.*

The second response to my unit came in early July 1996 from the Principal Science Curriculum Officer. He also suggested that:

> *the aims and objectives be moved to the beginning of the unit and each activity be in dot point. There could also be some changes in phrases and words to some sections.*

The altered format sequence now included:

1. Unit

2. Description

3. Aims

4. Objectives/Outcomes

5. Product

6. Learning Areas

7. Cross Curricula Perspectives
8. Level/Strand/Strand Organiser
9. Context
10. Resources
11. Work Samples

A special SOSE meeting was held at my school in late June 1996 to discuss how we should plan units in SOSE, as this was a school curriculum priority for 1996-7. The discussion outlined that schools throughout Tasmania would be required to report on SOSE outcomes for 1997. The unit I had detailed on Wetlands/River Systems had the capability to report on SOSE and science outcomes.

Students in my Grades 1/2/3 class would be aiming to achieve outcomes in level 1, Band A of the SOSE and science National Profiles. In science the major organisers included, *life and living* and *working scientifically* and in SOSE, *place and space* and *investigation, communication and participation.* Science outcomes outlined in the strand, *life and living,* Curriculum Profile for Australian Schools (1994) included:

> 1.7 Identifies personal needs and the needs of other familiar living things.
> 1.9 Identifies personal features and those of animals and plants that change over time   (p. 15).

Studies of society and the environment outcome in the Curriculum Profile for Australian Schools (1994) included:

> 1.5 Identifies places that are important to self and others.
> 1.6 Takes part in routines and projects to care for significant
>   place (p. 13)

A variety of assessment tasks could also be used to gauge whether an outcome or a measure of understanding had been achieved. Types of achievable assessment tasks would include, work samples, observations, interviews, tests, research projects, concept maps, diaries, photographic displays, videos of students performing tasks, journals, reports, diagrams and questioning. Students with special needs, such as Down syndrome, would be assessed according to work samples or observations of their understanding of a particular concept, such as pollution, weed management, re-vegetation, water quality or erosion.

In early August 1996, the revised unit Wetlands/River System was shown to the SOSE Implementation Officer. Her recommendations included:

> *I concentrate on only activities I did in my classroom. Anecdotal information should also be included with some of the activities to give clarification and depth to the activity. The resource section should include books, videos, posters and web sites.*

These recommendations were incorporated into the revised unit and forwarded to the Education Programs Branch in Hobart in mid August 1996 with work samples and photographs. The revised unit had an additional four pages, which required editing by the Educational Programs Branch of the Department of Education.

In early 1997 the published kit was released, its title had been changed from 'Work Futures' to *It's Working – Career and Work Education - Kindergarten to Year 8.* The kit contained five teaching units, a professional learning approach and Australian Industry in Asia. My unit had been condensed and included, a links map linking aspects of the unit to fundamental science and SOSE components. These components consisted of organisms, ecosystems, Aboriginal and Asian perspectives, issues related to landcare, water data, citizenship and mention of other wetlands and river systems. The compilation of a teacher's resource kit had taken over a year to complete, had been through several collaborative meetings and refinements and reviewed by principal educators within the Education Department.

The detailed attention required to formulate a curriculum unit for publication resembled an action research project. Kemmis and McTaggart (1998) described action research as:

> A form of collective self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of these practices and the situation in which these practices are carried out. Participants can be teachers, students, principals, parents and other community members, - any group with a shared concern (p. 5).

The experience gained through this project greatly enhanced my understanding on how to compile lesson and unit planning. The activities that evolved through this unit provided my students with a variety of learning experiences. Specified activities could now be linked to outcomes outlined in the (1994) National Curriculum Profile documents. My planning had metamorphosed from its humble beginnings in 1988 when only limited reference books were used to generate lesson or unit planning to now include national curriculum reference texts, community links and collaborative feedback. During this ten-year period, resource materials such as the National Curriculum Profiles, which included outcomes, state documents and improved professional learning programs had emerged to impact on all teachers' planning methodology.

Between 1988-95 my lesson planning had been detailed in the departmental foolscap sized daily planning book. At the end of 1995 the Education Department had discontinued this publication, which meant teachers were required to detail their planning in some other mode. My redesigned daily lesson-planning book incorporated some of the ideas used in the old planning book format such as, a section for each day of the school week and a reflection page. Modifications were added at the start of the book such as, a succinct outline of state outcomes in literacy and mathematics, which allowed easy

access to this information. Lessons such as, music, library, physical education and daily routines were recorded permanently into the weekly timetable and photocopied. The weekly timetable also had blank sections where lesson details were recorded and that linked to the year's overview. On the back of the weekly timetable specific learning headings were recorded. Under these learning headings specified activities or outcomes that linked to the curriculum were recorded in more detail. In subsequent years the planning books incorporated a reflection page similar to the old planning book format. The reflection page provided an opportunity to record improvements to be made in lessons, parent requests, disciplinary problems or impromptu lessons emanating from student inquiries.

Planning also needed to reflect departmental initiatives, current terminologies and outcomes. My daily planning book aspired to incorporate these features and being personally created could be modified accordingly. Many teachers who have viewed this planning methodology have also decided to record their planning in a similar way and including their own preferences.

In 1991-2 the Tasmanian Department of Education and the Arts had introduced the word constructivism to theorise how individuals construct knowledge and that coming to know is an adaptive process. I therefore needed to improve my understanding of this theory. In 1996 as part of my Master of Education Degree an analysis of the main tenets of constructivism were outlined in a paper. In my practice it appeared constructivism was achieved by helping students make connections between new knowledge and pre-existing knowledge by observing, questioning, listening to and interacting with my students. I used questioning and problem solving approaches to facilitate connections and helped the student to resolve problems. Constructivist theory was also evident as I endeavoured to improve the classroom environment by including myself as part of the learning process and empowering my students in decision making. Planning using the teaching and learning-planning guide became part of my planning agenda. This guide closely followed constructivist theory by firstly engaging students, refining their questions, extending their ideas and reflecting on what they had learned.

In the third year since recommencing teaching a rudimentary outline of the year's unit of study was outlined on one page in my planning books. However during the period 1995-2002, the year's outline became much more detailed. In 1995, my year's planning comprised of 17 A4 typed pages with aims, specific national curriculum strand links and designed questions associated with each of the stages within the teaching-planning guide. In each unit the activities used the language of Bloom's Taxonomy such as, invent, imagine, summarise, identify, classify, list, predict or experiment.

After 6 years in the one school I transferred in 1997 to a new rural school in southern Tasmania. Rather than developing my own set of units for the year I consulted the school's science curriculum package for guidance. My new school had undergone a revision of the science curriculum in 1996 to indicate how science units would connect to each grade. The teaching and learning-planning guide had also influenced this school's planning outline. Units selected for each grade incorporated elements from each of the National Science Curriculum strands. These included, the human body, nutrition, air, water, gas and liquids, marine environment and the solar system. Details of previous saved units allowed me to update and innovate on these units. This was not possible when I first commenced the teaching and learning journey in 1988.

The basic principles of lesson and unit planning evolved over time. A year's vision of selected units linked with subject areas and also included a list of resources needed for that unit. The inclusion of school and community interests influenced my planning between 1995-7. These interests included, the wetlands and river systems and later a school based science curriculum in 1997.

In 2001 I was transferred to a new rural school again in Southern Tasmania. In this school dramatic transformations occurred in my planning methodology brought about by radical changes in the curriculum in Tasmania. The

curriculum referred to as, the *Essential Learnings* transformed all teacher's planning.

CHAPTER 4

THE NEW MILLENNIUM

In 1996 my planning was mostly influenced by a collaborative approach during the production of the teacher resource kit, *It's Working – Career and Work Education Kindergarten to Year 8 (1997).* My planning retained elements of the teaching and learning-planning guide (1995) until 2002. In 2002 drastic changes impinged upon my planning methodology. The new millennium saw a rethink and rework of the curriculum in Tasmania.

Included in this chapter are annotations collected from various professional learning programs including, staff meetings, departmental memos, summaries from newsletters and extracts from the Tasmanian Department of Education websites and documents from 1997 until 2004. The advancement of a new planning ethos began in 1997 with the dissemination of a discussion paper produced by the Tasmanian Department of Education outlining why we should focus on student learning outcomes. A succinct synopsis of the main tenets of this discussion paper included:

> * Shared teaching intentions based on outcomes and pursued through the whole school's actions will improve student learning for all. Shared clarity of purpose and focus is necessary in an effective learning environment.
> * Focusing and organising a school's entire program around the outcomes it wants all students to demonstrate improves opportunities for learning.
> * "All students can learn and succeed, but not all in the same time or in the same way". (Killen, 2000, p. 1) Clearly described outcomes are necessary for a school to provide for individual needs and learning styles.
> * Outcomes allow all students to succeed and successful learning promotes more successful learning.

* Outcomes can establish and describe intellectual quality and rigor and provide a framework that describes high expectation.
* Expectations are clear through outcomes and necessary for effective learning and teaching.

The 1997 discussion paper materialised in 2000 with a vision for education in Tasmania. The Department of Education produced the document, *Learning Together* (2000) with proposals for education, training and information into the 21st century. The overarching goals stated in this document were:

1.Responsive and continually improving services. 2. Enriching and fulfilling learning opportunities. 3. Safe and inclusive learning environments. 4. An information-rich community with access to global and local information resources. 5. A valued and supported education workforce (p. 10).

The Minister for Education, P. Wriedt (Member of the House of Assembly), stated in her address to educationalists after the launch of this document in December 2000:

Learning Together recognises that how we learn and work is changing dramatically. We are in a new era, driven by science and technology. Our education, training and information systems need to give young people both the opportunity to do university level work as well as the essential skills to prosper in a world where brains, not brawn are the driving force of economic expansion.

In December 2000 the Minister also launched the Values and Purposes Statement, which indicated what the education system should stand for and underpin our teaching programs in the 21st century. Values and purposes provided the first step in selecting the curriculum elements seen as '*essential*'. Formulation of the new curriculum included, a collaboration of all stakeholders in a child's education from birth to aged 16 years such as,

teachers, parents, students, children's services, professionals and members of the wider community. Essential Learnings components agreed upon during this collaborative process were divided into 5 curriculum organisers. These Essential Learnings organisers included, personal futures, social responsibility, world futures and communicating. Underpinning these Essential Learnings, students would engage in thinking flexibly and creatively.

In 1994 the Tasmanian Education Department had issued a policy on requirements for balance in the curriculum, however in 2000 there was no policy on curriculum as the Essential Framework 1 (2002) and later 2 (2003) broadly scoped the directions for curriculum in the 21st century. The Essential Framework 1 (2002) and 2 (2003) represented a policy, which established requirements and standards in a way not seen in Tasmania before. This was stated in the November 22nd, 2002 discussion paper, *Transforming Schools through the Essential Learning Framework.*

The Essential Learnings Framework 1(2002) was circulated to all schools at the end of 2002 and assumed to address the problems of:

> A crowded curriculum, to engage learners more deeply in their
> learning, make learning more relevant, improve learning across
> all areas, develop higher-order thinking and support the transfer
> of learning (p. 4).

The Essential Learnings Framework 1 (2002) was designed to develop a curriculum for learners from birth to Year 10. This framework would help establish a link before children entered mainstream school to Kindergarten. Early years co-ordinators were appointed to establish an *Early Years Program.* This program assisted childcare centres and schools to identify the characteristics of learners from birth to Year 10 by producing the *Learners and Learning Statement*. This statement indicated the provision childcare centres and schools should make within the Essential Learning Framework to support learners at different stages in their development.

The Curriculum Consultation co-construction process also included a selection of schools referred to as Project Schools. Project Schools began the consultation process in 2001 and were referred to as a First Year Project Schools. In the following two years additional schools commenced the consultation process. These schools were referred to as, second or third year Project Schools depending on when they commenced the consultation process. The main role of a Project School was to support the implementation of the Essential Learnings through the co-construction of indicative outcomes and standards. The Essential Framework 2 (2003) states, "standards were then calibrated to ensure they accurately described an appropriately sequenced continuum of student achievement across five levels" (p. 7).

My new school became involved in the Curriculum Consultation Project in 2002. It was therefore referred to as a second year project school. This school began the consultation process at the commencement of 2002 by defining and understanding the Values and Purposes, an important component of the Essential Learnings. A district school cluster professional learning program was held at the start of 2002 to familiarise all staffs within the district with the Values and Purposes.

This professional learning session included an insight into higher order thinking. Thinking was a desirable component aspired by the Essential Learnings and should occur in all learning areas. One way to explore higher order thinking was through a philosophical inquiry approach using literature as the lens. Using a philosophical inquiry approach promoted different perspectives or possibilities into questions or issues. This approach also provided an opportunity for students to discover there is no single 'correct answer'. Cam (1993) argued philosophical inquiry taps into children's natural curiosity and can engage them into a search for meaning. During a philosophy lesson students would engage in questions using literature as the focal point. In a typical philosophy of inquiry lesson the picture book would allow students to discuss interesting ideas about the story. Students would also be encouraged to think of thought provoking, usual or puzzling questions contained within the text. These questions could then be used in group situations to be discussed

further or to raise new questions. Students would need to explain why a question was raised or explain the intentions of their question. During dialogue disagreement would be encouraged, however, it would be an expectation that individual's opinions are respected. When disagreeing with opinions, students should give logical reasons for their dissention.

An educationist familiar with the techniques of philosophical inquiry demonstrated to interested staff members how to undertake a lesson on philosophical inquiry with their students. A variety of picture books containing interesting concepts or questions were used in the demonstration. The demonstration provided teachers with the techniques to undertake philosophical inquiry in their own classrooms. Teachers took a variety of lessons on philosophical inquiry over a five-week period. In my classroom discussions occurred using the theme, beauty and ugliness. The picture book, *The Bunyip of Berkeley's Creek* (Wagner, 1975) and some classic fairy tales were used as the stimulus for this discussion. The language used in these texts to describe characters provided thought provoking questions on how it influences our thinking. When the language changed from negative to positive connotations students often changed their perceptions of a character. Through this procedure it demonstrated the persuasiveness of language on students' thinking. In teaching practice this demonstration should alert teachers to the use of emotive, persuasive language in shaping students' thinking especially in sensitive topics such as the environment.

Paramount to the introduction of the new curriculum was a series of professional learning programs and specific staff meetings aimed to improve teachers' familiarity of the *Essential Learning Frameworks 1*. Included in these professional learning programs were relief teachers, as their involvement was a requirement for teacher registration. In addition to the professional learning sessions were a series of monthly newsletters informing teachers about the curriculum consultation process. The school's project officer and key education department personnel compiled descriptions of the process. It mentioned in the descriptions that widespread consultation with parents,

guardians, the community, pamphlets and newspaper articles informed these people about the new curriculum initiatives.

The professional learning programs included renowned educationalists such as, Tina Blythe, Kath Murdoch, Barrie Bennett and key personnel within the Education Department to speak of new advances in education, such as putting understanding up front, powerful pedagogies and activity design. At the commencement of 2002 teachers were given the opportunity to attend a one-day professional learning session with Tina Blythe. Tina Blythe is a researcher at Project Zero, Harvard Graduate School of Education. Blythe's research had been carried out in a number of areas including teaching for understanding, project-based learning, collaborative assessment of student work, after-school programs, the educational applications of multiple intelligences theory and professional development. Blythe's fundamental message to educationalists during this presentation was to put understanding upfront. This meant putting thoughtful engagement upfront by teaching with good activities. Blythe (1998) defined a students' understanding as:

> Learners must spend the larger part of their time with activities that ask them to do thought-provoking tasks such as explaining, making generalizations, and, ultimately, applying their understanding on their own. And they must do these things in a thoughtful way, with appropriate feedback to help them do better (p. 14).

Blythe used the metaphor of boats during the presentation to describe teaching practice. The metaphor of busy quays, where boats were tied up at the quay and did not go anywhere, reflected many teachers' classrooms. In these classrooms students were engaged in busy activities, however, these activities did not lead to deep understanding. Boats that ventured into open or stormy seas reflected teachers who are prepared to take their students beyond superficial activities and delve into more engaging activities that require them to think creatively. The metaphor of good seamanship reflected teaching

practice where challenging or thought provoking activities would lead students to use their understanding in new situations.

Blythe's professional learning session emphasised the need for educators to develop deep understandings in their students by using thought provoking questions and activities. This inclination hinted at a strong constructivist approach where students build on their knowledge and with understanding as a key component. Blythe's presentation did provoke perplexing questions with many teachers. These questions were documented in the Curriculum Consultation Newsletter, (number 8 – 2002). The questions were listed into four main areas and included, understandings, performances, goals and time. The questions included:

> *Understanding questions* included: what are good questions? What questions do we ask children to assess their level of understanding? How do we link understanding goals and performances? How do we know students have understood?
>
> *Performance questions* included: how can I make Japanese 'open seas' and not 'busy quays? How can I develop good performance indicators?
>
> *Goal questions* included: how could I develop throughlines? How do we decide what is most important and worthy of being an understanding goal? Why do misconceptions happen? How do we know what is a good understanding goal?
>
> *Time questions* included: time to allow all students to be able to do this? How can we as a staff share our learning with others as we go through the curriculum consultation project? How can we organise off class time and class time to fully prepare for this? How can a teacher realistically manage the program to ensure 'the stormy seas' can be sailed? Does this new emphasis entail a total change in timetable?

The Education Department provided money for schools involved as Project Schools. This money provided for the inclusion of a senior staff member,

referred to as the Project Officer, whose task was to manage the implementation of the new curriculum within that school and also within a district. The money also allowed for the provision of professional learning programs in both the project school and cluster schools. Money also targeted specific programs and to purchase relevant literature advocating educational advances.

By the end of 2002 my school needed to produce specific outputs for the Curriculum Consultation Program. The outputs produced by my school included, using a philosophical inquiry approach from Prep. to Grade 6, information technology to improve skills and integrate information technology into planning, a community flyer to inform the community about the new curriculum, school programs and structures that could be incorporated into a workable whole school timetable. Aspects of our school's outputs would then be put online to be used in the *Learning, Teaching and Assessing Guide* in 2003.

In mid 2003 an international philosophical educator, Dr. Laurance Splitter, presented a further professional learning session on philosophical inquiry using literature. Dr. Splitter, professor of Education at Hunter College City University of New York, reiterated much of the rhetoric given in 2002 about using a philosophical approach to extend students' thinking. During this session it was highlighted that thinking was at the heart of the Essential Learnings and philosophy can promote thinking in diverse ways. Philosophy was defined as presenting challenges, disagreements and questions that do not necessarily have an answer to a concept. Concepts could be broad ideas such as defining beauty, good, evil, virtuousness, friendship or loyalty.

Dr. Splitter presented inquiry as representing a 3D model. The first part of the 3D model involved personal and interpersonal growth of seeing oneself as one among others. The second part of the 3D model cultivated skills, tools and dispositions (attitudes, motivation) of good thinking, dialogue and judgement. The final part explored concepts, issues, questions and themes judged by the community to be significant. Dr. Splitter suggested from a pedagogical

perspective, community of inquiry is an environment, which involves children in dialogue. This dialogue was especially relevant using specified literature as the focal point and discussing issues arising within the text. During reflection time students and teachers should develop a deeper understanding of the concepts conveyed in a book.

In January 2003 the Tasmanian Department of Education created a new office, referred to as the Office of Curriculum Leadership and Learning. The function of this newly created office was to oversee education policy and determine curriculum for the compulsory years of schooling in Tasmanian government schools and colleges. The other function was to provide extensive professional learning support that was directed at improving key element outcomes as defined by the Essential Learning Framework 2 (2003). The professional learning offered through the Office of Curriculum Leadership and Learning could also be accredited at a national level.

In early 2003 the *Essential Learnings Framework 2* (2003) was published. This document formed the second set of publications developed to support educators in implementing the new curriculum by the effective use of key element outcomes and standards. Essential Learnings Framework 2 (2003) included a booklet outlining the outcomes and standards, a description of each key element outcome and standard and the learners and learning provision statement. A web-based learning, *Teaching and Assessing Guide* also supported Framework 2. The Essential Learnings Framework 2 built upon the Values and Purposes statement, the Essential Learnings and the Learning, Teaching and Assessing principles outlined in the Essential Framework 1 (2002). By 2005 all schools would need to inform students and their families about their performances against learning outcomes and standards in the key elements of inquiry, literacy, numeracy and maintaining wellbeing. The challenge therefore for school communities would be deciding what their transformed schools would look like and decide how they would best get there. After 2006 there would be 18 outcomes to form the core of assessment and reporting of student learning.

The requirement of my school as a second year Project School in 2003 was the implementation of a whole school scope and sequence output for curriculum planning models using personal futures as the essential learning and focusing on the key element of maintaining wellbeing. These plans would encompass the notion of scope and sequence, continuity and coherence. The output needed to show how the Essential Learnings are planned for and patterned across age and grade levels by, (1) focussing upon generative topics (2) making explicit the focussed teaching and transdisciplinary aspects of a unit of work (3) and describing the process on how such decisions are derived. Schools needed to identify in early 2003 where they were with the Essential Learnings and where they wanted to be by the end of the year. Two specific goals were identified for my school, (1) linking assessment to our understanding goals and extending a repertoire of appropriate assessment strategies to support the Essential Learnings (2) incorporating the thinking and communicating Essential Learnings into our integrated unit planning.

To be able to provide the required output for our school, teachers needed to engage in a collaborative planning process. Collaborative planning was undertaken in grade groups. This would allow teachers to ascertain a scope, sequence and continuity through all grade levels using the Essential Learnings key element of maintaining wellbeing. Over three consecutive staff meetings teachers were asked to choose between planning with a partner or team without support, planning collaboratively with senior teacher support using suggested planning models or being involved in a protocol to closely observe a colleague's planning.

At the commencement of 2003 the staff identified a scope and sequence for the curriculum consultation project and was provided with a structured introduction into planning. Teachers were guided through a sequence of steps and provided with on-going support for the first full day of planning. During the implementation stage of this collaborative planning process questions and issues arose within the teaching staff. These questions and issues included:

What are the ideal numbers of teachers for collaborative planning?

Providing time to plan, changing planning partners, incorporating specialist teachers in the collaborative planning process, providing feedback about our planning, resource problems when all teachers are doing the same topic, what happens when all planned activities are incomplete and outcomes are not necessarily met within the given time?

To have planning sessions closer together. Some teachers felt that the individuality had been taken out of their planning when the whole school focused on the same topic.

Having an understanding of what is required in an integrated unit. Some teachers were not inspired with the chosen topic and therefore felt they could not put in a maximum effort. Some staff members were unsure if collaborative planning would be ongoing. Some staff members thought there should be provision for sharing of our planning, and deciding as a whole school which key element of the Essential Learnings should be covered.

After the imposed planning at the start of 2003 teachers had the opportunity to plan a self-selected unit before beginning another whole school focus at the start of term 2 (June-July), 2003. This allowed for a balance between times where there was imposed structure and time when teachers were able to pursue self-selected topics. This whole school scope and sequence output was then forwarded to the Tasmanian Department of Education in October 2003.

Activities developed as part of our planning, needed to reflect deep understanding of the topic and incorporate different modes of thinking. A key component for planning with the Essential Learnings Framework 1 depended upon being able to frame questions to guide inquiry learning. In using guiding questions there would be the development of supporting questions generated by the teacher and the students, which help to develop specific understandings. (Traver 1998) stated:

> A guiding question is the fundamental query that directs the search for understanding. Everything in the curriculum is studied for the purpose of answering it. As a result of this

function, guiding questions can direct the curriculum author's choice of ideas and activities and can transform the often-disparate topics from a scattered survey of the subject, problem, or theme, into a logical, coordinated instrument for attaining knowledge (p. 70).

The staff therefore needed to identify the big ideas and guiding questions for each grade group to ensure that an appropriate sequence was maintained. Specific outcomes for the key element, maintaining wellbeing, were used to guide the selection of understanding goals and performances of understanding. The staff was able to choose a standardised proforma to guide our planning, which was designed by the school's Curriculum Consultation Project Officer. This proforma was made available through the staff's email. The language on the proformas had been adapted from the key references of Tina Blythe (1998), Kath Murdoch (1998) and the Essential Learnings Framework 1 (2002). The proformas contained the headings of, title of the unit, generative topic, throughlines, guiding questions, understanding goals, key questions and Essential Learnings focus. The teaching and learning component of the proforma required teachers to design a list of appropriate activities in their planning that would allow students to use their existing knowledge to tune into the unit. This component of the planning resembled a constructivist approach where existing knowledge would be ascertained before new knowledge was built upon. New knowledge or understanding would evolve through subsequent components of the proforma.

The next component was guided inquiry this involved selecting activities that would further develop students' prior knowledge. Drawing conclusions was the next component and involved activities that developed deeper understandings of the unit. Culminating performances was the final component of the proforma. The activities selected in this section indicated students' level of understanding and could be utilised as an assessment tool. Throughout the duration of the unit, students would be involved in on-going assessment tasks such as, written, oral or visual products. The final component of the proforma

comprised of a section for reflective comments and listed the resources used throughout the unit.

The inclusion of a reflection section on the proforma was a necessary addition as it permitted teachers to review and improve their practice, monitor and evaluate the effects of change and evaluate activity choices. My lesson and unit planning included a reflection section, which I used daily to record how lessons transpired, to change procedures or include information to be used at a later date. In a collaborative planning process teachers could collate their information on how lessons or units transpired and how they could improve the unit in the future. The collaborative planning process had made our planning easier.

To guide teachers through the planning process, key educationalists and senior teachers were available to assist in planning. Resources were also available in the school plus the inclusion of departmental websites that frequently updated information. Information included already trialled units, which teachers could access and alter according to their particular grade group. Costa (2002) proposed that working collaboratively could be more powerful than working individually. He stated:

> Cooperative humans realise that all of us together are more powerful-intellectually and/or physically-than any one individual. Probably the foremost disposition in our post-industrial society is the heightened ability to think in concert with others. Problem solving has become so complex that no one person can go it alone. No one has access to all the data needed to make critical decisions; no one person can consider as many alternatives as several people can (p. 10).

In 2003 the whole school was jointly involved in the Essential Learnings focus of, maintaining wellbeing. Time was allocated for collaborate teams of teachers to meet regularly and develop their planning. During this time suitable activity choices were collectively agree upon for their students that would

promote deep understandings. Teachers had access to recommended texts for these activity choices, which meant they were deemed appropriate for promoting understanding. In this planning time the complexities of the new curriculum were also deconstructed.

This was contrary to past planning practices as individual teachers made the decision on unit choices and the activities to support those units. Past planning practice was done in our own time and in isolation with little or no feedback from colleagues. Activity choices, which seemed appropriate, were now challenged for their relevance to the topic, promotion of understanding or connecting to the understanding goals.

At the commencement of 2003 my teaching practice also underwent another transformation. I commenced a yearlong training course in Reading Recovery. This meant that half my teaching load was devoted to Reading Recovery and the other half as a classroom teacher on a Grade 1-2. In Reading Recovery, Grade one students are individually accelerated in literacy over a period of 12-20 weeks. At the end of the intervention the student's literacy level should then match the grade group average.

This intervention program is based on the work of Dame Marie Clay, a New Zealand teacher, educator, child psychologist and researcher in developmental psychology. Clay introduced this intervention program in the late 1970s into New Zealand schools. In the 1980s some Australian states adopted Reading Recovery. In 2000 Tasmania introduced the program into some government primary schools.

Clay devised the intervention program from astute observations of children's reading behaviours. These observations revealed reading patterns of children who made good progress and children who found reading a challenge. Clay advocated that children's prior literacy learning experiences before entering formal school is an important component in gaining success in the literate world. Clay also noted that meaning is a crucial factor for reading and writing, and readers will bring different meanings to texts. This also applies when

theorists interpret another's theory and derive their own meaning from that theory.

As a result of Clay's observations a series of seven systematic measurement tasks were produced, referred to as *An Obserational Survey of Early Literacy Achievement (2002).* These measurements tasks have been widely received and have assisted teachers in their teaching programs for young students. Clay's measurement tasks are given to lower achieving students in reading at the start of their Grade 1 year. The first ten lessons of Reading Recovery are referred to as, *roaming around the known*. During these 10 lessons students engage in tasks using prior knowledge, which has been ascertained from the battery of measurement tasks. Once roaming around the known has been completed, teachers are expected to accelerate their students using a specified program consisting of, reading familiar and unfamiliar texts, making and breaking familiar words using magnetic plastic letters, text written by the student, teacher recording the student's text on a paper strip, cutting the paper strip into word groups and the student piecing together their text. To be effective in Reading Recovery, teachers need to be astute observers of their students in both reading and writing tasks and to monitor their progress. Teachers record their observations in detail on recording sheets that lead to specific teaching points in the subsequent lesson. Clay recommended teachers engage in reflective practice and self-correct their thinking on learning to read by revisiting specified texts.

Reading Recovery simulates constructivist theory. Students commence Reading Recovery by roaming around the known and after roaming, students then engage in new understandings. Students construct new meanings built from previous understandings by reading and writing texts from their everyday experiences.

Although Clay's Reading Recovery simulates constructivist theory a more thorough examination of the underlying principles of constructivism was apparent to gain further understanding. It was in 2002 the underlying principles of constructivism were disseminated in a doctorial institute. The

following chapter outlines important papers rigorously scrutinised during this institute.

CHAPTER 5

CONSTRUCTIVISM LITERATURE REVIEW

During my Master's Degree (1994-6) I undertook a brief examination of constructivist theory. The implication of this theory, however, was not fully realised especially in terms of my classroom practice. In 2000 I underwent further study, which encouraged me to review my teaching practice especially evaluating current educational thinking.

Two further institutes undertaken in my doctoral studies included, Learning Environments and Constructivism. These institutes provided essential information for components in this thesis. In the Constructivism institute participants were required to deconstruct several influential papers for the purpose of writing assignments. These papers required reading, re-reading several times, understanding terminologies, concepts, rewording and writing assignments in a language meaningful to myself. Partaking in this process raised my level of understanding regarding the theory of constructivism. It also became evident while deconstructing these papers; constructivism can have practical implications in teaching practice. Anecdotal situations have been described to support the intentions of certain papers, which help clarify the information. A revision of these papers forms the basis to this chapter, *Constructivism Literature Review*.

A brief philosophical history is required to ascertain how the theory of constructivism evolved. The epistemology of modernism and postmodernism are briefly discussed as entry points to the theory of constructivism. To further understand postmodernism epistemology an examination of the period prior to this was required, which was modernism.

The Encyclopaedia of Philosophy (1972, Vol. 5) stated prior to postmodernism was the modern period referred to as modernism. The modern period had a philosophical manifestation upon education in the seventeenth century during

the Enlightenment and included philosophers, Locke, Berkley, Hume, Rousseau, Bacon, Descartes and Newton. Enlightenment was a general term, which represented a mental construct of eighteen-century culture. Three key cluster of ideas emerged during the Enlightenment, reason, nature and progress. Enlightenment culture was effectively spread by way of an increasingly number of books and periodical productions rather than by direct contact with the work of famous philosophers. Russell (1961) claimed the distinguishing feature of the modern world as apposed to earlier centuries was the rise in science where new concepts profoundly influenced modern philosophy. Russell further reasoned that Copernicus, Kepler, Galileo and Newton were pre-eminent in the creation of science and Descartes to a lesser degree the founder of modern philosophy. The evolution of science had a profound change in the concept of people's place in the universe where earth now was a minor planet of a minor star not the centre of the universe as believed in prior centuries.

Taylor (in press) stated the modernist movement was represented as a logical and ordered universe that has regularities, commonalities and laws, which can be discovered by scientific investigation. Lyotard, (1984) argued the application of these scientific laws was designed to benefit humankind and free the world of sickness, poverty, destruction, and class servitude. Taylor asserted modernism is still evident in many classrooms today. Taylor (in press) claimed:

> Educational reformers have attributed many of the ills of education to the legacy of modernist science, including: teacher-dominated classrooms that rob students of their agency as learners; curriculum that trivialise students' life world beliefs and experiences; 'cookbook' practical activities in school science that aim to confirm rather than stimulate inquiry, and a deterministic culture of social reproduction and conformity
> (p. 1)

Modernism has been associated with philosophical movements such as, liberal protestantism, positivism and evolutionism. Positivism commenced in the nineteenth century and was not just a theory of knowledge but also a cultural and political point of reference with major beliefs. Benze and Shapiro (1998) stated:

> Positivists believed that the sciences were the only legitimate form of knowledge, replacing religion, metaphysics, and philosophical assumption as official knowledge. Knowledge was structured atomistically where reality consisted of a collection of disconnected facts, and experiences that consists of a collection of disconnected perceptions or observations (p. 28).

Although positivism originated in the nineteenth century it has continued to shape twentieth century thought with its extreme forms of logical and logical empiricism of the 1920s and 1930s. Positivists believed social and human progress was interpreted as scientific progress, and the motto for positivism became "order and progress".

Polkinghorne (1992) believed the philosophy espoused in the modernism/positivism movements of an unrestrained scientific methodology consequently resulted in problems. These problems included, environmental problems, urban ghettos, world wars and the continual possibility of nuclear war.

The identification of problems, which could be partially attributed to modernist philosophy, postmodernist philosophy evolved. Donald Polkinghorne (1992) has given clarity to the epistemology of postmodernism from a psychologist and educationalist perspective in his paper, *Postmodern Epistemology of Practice Psychology and Postmodernism*. Postmodernism took on two forms, a radical rejection of possible knowledge and a celebration of differences and uniqueness. Postmodernism celebrated the notion of fragmentation of knowledge where knowledge is built up from the fragments

of understandings. Polkinghorne acknowledged postmodernism is the total acceptance of the ephemerality, fragmentation, discontinuity and the chaotic.

Polkinghorne further alleged postmodernism epistemology has emerged from the deconstruction of modernist epistemology and has 4 basic themes of, foundationlessness, fragmentariness, neopragmatism and constructivism. Polkinghorne proposed these themes are used to guide the contemporary practice of psychology in psychotherapy. In postmodern epistemology these themes are construed as models or metaphors for understanding client's experiences. Polkinghorne (1992) stated:

> human knowing is the outcome of interpretive cognitive schemes that produce a recognisable order in and meaning of experience. Human awareness consists of constructions based on human organising capacities and experience, which is a representation of an external reality. Our virtual reality is made up from our biological makeup, cultural assumptions and language, which are immersed (p. 148).

Each of the four themes of foundationlessness, fragmentariness, neopragmatism and constructivism appear to have influenced teaching. Foundationlessness for example, uses a diversity of theoretical models to guide practice. During the course of one year teachers can be involved in a diversity of professional learning programs. Many of these programs offer alternative models for teachers to improve their pedagogy. From these professional learning sessions or from the literature, teachers usually select the components they feel will benefit their students or their own needs.

Polkinghorne advocated the theme of fragmentariness underlies the uniqueness of each individual person. This uniqueness is the result of each person's own set of experiences developed in the context of their culture and personal histories. Teachers are encouraged to view each of their students as individuals with their own set of strengths and weakness. The assessment of these

strengths and weaknesses allowed teachers to select appropriate activities to cater for students' individual needs.

Neopragmatism, as stipulated by Polkinghorne (1992), is valuing practical knowledge, rather than theoretical knowledge. In education, teachers' practical knowledge was invaluable in the success of their pedagogy including the positive relationships developed with their students. In the practical knowledge of experience, teachers use successful cuing techniques to gain valuable insights into students' understandings such as, observations, purpose designed assessment tasks and discussions that include questioning.

The theme of constructivism as mentioned by Polkinghorne (1992) is a postmodern epistemology. Human knowledge is not a copy of reality but is built from cognitive processes and experiences. Ultimately cognitive processes and experiences provide meaningful interpretations of what is real. In an educational context constructivists believed students developed their understandings by way of cognitive processes and experiences. These cognitive processes and experiences then lead to meaningful interpretations of what is real. Teachers allowed their students to have a variety of experiences within the framework of a topic, which will ultimately lead to understanding of that topic. Polkinghorne (1992) asserted:

> knowledge is a construction built from the cognitive processes (which mainly operate out of awareness) and embodied interactions with the world of material objects, others and the self. He further stated: constructivism to be "human knowledge which is a construction built from cognitive processes and results from interactions with material objects, others and the self (p. 150).

The second paper, *Constructivism in Mathematics Education* by Nel Noddings (1984) asserted constructivism is positioned as post-epistemological.

Positioning constructivism as post-epistemological proposed there has been an abandonment of traditional epistemology language, the language of absolute truth, to a body of knowledge that is continually under construction. Noddings asserted, when constructivism is placed in a post-epistemological position it can be powerful in evoking new methods of research and teaching. Noddings (1984) stipulated this is acquired through being able to "recognise the power of the environment to press for adaptation, the temporality of knowledge, and the existence of multiple selves behaving in consonance with the rules of various subcultures" (p. 12).

Noddings further asserted there are conceptual differences in current constructivist views, which have generally agreed basic principles. These basic principles are divided into four categories. A succinct outline included:

> 1.The first principle is that all knowledge is constructed. In mathematics this knowledge is gained partly through reflection.
> 2.Cognitive processes are engaged in the processes of construction.
> 3.Cognitive processes are continually changing or developing.
> 4.Methodological constructivism is used especially in research to study cognitive processes. Methodological constructivism is also associated with pedagogical constructivism, which facilitates cognitive constructivism. (p. 10)

The description outlined by Noddings places constructivism with two positions, a cognitive position and methodological perspective. Noddings believed cognitively, constructivism is defined as; all knowledge is constructed using cognition that is innate, (Chomsky, 1968; 1971) or products of development, (Piaget, 1953, 1970a, 1971a). Noddings claimed Piaget's theories are described as thoroughly constructivist.

> Piaget explained that cognitive structures are the result of developmental construction rather than innate. Piaget relied on the concept of reflective abstraction, which is a process of

interiorising our physical operations on objects. As we move sets of objects about and rearrange them, we interiorise properties of mathematical operations rather than objects; we acquire implicit understanding of communtativity, associativity, and reversibility. (p. 9)

The assertion of Piaget's theories being thoroughly constructivist did provide an understandable history of constructivism. When I was first introduced to the work of Piaget 30 years ago, I remembered Piaget as an astute observer who carefully documented children's developmental stages. During this period the word constructivism and the influence of Kantian philosophy on Piaget's theories was not referenced. Noddings (1984) suggested Kant was recognised as the first person to "describe the structures by which any competent subject acquires or generates knowledge" (p. 8). Piaget, however, transgressed from Kantian philosophy as Kant described cognitive structures as being innate, rather than developmental.

Noddings asserted constructivism also has a methodological perspective. This perspective is represented in the social sciences, as constructivism assumed people have the ability to organise their knowledge. This is represented in education as methodological constructivism and develops into pedagogical constructivism. Noddings description of pedagogical constructivism provided a tangible connection to the concept of constructivism, as it is the teacher or pedagogical constructivist who establishes the classroom environment, not a mandated prescriptive methodology. Each classroom's environment therefore would reflect the experience and expertise of the individual teacher. An exemplary pedagogical constructivist would probe into a student's knowledge base to establish their understanding of a topic. An exemplary practitioner would encourage a classroom environment where students' misconceptions would be ascertained from assessment feedback. Misconceptions would then be addressed by follow up activities. Noddings suggested one type of feedback to test students' misconceptions or pattern of thinking is through overt thinking. Overt thinking encourages students to discuss each methical step they did to arrive at an answer. Through this discussion teachers are able to

uncover the misconception. Teachers can then reassure the student that they are doing some things right and that their errors are correctable. Explicit teaching to create a more valid response would then follow. The teacher would then initiate some practise exercises after the instruction to consolidate an understanding of the concept.

In my Grade 1-2 class, overt thinking has been used to uncover mathematical errors. Students sit on the floor in a circle formation and one student discusses how they arrived at an answer. This discussion can lead to dissention within the student group if the answer is incorrect. It follows that another student would provide an alternative explanation. If the alternative explanation is long and involved other students contribute an alternative explanation. Other methods used to uncover misconceptions or systematic errors are through discussions, written and pictorial representations. Students share and explain their written or pictorial representations in the same circle formation. A misconception can also be uncovered through questioning of their representation either by the teacher or other students.

Noddings also asked the question, could we promote student thinking in the whole class situation? Noddings suggested various thinking models could be used. A common characteristic shared by each thinking model is, they are all highly interactive. An interactive thinking model described by Noddings was teacher's questions to elicit information. Using this technique, however, requires knowledge and pedagogical skill.

The Essential Learnings strongly recommended teachers use questions to direct the course of an inquiry. Guiding questions, in particular, can stimulate the choice of activities and ultimately lead to deeper understanding. In May 2003 my Grade 1-2 class did a unit on Waste and Recycling. The guiding questions for this inquiry included, What is waste? and What can we do to look after our environment? In addition to the guiding questions were key questions. The key questions included, Why do we need to recycle? In what ways can we care for our environment by recycling? And how can we take personal and collective action for the environment? Noddings suggested the

shift in emphasis to include thought provoking questions has lead to strong constructs in our classrooms.

During question times, however, some students can be constructing with strong constructs, while others are at a weaker level. Asking the right question, a question that is open ended, has multiply answers and is non bias has the potential to engage students into deeper levels of thinking. Teachers are usually the major generators of questions therefore, they should consider whether the question is probing and directs a search for meaning. A framework teachers could utilise to guide the level of questioning is Bloom's Taxonomy. This framework has been strongly recommended through professional learning programs associated with the Essential Learnings.

Notes provided at a professional learning program indicated the types of activities and questions teachers could ask using Bloom's Taxonomy. At the knowledge level the question cues included, list, show, tell, describe or examine. An activity could include, arrange a scrambled story sentence in sequential order. The application level question cues consisted of, classify, apply, relate, change or show. An activity associated with this level could include, classify the characters as human, animal, or thing. The evaluation level included question cues of, grade, test, convince or conclude. An activity generated from this level could be, decide which character in the story you would most like to spend a day with and why?

(http://www.younstown.k12.oh.us/pyett/thinking/knowledge.htm pp. 1-12)

The ability to reason, to think creatively, to reflect on essential questions and develop understandings are included as part of *The Values and Purposes Statement* (2004). One purpose outlined in the statement included:

> *Learning to think, know and understand*. This purpose promotes the application of knowledge to new situations and the capacity to make informed decisions. Developing the ability to reason, to think creatively, to reflect on the essential questions of human existence; learning to challenge and

question propositions and theories; developing understandings about the crucial role of language in thinking; developing critical thinking skills and the ability to differentiate between fact and fiction (p. 1).

There can be many different teaching pathways to follow before arriving at an endpoint. To be able to learn involves mental activity whether it is weak or strong acts of construction. Noddings mentioned the issue of rote learning as being one of these teaching pathways. Rote learning however, would be described as a weak form of constructivism as it limits a student's ability to perform beyond the knowledge level. Strong acts of construction give a thorough understanding of a topic and encourage students to think more deeply.

To achieve strong constructions many students need to have experience using concrete manipulatives. Fogarty (1998) stated, "Piaget's theory of developmental psychology described intelligence as developmentally constructed in the mind by the learner and moves from concrete to abstract stages of understanding" (p. 10). Piaget emphasised developmental construction using a process of interiorising our physical operations on objects. This also laid the path to methodological constructivism. Noddings (1984) used the words manipulatives or concrete experiences to describe a common constructivist approach using Piagian theory of teaching abstractions. There is a connection between purposeful activity and the development of cognitive structures where the manipulatives or concrete experiences play a role in reflective abstraction. Students, however, must have a purpose when engaging in manipulatives or concrete experiences otherwise these could also become abstracts if the student is sent blindly to work on their own. Noddings cited the example of the mathematical manipulative, Cuisenaire rods. Cuisenaire rods represented numbers using different colours and length rods. Explicit teaching was needed before students had a thorough understanding on how to use these manipulatives. The purpose for their use would be to perform number operations. The Essential Framework 1 (2002) emphasised we share the purposes for our learning by:

1.   Learning to relate, participate and care.
2.   Learning to live full, healthy lives.
3.   Learning to create purposeful futures.
4.   Learning to act ethically.
5.   Learning to learn.
6.   Learning to think, know and understand. (p. 7)

To express a purpose for an activity needed to be addressed more in my own teaching practice. I often become absorbed in the explanation of an activity and neglect to tell students the purpose of the task. Alternatively the students could provide their own explanations for the purpose of the task. This would allow students a voice and to think laterally about the task.

Constructivism emphasised multiply ways to engage in learning where all students have the opportunity to construct meaning. This can be achieved when teaching students individually or in smaller learning groups. In smaller learning groups social interaction or social constructivism is often a source of mental cognition. During social interaction sessions, students interact and begin to challenge themselves, ask for reasons and monitor their own work. Noddings (1984), however, argued that group interaction could also have negative effects such as, students being rude or cruel to one another rather than assisting, caring or students who do not fully participate within the group structure.

Noddings concluded constructivism has both a cognitive position and methodological perspective. Methodological constructivism permits teachers to develop an appropriate pedagogy that reflects their individual classroom needs and their own experiences, not a prescriptive pedagogy. Methodological constructivism can also be enhanced through reflective practice. Reflection sanctions teachers to include new or imaginative ways to deliver the curriculum.

Methodological constructivism applies in my practice, as I am willing to change aspects of my practice deemed ineffective. The inclusion of regular reflective documentation in my planning book can uncover ineffective practice. The reflections often state how I can change what I do in future lessons. Comments can also relate to various students' learning styles such as, "Tim needs to be assessed for alphabet recognition" or "Sam does not recognise numerals 1-5. The inclusion of these reflective thoughts or debriefing a day's events gives me time to think and assess how I should incorporate more effective changes.

The One and the Many. Constructivism in Education, by Paul Ernest's (1995) provided the 3rd literature review. Ernest's paper gave clarification to the term epistemology. Ernest devoted 5 paragraphs to the term and argued it has two main contexts of use, psychological and philosophical. In psychology it focuses on "theories of knowledge growth and development, the structures of knowledge constructed by individuals and theories and the general conditions of learning" (p. 460). Less common is also the nature, structure, and development of knowledge. Ernest described conventional knowledge and its "relationship with the individual knower and that knower's learning" (p. 460).

In a philosophical context epistemology is "a synonym for the theory of knowledge, which is understood to concern the logical categories of knowledge and its justification basis" (p.460). In a traditional sense it is knowing whether knowledge is true or false. This has lead to foundationlist programs to establish absolute truths of knowledge. In a philosophical context epistemology deals with logical classification and justification of knowledge. Noddings described constructivism as having a post-epistemological position, which parallels to the movements of postmodernism and poststructuralism and rejects foundationism or traditional epistemology. Ernest (1995) argued, "even in traditional terms antifoundational epistemology is possible, and the warranting of knowledge can be addressed without presupposing absolute foundations" (461). *The Macquarie Concise Dictionary* (1998) stated epistemology " is the branch of philosophy that deals with the origin, nature, methods, and limits of human knowledge" (p. 372). Given Ernest's definition

and the dictionary reference allowed me to undergo constructivism by improving my understanding and knowledge of this term.

Ernest explained the title of his paper, *'The One and the Many'* both by analysis and synthesis of various constructivist paradigms. The synthesis (the one) unites constructivist paradigms by considering what these paradigms have in common. Analysis is diversity (the many) the significant differences between constructivist paradigms.

Ernest described constructivism as seven different paradigms where each paradigm has significant differences. To define each of these paradigms, Ernest used metaphor to reveal the underlying difference and helped to clarify the inferred assumptions contained within each paradigm. *The Encyclopaedia of Philosophy* (1972) clarified the cognitive aspects of metaphor by claiming, "its function is the acquisition and communication of knowledge". A common definition of metaphor "is a transfer of meaning, both in intension and extension". (pp. 284-8)

Metaphor can be defined as having cognitive roles. Firstly for extending language, by creating novel senses of words for particular purposes and on occasions a second metaphor provided a condensed version by which many properties are attributed to an object at once. Ernest, however, cautioned the extended use of metaphor as it can have epistemological problems where it is a manner of speaking and therefore a manner of thinking or an aid to thought rather than a special mode of thinking.

Ernest unravelled each paradigm and their associated metaphor. Ernest stressed his attempt at this exercise is in itself an act of construction, where he needed to radically condense these paradigms for them to relate the positions to a satisfactory framework. Ernest used a metaphor to describe his attempt at a classification as, "turns out to be a procrustean bed onto which the positions do not fit neatly. Clearly any attributions must be offered tentatively" (p. 467). The seven different paradigms are most a variant of radical constructivism, with the exception of traditional empiricism. Ernest claimed radical

constructivism provided a detailed account of the process of individual construction of knowledge. Ernest (1995) postulated, "that radical constructivism represents the state of the art in epistemological theories for mathematics and science education" (p. 474). Ernest claimed von Glasersfeld's first principle of constructivism unites all constructivist positions. Von Glasersfeld based his basic principles of radical constructivism using the essential elements of Piaget's writings. Von Glasersfeld's (1990) first principle stated, "knowledge is not passively received either through the senses or by way of communication. Knowledge is actively built up by the cognising subject" (p. 22).

Ernest's paradigms included, traditional empiricism, information-processing theory, trivial constructivism, sociocultural cognition, radical constructivism, social constructivism and social constructionism, with reference to some leading protagonists within each paradigm.

The paradigm of traditional empiricism represented an "historical backdrop against which the other paradigms have developed" (p. 467). Ernest's metaphor for traditional empiricism was, "an empty bucket or blank page waiting to be filled with sense impressions or the results of reasoning" (p. 467). In an educational context using this paradigm, as a referent would represent, "learning takes knowledge to be received ready made by the learner. In its simplest form, it assumed a naïve transmission view of teaching as its pedagogy, and a passive-receptive view of learning" (p. 468). The view of learning associates student errors and misconceptions are the result of poor memory, recall or careless application. Ernest argued, this view is deeply embedded in the consciousness of the public and unarticulated is the default paradigm of some teachers and student teachers.

A simpler form of constructivism is information-processing theory, which appears to incorporate von Glasersfeld's first principle of constructivism. Ernest (1995) believed it, "falls short of being even a form of trivial constructivism" (p. 468). The metaphor Ernest used for this paradigm is, "of the mind as computer" (p. 468). In this paradigm Ernest (1995) asserted the

mind "actively processes information or data using various routines and procedures, organising memorization and retrieval of data" (p. 468).

In the theory of learning, information-processing theory differs from the previous paradigm as it recognised that knowing involves active mental processing that is based on earlier attained knowledge. To use a pedagogical perspective, information-processing theory accounted for student errors or misconceptions. Learning therefore involved selection, processing and assimilation of information within the mind of the learner.

A weaker form of constructivism was trivial constructivism. This concurs with von Glasersfeld's first principle. This paradigm recognised that "all individual human knowledge is constructed by each individual" (p. 469). Trivial constructivism aligned with traditional epistemology by regarding knowledge as, "only tries to account for the knowledge representations of individuals as knowledge is self-constructed" (p. 470). Ernest used the metaphor to describe this paradigm, of the "mind is a soft computer" (p.459). Ernest (1995) claimed there is a weakness in this paradigm as it is:

> difficult for the dual aspects of its epistemology to co-exist. On the one hand, all individual knowledge is constructed. On the other hand, there is a realm of objective knowledge, which would include truths and facts about the world. But how can any individual know such knowledge if their knowledge is a personal construction (p. 470).

Ernest proposed a valuable theory of learning or basis for pedagogy can be utilised from trivial constructivism. This is evident in the application of reading and writing programs that promote independence or in conjunction with groups of students.

The paradigm of sociocultural cognition was the next of Ernest's paradigms. Sociocultural implied social interaction was important and supported a sociocultural framework. Ernest used the metaphor, "the mind as game player

and strategist" (p. 471). The mind has been extended from the "mind as a computer" metaphor used for information-processing theory. This was because of "the rational rules, scripts, and procedures that described game playing and strategies" (p. 471). The pedagogical implications of this position placed an emphasis on social aspects of the teaching-learning situation and how these social situations have an influence on the acquisition of knowledge and learning. Ernest used an example of admitting novices into social practices such as, craft apprentices. This paradigm was evident in formal education systems where learning has clear cultural dimensions. An innovation built into a socio-cultural cognition context was the inclusion of learner's goals.

The paradigm of radical constructivism originated with the work of Piaget, who preferred a theoretical framework for knowledge that emphasised the social and cognitive components. Piaget, however, largely unanalysed the socio-cultural processes of knowledge construction. Von Glasersfeld in a series of publications, which covered a 15-year period, extended radical constructivism in terms of epistemology. Radical constructivism implied all knowledge constructed by an individual was on the basis of their cognitive processes and within their experiential world. Radical constructivism, from a definition perspective, embraced both the first and second of von Glasersfeld's principles. The second of von Glasersfeld's (1990) principles stated:

> 2 a) The function of cognition is adaptive, in the biological sense of the term, tending towards fit or viability.
>
>   b) Cognition serves the subject's organisation of the experiential world, not the discovery of an objective ontological reality. (p. 23)

Von Glasersfeld (1995) gave a concise definition of radical constructivism to be:

> It starts from the assumption that knowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows

on the basis of his or her own experience. What we make of experience constitutes the only world we consciously live in. It can be sorted into many kinds, such as, things, self, others, and so on. But all kinds of experience are essentially subjective, and though I may find reasons to believe that my experience may not be unlike yours, I have no way of knowing that it is the same. The experience and interpretation of language are no exception (p. 1).

Ernest found it difficult to isolate the underlying metaphor for radical constructivism, as it is positioned in the mind as experiences. The most apt metaphor used by Ernest described the "mind or cognising subject is an organism undergoing evolution" (p. 473). The organism was always evolving and adapting somewhat like the Darwinian theory of survival of the fittest.

Ernest alleged radical constructivism implied that all knowledge was constructed by the individual on the basis of his or her cognitive processes in dialogue with his or her experiential world. He claimed also, radical constructivism represented the state of the art in epistemological theories for mathematics and science education, which offered an innovative, productive body of research.

Ernest considered, however, radical constructivism should be subject to critical scrutiny, which will allow it to grow and develop further. Ernest acknowledged, radical constructivism does little to endorse the value of interpersonal communication, for shared feelings and concerns or shared values. The paradigm therefore needs to include knowing with feeling, to acknowledge that humans are interconnected and should draw on elements within social constructivism. Ernest implied that the socially situated nature of knowledge may raise a problem of transfer of mathematical or literacy skills. The implications for pedagogy meant being sensitive to individual constructions and facilitating a strong social basis within the classroom.

Social constructivism, the next of Ernest's paradigms, included the realm of social as interconnected. Social constructivism was represented by individuals cognising through their interactions with each other and also by way of their own individual processes. Ernest (1995) advocated social constructivism was "based on a fallibilist epistemology that regards conventional knowledge as that which is lived and socially accepted" (p. 480). Ernest used the metaphor, "persons in conversation, persons in meaningful linguistic and extra linguistic interaction and dialogue" (p. 481). A deficiency of the radical constructivist position was the exclusion of interconnectiveness and the social aspect of learning. A number of radical constructivists (Diver, Wood et al, and Confrey) recognised this deficiency and now employ elements of social constructivism in their positions as a result of re-conceptualising radical constructivism.

Ernest (1995) indicated strong implications follow from radical and social constructivism that go beyond an emphasis on pedagogy, that included:

1. Knowledge is problematic

2. Methodological approaches are required to be more circumspect and reflexive.

3. Focus on learner's cognitions, beliefs, and conceptions of knowledge.

4. Teachers' beliefs, knowledge, subject matter, diagnostic skills, conceptions and personal theories.

5. To be able to understand the realities of others along with our own realities.

6. Emphasis on social construction with a pedagogical emphasis on discussion, collaboration, negotiation and shared meanings (p. 485).

Ernest's final paradigm was social constructionism. Ernest gave a brief explanation of this paradigm to state, it rounds out the range of paradigms. Social constructionism resembled social constructivism combined with aspects of radical constructivism, however, an emphasis is placed on the social above the individual. Ernest used the metaphor; "of mind is that of dialogue or

drama, with individuals represented as actors with parts to play in the drama"
(p.481). Pedagogically this paradigm was less developed as it applied more to
a psychological therapy context.

Ernest suggested, constructivism recognised knowing was active, individual
and personal and was based on previously constructed knowledge. The
unifying metaphor that binds all the various forms of constructivism is, of
carpentry, architecture or construction work where the structures have been
built up from pre-existing pieces to create a new structure. In a human context,
this metaphor represents understanding is a building of mental structures and
the term restructuring, accommodation or conceptual change, represents
altering understanding in some way. Ernest proposed constructivism does not
imply "understanding is built up from received pieces of knowledge but is the
product of previous acts of construction" (p. 461).

The dichotomy of social and individual constructivism posed a concern to
Ernest. Can constructivism be a mental construction or a social construction?
Or be a combination of both? Ernest believed it could include both paradigms.

Ernest maintained constructivism should be termed alternative epistemologies
in education, where ultimately constructivist theory leads into pedagogy.
Ernest (1995) described pedagogy "as a theory of techniques for achieving the
ends of communicating or offering the selected knowledge or experiences to
learners in a way consistent with a set of values" (p. 484). Ernest outlined
pedagogy as a procedure for achieving the ends of communicating or offering
the selected knowledge or experiences to learners in a way consistent with
these values. Teachers' pedagogy should steer students from unproductive to
more productive solutions by making the activities in a unit of work
meaningful and purposeful. Students should be engaged in a deeper level of
thinking by the use of specially designed questions. Ernest (1995) asked
important questions about pedagogy such as, "What are the aims of education?
What types of interactions are necessary to fit with the values? 'What view is
of the child or person and their rights and powers?" (p. 484)

Ernest (1995) stipulated, pedagogy encompassed a set of values however; it should be reflective by using the following questions:

> 1. What are the aims of education?
>
> 2. What selection from the stock of cultural knowledge is valuable to teach?
>
> 3. What forms of human organisation and interaction fit with the values?
>
> 4. What view of the child or person, with what rights and powers, is associated with the values?" (p. 484)

There could be a danger of constructivism appearing overly child-centred, romantic progressivism or conceived in a loose and emotive way and associated with a sentimental view of the child. Ernest implied, learners construct their own meanings and for the teacher and peers to interact with the learners to negotiate passages of knowledge. The Essential Learnings Framework 1 (2002) agreed with the premise that learners construct their ideas. The document stated:

> Educators are concerned with the development of understanding. They recognise that ideas are constructed and open to question or refinement. View curriculum as being based on key ideas or questions and are patient with the time it takes to build meaning   (p. 42)
>
> .

Ernest (1995) outlined important pedagogical implications for teachers to value, which included:

> 1.   Sensitivity toward and attentiveness to the learner's previous constructions;
>
> 2.   Diagnostic teaching attempting to remedy learner errors and misconceptions; perturbation and cognitive conflict techniques as part of this;

3.   Attention to metacognition and strategic self-regulation by learners (p. 485).

Methodological approaches are required to be much more circumspect and reflexive because there is no 'royal road' to truth or near truth. The Essential Learnings recommended diagnostic teaching using authentic assessment tasks. An authentic reflective assessment task utilised in my practice and encouraged in the Essential Learnings is the use of self-assessment and peer assessment. The Essential Learning Framework 1 (2002) outlined, when learners determine their own learning they can, "self-assess and develop their capacity to monitor their own learning. Learners negotiate assessment criteria and assessment tasks" (p. 43)
.

A pertinent issue raised at the end of Ernest's paper was reflexivity. Reflexivity raised levels of self-awareness within students and encouraged them to think about themselves as learners and thinkers. This should also apply to educators in relation to their pedagogy. Educators should include self-awareness and reflection as part of their practice. Educators should also value each other's perspectives, as it is important that we are consistent and offer each other the same respect.

A reflective thinking, self-assessment task currently promoted through the Essential Learnings is the rubric assessment framework. The rubric assessment framework was introduced to teachers through professional learning sessions in 2003-4. The rubric framework is a quick and efficient way to assess areas of the curriculum and can be jointly compose by students and teachers. The rubric framework consists of a list of essential criteria in a particular curriculum area placed along a vertical axis. On the horizontal axis is a graduation of work quality ranging from not developed, partially developed to well developed. For younger students the graduation of work quality can be represented by a series of faces.

In July 2003 a rubric framework was used in my practice to assess journal writing for my Grade 1-2 students. The lesson commenced with a discussion

about the rubric assessment framework. Students considered what good journal writing should look like. Students were divided into 4 groups to brainstorm, what good journal writing should contain. After the group brainstorming session, students came together to share their ideas. The collated ideas included, handwriting should be light, the right size, have spaces between words, spelling should be correct and use a dictionary, the story should make sense, we should write as much as we can and include punctuation such as, capital letters and full stops. These ideas were succinctly written and incorporated into a rubric framework, which was pasted into their journal books.

The following week a selected student composed a short sentence on the class white board. A rubric assessment framework was included for him to demonstrate to the whole class how he could do a self-assessment using the criteria of handwriting, spelling, punctuation and story content. The student then ticked the appropriate space within the framework. This demonstration provided students with an understanding on how they could complete their own rubric framework. Students then undertook journal writing and trailed the rubric assessment framework for themselves. Some students were confident using the assessment framework however, other students required assistance. A debriefing session followed student's journal writing and the self-assessment process. Comments included, 'that this was the most they had ever written, their writing was very neat and they had improved in their spelling'.

The use of the rubric assessment framework in journal writing proved a positive experience. The students were able to identify what good journal writing should look like, by using their own selected criteria. A purpose for writing also became evident as students wanted to improve on their previous performance as outlined on the assessment framework. I am therefore encouraged to continue this assessment task in other curriculum areas.

Kenneth Tobin and Deborah Tippins provided the 4th paper for the literature review. Their paper, *Constructivism as a Referent for Teaching and Learning* (1993), explored constructivism from a social constructivist viewpoint in

teaching science and mathematics. Tobin and Tippins (1993) began by defining the nature of constructivism and stated:

> we see constructivism as a form of realism in the sense that the existence of a reality, however, is that we can only know about it in a personal and subjective way. Our constructions are constrained by experiences, which comprise subjective interactions with the real world as we have constructed it. A constructivist perspective acknowledges the existence of an external reality but realises that cognising beings can never know what that reality is actually like (p. 1-2).

Tobin and Tippins (1993) positioned constructivism as post-epistemological, a similar position to von Glasersfeld (1990) and Noddings (1984). Tobin and Tippins (1993) qualify their assumption of von Glasersfeld's post-epistemological position and stated:

> constructivism is not concerned with the question of knowledge as a representation of truth; rather, it focuses on the manner in which knowers construct viable knowledge, that is, knowledge that enables an individual to pursue goals in the multiple contexts in which actions occur (p. 2).

Tobin and Tippins argued, constructivism often ignored the social component of knowledge and proposed, knowledge should be viable both in the personal and social contexts in which actions occur. In a social context, language is used to communicate with other individuals. Language therefore stimulates thinking, even though it is occurring in the mind of a single individual. Students are able to develop higher order thinking skills through language. This also allows students to make connections, clarify, elaborate, build alternatives, hypothesise and generate good questioning skills.

Tobin and Tippins believed constructivism should incorporate the social component of knowledge, which is a representation of society. Tobin and

Tippins (1993) implied that, "knowledge has both individual and social components that cannot be meaningfully separated and enables us to construct learning environments where multiple ways of knowing are sought and valued" (p. 6). The authors also stated, constructivism should contain an interactive element as occurs in small group situations. This allows for social interaction and a co-construction of negotiated meaning. In the small group situation meaning can be shared and negotiated and has the potential to transpire into whole class dialogue. Dialogue has the potential to provide personal meaning through reflection for many students.

Tobin and Tippins use the example of a science curriculum to explain constructivism in action. In science, learners make sense through an existing conceptual structure, which is a social process. Teachers need to ascertain students' prior knowledge and subsequently plan appropriate learning opportunities. Tobin and Tippins proposed there is a need to consider the type of experience, which facilitates learning and represents what the learner already knows and gives meaning to these experiences. The authors suggested experiences that lead to optimum learning could include, using the senses, representing knowledge through language, diagrams, mathematics, clarification, elaboration, comparison, justification, alternatives and selection of viable solutions to a problem.

I include these experiences to promote understanding of a specific a topic with my primary school students. Students are often provided with concrete experiences such as, the use of manipulatives in mathematics. Manipulatives are a powerful learning tool, which promote understanding of concepts such as, addition and subtraction. Other concrete experiences can be provided through, excursions, painting, writing and thinking about an experience, generating their own questions, having group discussions, performing a drama or presenting a speech. Assessment of students' knowledge can be through discussions to ascertain their thinking process, collections of work samples, use of peer generated questions or self assessments whereby students give their own ratings according to negotiated criteria.

In a classroom that would promote constructivism, teachers monitor students' understanding where assessment is through negotiation and problem solving situations. Teachers need to interact and guide discussions, whereby language is seen as the social vehicle for clarifying, elaborating, justifying and evaluating alternative points of view. The inclusion of portfolios where various work products are amassed represents an assessment tool. Students choose the products from the portfolio that reflect their understanding of a particular topic. This represents a tangible way to bring teaching, learning and assessment together. These representations of students' understanding could be through, visual arts, writing, and technology, using symbols, music or in drama.

The use of specified references allow teachers to select from the rich collection of graduated activities, activities, which promote understanding. These activities can range from a basic knowledge level to activities that provide students to think in diverse ways. These graduated activities provided a building process of mental structures for students and demonstrates evidence of constructivism.

Planning a unit of study with reference to the Essential Learnings consist firstly of a 'tuning in phase'. This introductory phase ascertains students' prior knowledge. Activities associated with the tuning in phase include, brainstorming, question of the day, mind mapping, think-pair-share, written or visual art products and learning journals that document students' understandings at various stages of the learning journey. Subsequent phases have an expectation that activities will build upon students' prior knowledge. Subsequent phases include, guided inquiry, drawing conclusions and culminating demonstrations. Associated activities that foster students' deeper understandings of a unit of work include, excursions, guest speakers, pictures books, posters, videos, discussions and focused questions for further inquiry, surveys, questionnaires or information disseminated from the internet.

In my present work place most teachers include constructivism as part of their practice. Constructivism, as mentioned by Noddings (1984), can take on

different teaching pathways. Learning involved mental activity whether it is weak or strong acts of construction. This also included rote learning as being one of these teaching pathways. I therefore argue we need to be mindful as educators to whether we are using weak or strong constructivist practices in our pedagogy. We also need to be attentive by using reflective practice to correct or change perceived anomalies in our practice.

Tobin and Tippins concluded, constructivism could be conceptualised as a set of beliefs about knowing that has the potential to facilitate different ways of thinking. In an educational context, for those wanting to understand its complexities, it can be confusing. Tobin and Tippins suggested, constructivism was a dynamic theory, which offered a personal epistemology for learning rather than being truth seeking. Tobin and Tippins (1993) stated:

> constructivism is conceptualised as a set of beliefs about knowing that has the potential to facilitate different ways of thinking about education, of framing problems, and of formulating answers that extend into areas not considered when objectivism was used as a referent (p. 20).

Tobin and Tippins claimed constructivism has been used as a theoretical framework or referent to guide teachers in their practice. Teachers are seen as learners, not delivers of truths, who can give personal meaning to experiences through reflection. This can lead to innovations either within the classroom environment or at an education departmental level. The new curriculum in Tasmania encouraged teachers to reflect on their practice by including a reflective section in the proformas.

In an educational context constructivists link prior knowledge and build upon this with the inclusion of multiply activity choices. Tobin and Tippins maintained constructivism occurs best in social situations where students learn best through social interaction where dialectical relationships promote meaning and deeper understanding. A focus for activity choices therefore should be to make activities inclusive, whereby all students have the

opportunity to participate in group situations. This can allow for purposeful and meaningful discussions that demonstrate knowledge in alterative ways. Examples of alterative activity choices include, music, poetry, drama, practise skills for consolidation, the inclusion of sensory stimulation, incorporation of cultural perspectives, framing and extending the range of questions and answers to a problem. A student's knowledge base often needs to be challenged using higher order thinking such as, ethical, altruistic and long-range thinking. Using alternative thinking strategies will become increasingly important in dealing with complex problems facing individuals, groups or organisations in the world today and tomorrow. Strong acts of constructivism, should therefore include a multitude of possible activity choices where questions and a range of answers feature strongly but were rarely practiced when objectivism was used as the referent.

The 5th paper to be reviewed is by Ernst von Glasersfeld. Glasersfeld's paper, *An Exposition of Constructivism: Why Some Like it Radical,* (1990) is an examination of radical constructivism and why constructivism needs to be radical. Von Glasersfeld (1990) disclosed the central point of radical constructivism, "that truth can never be claimed for the knowledge (any piece of it) that human reason produces. Radical constructivism is a theory of knowing rather than a theory of knowledge" (p. 19).

A common thread uniting Noddings (1984), von Glasersfeld (1990), Tobin and Tippins (1993) papers is their interpretation of constructivism. These authors believed knowledge is constructed in a personal and subjective way through a process of negotiation and consensus building. Their papers revealed individual knowledge has different entry points depending on our prior experiences and understandings of those experiences. They also believed, constructivism should be positioned as post-epistemological, which deviated from the traditional notion of truth. Von Glasersfeld (1990) stated, "constructivism does not claim to have found an ontological truth but merely proposes a hypothetical model that may turn out to be a useful one" (p. 27).

Von Glasersfeld acknowledged there are two prerequisites for consideration in any epistemological discourse of knowledge. These included:

> 1. What ever we like to call "true knowledge" needs to be independent of the knowing subject.
> 2. Knowledge has to be taken seriously only if claims to represent a world of "things-in-themselves" in a more or less veridical fashion (p. 21).

Von Glasersfeld (1990) asserted constructivism is not concerned with the question of knowledge as a precursor for truth but focused on the manner in which knowers construct viable knowledge. Knowledge evolved through the processes of negotiation and consensus building, as we experience the world and consequently our constructions are constrained by our experiences. Von Glasersfeld therefore positioned constructivism as post-epistemological.

Von Glasersfeld (1990) cited various philosophers, Xenophases (6th century B.C) Sextus Empiricus (200AD), Montaigne, Berkeley, Vico, Kant, the Italian Operational School, through to Piaget's genetic epistemology, who have inspired constructivist theory. These philosophers and especially the work of Piaget whose work spanned over a half a century described knowledge as being derived from human experience. Von Glasersfeld acknowledged contradictions existed in Piaget's work, such as, the theory of stages. This was later superseded by his theory of equilibration. If Piaget's writings could be compromised into one theory then von Glasersfeld (1990) believed the basic principles of radical constructivism emerged. These basic principles included:

> 1. The cognising subject actively builds up knowledge.
> 2. (a) The function of cognition is adaptive, in the biological sense of the term, tending towards fit or viability.
>
> (b) Cognition serves the subject's organization of the experiential world, not the discovery of an objective ontological reality (p. 22-23).

Von Glasersfeld emphasised radical constructivism, where social interaction is secondary, digressed from Noddings, Ernest, Tobin and Tippins interpretations. Von Glasersfeld (1990) asserted, "radical constructivism does not claim to have found an ontological truth but proposes a hypothesis model that could be useful" (p. 27). He argued, under constructivist theory perception is not passive, but under all circumstances the result of actions. Von Glasersfeld also believed a connection can be made with everyday experience and conceptual practice where learning reflected the real world. Von Glasersfeld gave the example in mathematics where, "counting starts out as ordinary things that have been abstracted from ordinary experience, and the basic abstract concepts, such as oneness and plurality, have a life of their own before they are incorporated into the realm of mathematics" (p. 25). He also noted the patterns of a cognising organism can and does abstract from experience and depends on the operations of distinction and coordination, the organism can and does carry out.

Von Glasersfeld (1990) mentioned rote learning in mathematics as a construction, however, suggested it is only trivial and has "no place in constructively oriented instruction" (p. 26). Noddings concurred with von Glasersfeld's view of rote learning in classroom instruction. Noddings suggested, through a cognitive constructivist lens rote learning can only be weakly constructed and limits the student's ability to think more deeply.

Educators using Bloom's Taxonomy as a referent could include rote learning in the first level of the taxonomy where facts can be remembered. It would be assumed that educators would structure learning environments to optimise understanding by building onto the first level. The other five levels of Bloom's Taxonomy, which include, comprehension, application, analysis, synthesis and evaluation are structured for building understandings. There are students who for what ever reason are unable to engage in learning activities that go beyond the first three levels of Bloom's Taxonomy. For these students rote learning may be the only way they can remember information. When time is a constraining factor in a classroom especially for very young students, the inclusion of rote learning is often a more efficient way of teaching. The instant

recall of numbers, alphabet letters and common sight words are examples of opportunities using rote learning.

The 6th paper in the literature review, *Images of physics: How students are influenced by social aspects of science* is by Joan Solomon (1992). Solomon's paper explored how social aspects of science influence students' understanding. Solomon's research, investigated two educational projects, the DISS (Discussion of Issues in School Science), and Nature of Science projects. The intention of the research projects was to track the learning patterns of 130 students for a year using specially prepared teaching materials.

The DISS project investigated how 17-year-old students "use their school knowledge of science and out of school knowledge during informal discussions of science-based social issues such as, the risks from nuclear power production" (p.141). The DISS project involved a selection of schools from different parts of England. These schools had already undertaken a complete years course in science, technology and society. The study comprised of viewing 6 television excerpts from general programs about science. Each excerpt conveyed emotive or social messages including scientific information. The television excerpts consisted of, nuclear power, kidney donations, genetic counselling, compensation for veterans of the atomic tests on Christmas Island during the 1950s, industrial pollution and public risk and third world medicine. Solomon quoted, Wiesenmayer et al 1984 research into environmental issues and found American high school students often referenced television viewing as a primary source of information. Research by (Lodge and Tripp 1986) however, indicated students who are highly interactive, acquire most of their information via discussions.

The findings of the DISS project were more complex than a dichotomy between knowledge and influence. Students received information from three general sources, television excerpts, outside school and formal learning at school. Outside school information came from various sources such as, books, other people or television programs. The process of constructing understanding, personal, social and scientific was mostly through discussion

and sharing the information from the excerpts. Discussions also revealed, information gained from the television excerpts by the students was complex and often incorrect. Some information was rejected because of bias, prejudice and commitment to personal values and empathy with others. The information therefore was reconstructed and often reflected misunderstandings.

The second research project, Nature of Science Project involved younger pupils understanding of science experiments and theories. This project involved over 400 students aged between 11-14 years in three different English localities. Students were required to carry out experiments, to test explanations and to operate scientific models like real scientists would perform. Scientists demonstrated their projects to students and students were then invited to join them. The researchers attempted to open aspects of science knowledge to those who may themselves take part in its construction.

To ascertain students' understanding, the researchers used a simple questionnaire that asked, 'Why do scientists do experiments'? And the nature, theory and explanations of experiments. After completing the questionnaire students explained their responses via interviews. The results indicated, "almost 50% of students believed scientists performed experiments with no expectation of what might happen in order to make discoveries" (p. 148). The relation of theory to explanation was understood in approximately half the student cohort. This however, could not be transferred back to their own learning, as they were unable to describe an experiment that helped them understand a theory. The statistical analysis of the total range of answers showed a mismatch between similar responses to different questions. When interviewed about the inconsistencies students were unconcerned about their conflicting or inconsistent answers.

The conclusions established that both projects had commonalities. These included, the acknowledgement of out-of-school experience affects student understanding and sociological theory rather than a more narrowly conceived constructivist perspective also effects understanding. Solomon claimed in education the term constructivism came later and had a number of vague but

specialised meanings. Piaget the pioneer of constructivism, believed students engaged in private cogitation that connects to a series of stages. Solomon's research projects however, established a sociological preference to advance student understanding. The implication of this research consequently has an impact on science teaching with the inclusion of social situations to assist learning. Social situations can be achieved in collaborative groups or through peer discussions where ideas are exchanged. Solomon advocated that social construction mirrors how we learn in daily life and may owe little or nothing to school teaching or that learning only takes place within the isolation of a classroom.

The studies explored how students reconstruct their understanding during these social exchanges. The studies also found students began to accept that others might hold different but valid opinions to their own. In both situations the social construction process is like real life and complements private knowing or what goes on inside the learner's mind. During these social exchanges the speaker or listener reconstructed knowledge for it to have meaning to them. Solomon maintained understanding is intrinsically social. This position is similar to Noddings (1984), who suggested, in social interaction sessions students begin to challenge themselves, ask for reasons and monitor their own work.

The projects used methodology, which are susceptible to social influences and interpretations and take account of ideas from sociology of knowledge. Solomon recognised that both projects are fundamentally constructivist and could not have existed in the days before "the cognitive revolution" of the 1950s and 60s.

The 7th literature review, *Characteristics of classroom mathematics traditions: An interactional analysis* (1992) is by Paul Cobb, Terry Wood, Erna Yackel and Betsy McNeal. Their paper highlighted the need to reform mathematics education, which promoted instructional situations and transform pedagogy into meaningful learning and learning for understanding.

Video transcripts were used to describe the teaching styles of two primary school teachers. The first teacher taught a Grade 3 and the second teacher a Grade 2. The authors witnessed from the video transcripts two different pedagogical approaches for the same mathematical topic of, place value, two-digit numerals and number words. Cobb et al. (1992) suggested the use of video analysis to describe mathematics traditions can "be brought to the fore by analysing teachers' and students' mathematical explanations and justifications during classroom discourse" (p. 574).

The authors used the term situations for justification and explanation to sample episodes in the classroom involving problem solving. In the situation examples, the authors suggested, mathematical communication could "breakdown unless the need to explain or justify an interpretation or solution is taken as shared" (p. 579). Examples of *situations for action* that required students:

> to search for a solution to a given task, situations for formulation require students to make their interpretations and conceptualisations explicit, situations for validation require students to justify what they have made explicit, and situations for institutionalisation require students to accept the teacher's legitimation of mathematical constructions selected from those that have been developed in the course of classroom activity (p. 577).

Cobb, et al's (1992) attempted to "clarify what it means to teach mathematics for understanding and to learn mathematics with understanding" (p. 573). An important issue raised by the authors, was to clarify how students came to view school mathematics, where students used sometimes obscure symbols and where the teacher's aim is for students to learn with understanding. Students were asked in most instances to make their interpretations and conceptualisations explicit during the lessons. Seaton (2004) in his keynote

address at a Hobart Literacy Conference in June 2004, believed teaching for understanding is a challenge:

> where teachers need to create contexts for action that are real enough and engaging enough that understanding matters to students. Teachers need to discover students' current understanding, or at least help them to. They also need to help students to have experiences that either confirm their existing understanding, or make them realise it is unworkable and needs to be reconstructed (p. 8).

The first lesson analysed was in a Grade 3 classroom. The lesson involved the whole class where the teacher and students interpreted the concept of place value, two digit numerals and number words. Instruction commenced using an overhead projector. The teacher asked the students to give a quick approximation of the number of tally points shown on the screen without counting. After the students gave their approximations the teacher demonstrated her procedure. The teacher's procedure entailed circling groups of tens to make counting easier. Examples followed using pop sticks where groups of tens were circled with the inclusion of remaining sticks.

Few students responded to the teacher's questions of 'how many groups of ten? And 'How many left over?' The lack of response suggested few students understood the aim of this lesson. The over-riding goal for the students was to follow specific procedural instructions where the teacher acted as the sole validator of what could count as legitimate mathematical activity. The lesson concluded with set textbook tasks. During the course of the lesson students did not challenge the teacher's rationale and therefore she did not have to defend her procedures. The instructional routine of the Grade 3 teacher indicated mathematical procedures were fixed, self-evident and mathematical interpretations did not need to be justified, as place value was a set of preconceived set of procedures.

The authors noted, "that none of the teacher's challenges initiated the interactive constitution of a situation for justification. One situation for explanation occurred, when the teacher asked, 'why seven tens and zero ones would not be seven'. The authors maintained, if situations for explanation do not exist, then mathematics is "reduced to an activity that involves constructing associations between signifiers that do not necessarily signify anything beyond themselves" (p. 587). It can be concluded from the discussions of these Grade 3 students that mathematical concepts such as, place value using manipulatives were not generally conceptualised. Cobb, et al (1992) believed an instruction flaw was the over use of sequencing tasks and questions that required right or wrong answers rather than explicit teaching or demonstrations that promoted understanding.

In the second classroom, a Grade 2, instruction also involved the whole class and focused on place value using similar manipulatives. The first instructional activity involved placing two longs and eleven individual cubes on an overhead projector. This was quickly shown to the students for them to describe. Some students described the correct number of cubes while others disagreed. In this instance the teacher asked an inquiry question, 'how are we going to figure this out?' This question encouraged students to challenge each other's interpretations, solutions and answers. Later in the lesson both the teacher and the students engaged in an assortment of activities that included bundling and sorting matchsticks into groups of tens. Interaction constituted this classroom mathematics program rather than a traditional mathematics program that can be described as paradigmatic.

The pedagogical practice used by the Grade 2 teacher, had been used from the beginning of the year. Students felt comfortable in the belief of challenging each other. Shared understanding was encouraged and supported by this teacher where mathematical activity was intrinsically explainable. The primary instructional routine used by involved questioning and for the students to explain to each other the details of a mathematical relationship. In this classroom students were not passive recipients of mathematical knowledge but actively engaged in constructing mathematical knowledge by interacting with

the teacher and other students. Cobb, et al advocated, students and the teacher should be actively involved in the development of their classroom mathematics tradition.

On the Tasmanian Department of Education website, it stated to be an effective teacher, questioning is the basis of effective inquiry. The article stated:

> Good questioning promotes understanding by providing opportunities to explain, clarify, probe, make connections and identify problems and issues. Questioning contributes to dialogue between teachers and students and has an impact on students' use of questioning to promote their own learning
> (p. 1).
> *(http:www.ltag.education.tas.gov.au/effectteach/pedagogy/questioning.htm.)* (2004)

Cobb, et al (1992) "contended that cognitive models which document students' construction of increasingly sophisticated mathematical objects are essential to analyses of their activity as they participate in the interactive constitution of an inquiry mathematics tradition" (p. 601). The authors believed an important goal in learning, was the development of the meanings that individuals and collective mathematical activities have for the teacher and their students, and where both a cognitive and a sociological process are encouraged. The authors also advocated classrooms should showcase implicit teaching approaches that involve creative thinking, collaborative approaches and for teachers to become more like facilitators of learning. Facilitators of learning create conditions that use conflict resolution, mutual perspectives and askers of questions that can prompt students to move towards socially negotiated accepted meanings.

Although Cobb, et al (1992) do not mention the theory of constructivism in their paper, it would appear from their pedagogical preference that constructivist ideals have been incorporated in the second classroom. Dantonio and Besenherz (2001) suggested meaning and understanding are intrinsically

associated with constructivism. They stated, "contemporary thinking about what understanding means embraces constructivism. Constructivist teaching practices help learners to internalise and reshape, or transform, new information" (p. 35).

The Essential Learnings Framework 1 (2002) stipulated to make learning more meaningful and encourage students to think in different ways mirrors the ideals outlined in Cobb, et al (1992) paper. The Essential Learnings Framework 1 2002, stated:

> Effective learners need the capacity to ask good questions, persevere in a line of inquiry, be systematic, set goals, and plan and follow a course of action. They need the skills to organise time frames and time usage, to conduct their own investigations and to predict and explore possible consequences and outcomes (p. 14).

The 8th paper reviewed is by Peter Taylor titled, *Mythmaking and Mythbreaking in the Mathematics Classroom* (1996). The purpose of Taylor's paper was to alert intentional constructivist mathematical educators. Taylor asserted mathematical educators could be restricted by the influence of restrictive power, which can disempower both teachers and students.

Taylor argued constructivism in recent years has become a major focus in pedagogical reform, however, constructivism used as a referent of learning as conceptual change has had limited benefits. Taylor introduced another face to constructivism, critical constructivist epistemology. Critical constructivism is a social epistemology that has links to von Glasersfeld's (1990, 1993) radical constructivism and included aspects of critical theory as described by Jurgen Habermas's (1972, 1984) "theory of knowledge and human interests and theory of communicative action" (p. 167). Critical theory also aligned with other transformative epistemologies such as, Ernest's (1991) social constructivism and Ole Skovsmose's (1994) critical mathematics education. Taylor proposed critical constructivism is a powerful theoretical framework

that addresses the socio-cultural context of knowledge construction. When constructivism is used as a referent it allowed teachers to deconstruct repressive cultural myths that underlie educational environments.

Taylor stressed that our society is immersed in powerful restrictive cultural myths. These myths offer a set of ideal images or measures of thought that are thrust upon us in everyday situations such as, in the media, billboards, supermarket shelves, interactions with family, friends or colleagues. Taylor (1996) suggested we should examine the appropriateness of these cultural myths that continue to shape our global conscience, for example the myth of Eurocentrism which:

> has long-shaped condescending attitudes of paternalist benevolence towards non-Western industrially developing countries. Of particular concern is the continuing role of the West's export education industry in maintaining the ascendancy of Western worldviews and institutionalised practices through our education system (p. 153).

Taylor stipulated, some cultural myths act to repress certain social activities by labelling them as disruptive or unnatural. In education we need to reveal the essence of these cultural myths, especially myths associated with structures, power, authority and knowledge that disempower teachers and students. Taylor (1996) used the example of the reality that exists in traditional mathematics classrooms. This reality has mostly been directed by powerful repressive cultural myths that control the "discursive practices of teachers and students" (p. 151).

Taylor (1996) introduced the myths of cold reason and hard control as two examples of power and structure that intrude into our educational practice. The myth of cold reason implied a pedagogical practice where there is belief in the certainty of mathematical knowledge, which is knowable using cognitive activity. In the classroom this translates to students working in isolation, "striving to (re) discover by means of cold reason, the priori universal truths of

mathematics" (p.163). The pedagogical practice of the Grade 3 teacher referenced in Cobb, et al (1992) would reflect the myth of cold reason. The descriptive vignette of the Grade 3 lesson on place value, where students were given few opportunities to engage in interactive discourse to negotiate meaning mirrored a traditional mathematical classroom. A traditional mathematical classroom would consist of, students working in isolation using textbook examples to obtain the universal truths of mathematics with little or no social interaction.

Taylor (1996) documented a collaborative action research study, of a postgraduate student identified as Ray, to demonstrate the myth of cold reason. Ray an experienced teacher of science; teaching for the first time senior high school mathematics, wanted to improve the unsatisfactory academic performance of his pre-university mathematics students. Ray endeavoured to transform his pedagogy to match constructivist ideals by innovating on the relationship between students' conceptions and their new conceptual development. Ray focused on the "relationship between students' prior mathematical knowledge and the new knowledge" (p. 163) by using more user-friendly transmissions of mathematical information. Ray also developed more interactive student-centred teaching strategies, adopted the role of teacher as learner and was able to evaluate more readily students' extant mathematical knowledge by using questioning and individual student consultations. Ray's pedagogical reforms however, were limited in their nature, scope and effectiveness. He continued to maintain a centralist classroom role of teacher as informer and controller. Ray asserted this disappointing outcome was the result of an accumulation of repressive myths such as, the of lack of available time, externally mandated curriculum, an examination system, accountability to his Head of Department, the parents and the students. Taylor argued this apparent rigid system of accountability historically appears to underlie secondary education in many western countries. This rigid system also contributes to teachers' failure to introduce pedagogical reforms to reflect constructivist ideals and in particular critical constructivist perspectives.

Taylor also outlined another powerful cultural myth, the myth of hard control. The learning environments experienced in traditional classrooms, where students' actions are predetermined by the strong control of the teacher. Hard control favours students who are passive and compliant. In these traditional classroom environments students' voices are usually silenced and they have little power over their learning. Taylor maintained the relationship fostered through the myth of hard control locks the teacher's role as controller and the student as a passive recipient of knowledge. Hard control is designed to reproduce rather than challenge the established culture. When the myths of cold reason and hard control work in concert the repressive nature of power becomes apparent. Taylor advocated:

> the myth of hard control prioritises the delivery of the curriculum and holds the teacher accountable in a managerial role or teacher as controller. In the traditional mathematics classroom the myth of hard control drives a hard bargain where communication gives way to technical imperatives. Despite appearances to the contrary, this is neither a natural nor inevitable state of affairs. Together these myths suspend teacher and students in a web of significance that portrays classroom teaching and learning as an inexorable journey through a pre-constructed landscape (p. l66).

Taylor (1996) asserted to produce successful pedagogical reforms depends on the power of the constructivist theory used as the referent. Taylor suggested adopting a critical constructivist perspective should expose the repressive nature of these myths. Classroom culture should reflect "social reality that is constructed by, and in turn constructs, the communicative interactions amongst teachers and students" (p. 159).

Taylor believed developing communicatively competent students was an important goal of a constructivist inspired teacher where students are engaged in open and critical forms of discourse. This was evident in Cobb, et al (1992) description of the Grade 2 classroom, where students were encouraged to

engage in open discourse. This allowed for the development of meaning to occur regarding the mathematical concept of place value.

To deconstruct the repressive nature of myths, Taylor (1996) asked the question, "To what extent should teachers be expected to shoulder the burden of reconstructing the epistemology of their own classroom"? (p. 168) Taylor asserted, individual teachers undertaking the sole responsibility of transforming their classrooms, where there is a degree of freedom turns out to be a misconception. Taylor suggested, pedagogies are well entrenched within a cultural milieu of the acculturating influence of their school communities. The cultural milieu consists of administrators, peers, students and parents. Taylor, however, argued central to educational reform included reforms that facilitate teachers' development in collective collegial communication, rather than individual communication. It is necessary for teachers to become skilled at communicative dialogue, which is both open and critical and encourages critical self-reflection. This critical reflection has the potential to uncover discursive practices such as, the myths of cold reason and hard control.

The 9th paper in the literature review is also by Peter Taylor (in press) titled, *Constructivism: Value added.* This paper could be interpreted as a sequel to the previous paper, where critical constructivism can be used as a referent to expose repressive cultural myths.

Taylor's paper commenced with a brief history of modernism. Modernism commenced with the work of 16th and 17th century philosophers such as, "(Bacon, Descartes and Newton). These philosophers described scientific knowledge as "an all-powerful internalised representation of reality arising from empirically-grounded inductive reasoning" (p. 1). Taylor asserted a modernist view of education still exists today. Modernist classrooms are teacher-dominated, have a curriculum that offers minimal inquiry opportunities for its students, a culture that promotes conformity and interprets teachers as trainers. In response to modernism have emerged alternative epistemological theories, one alternative being constructivism. Taylor believed constructivism

has become a popular psychological theory of learning where teachers can "weave the thread of knowing into the fabric of their pedagogy" (p. 3).

Constructivist theory emerged during the 1970s largely within the context of cognitive psychology that explained children as active constructors of knowledge. Constructivism emphasised children's' prior knowledge, rather than their minds being empty vessels waiting to be filled with knowledge. It was during the mid 1980s with the emergence of Ernest von Glasersfeld's radical constructivism that Taylor encountered the epistemology of constructivism. Taylor a former high school physics teacher, found students' pre-instructional knowledge, or misconceptions, an interesting research topic.

The research revealed students often came into class with well-established and highly resilient misconceptions that are often based on their extensive life world experiences. Some educational researchers became aware of their epistemological superiority and acknowledged children's' interpretations of their life world experiences. The term misconception was therefore changed to alternative frameworks or preconceptions. The research established an important component for conceptual change was the recognition of existing conceptual frameworks. The meshing of old with new concepts had relevance and ultimately viability for future learning opportunities.

The teaching of conceptual change to a learner's existing conceptual framework was integral to Taylor's 1980s notion of constructivism. Taylor suggested, "the research allowed teachers to understand why they cannot assume that their explanations or demonstrations will be interpreted by students in the ways in which they had intended" (p. 2). For teachers to accomplish conceptual change in their students they needed to introduce various strategies. These strategies could include, questioning, using critical dialogue or posing alternative positions where students could deconstruct their unsophisticated conceptions to more valid scientific concepts. The inclusion of social perspectives, rather than individualistic perspectives, recognised the need for students to express themselves verbally, by postulating their ideas and investigating solutions to problems. Taylor strongly argued what was missing

from constructivist theory was, "students be given firsthand experiences of science as a process of critical inquiry and critical understanding of the historical and cultural contingency of scientific knowledge" (p. 3). Taylor believed teaching methods such as, small collaborative groups, has been misleadingly construed as constructivism. Taylor believed students should be engaged into epistemological inquiry, which makes sense of the natural world using meaning-making activities.

Although constructivism has been helpful as a referent for teachers, Taylor asserted that modernism continues to be deep-seated and fixed in peoples' minds. Science consequently is viewed as a body of objective knowledge and of scientists searching for absolute truths. Taylor stressed constructivism cannot counter the myths of modernist science due to "constructivist's notion of viability that is concerned with the utility of knowledge for achieving valued goals, itself rests on a teleological ethic" (p. 6).

Taylor claimed part of the solution in deconstructing the domination of modernism is to empower teachers, "with rich understandings of the historical and cultural contingency of scientific and mathematical ideas and methods" (p. 4). In Taylor's (1996) critical constructivism analysis he suggested teachers could aspire to become self-reflective learners. Self-reflection could uncover hidden agendas, notably the myths, which permeate education. Taylor asserted, "constructivism needs to be elaborated and enriched beyond its current rather one-dimensional state" (p. 2). He advocated, constructivist pedagogical reform should include the interweaving of valuing, particularly the ethics of emancipation and care. Ethics of care required teachers to exercise feelings, values and emotionality in a communicative relationship with their students. Beck and Malley (2005) also endorsed this reform agenda and stated:

(http://www.cvc-net.org/cvc-online/cvcol-0303-belonging.html)

> Conventional classroom practices fail to engender a sense of belonging, especially among at-risk students. Indeed, conventional practices may exacerbate feelings of rejection and

alienation and place these students at higher risk for dropping out, joining gangs, or using drugs (p. 1).

Taylor believed if science education is to benefit from constructivist theory, "then science educators need an explicitly moral framework for helping students to judge the worth of competing knowledge claims and to avoid the trap of moral relativism" (p. 5). Taylor (1996a) recommended if constructivist theory is combined with the critical theory of Habermas's (1972, 1984) there emerged a social epistemology, which can "offer an ethical basis for regulating the discursive practices of knowledge construction" (p. 5). From a critical constructivist's perspective, teachers and students need to become reflective practitioners and construct and reconstruct the ethical and social strands within their classrooms. Communicative relationships are encouraged through critical constructivism, which fosters mutual understanding between students and teachers. Communication using language, however, should not always dominate. Distortion of the language can arise such as, power or oppression (sexist behaviour, bullying, intimidation or racism) which is linked to traditional thinking. In a classroom situation where a power game of assigning privileged positions occurs for example, teacher control, student conformity and social reproduction, the myths of modernism remain unchallenged.

Taylor emphasised the inclusion of an emancipatory ethic, which can occur through critical discourse. Critical discourse allows teachers and students to negotiate shared control over the planning, students be part of the assessment of classroom learning activities and for students to exercise a critical voice to contest pedagogical practices that hinder, perhaps unwittingly, their equal freedom to learn. Critical discourse, however, does not engender all students, especially those who have well-established objectivist epistemologies and respond more appropriately as passive-reception learners. For these students emancipatory ethics should be introduced at a much earlier stage in their schooling whereby it becomes the norm and not the exception.

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Taylor alleged teachers working collaboratively have the potential to transform their classrooms into sites of vibrant intellectual and communicative activity. The inclusion of constructivism and its many dimensions, used as a referent for pedagogical practice, has the potential to allow for change. Adding critical discourse and emancipatory ethics to the epistemological theory of constructivism allows teachers to critique their pedagogy to make visible repressive myths such as, cold reason and hard control a legacy of modernist philosophy. This can be achieved by adopting an ethic of care that encourages feelings, values and emotionality in communicative relationships. Taylor (in press) stressed by "maintaining empathic, caring and trusting educative relationships and for placing emotionality on an equal footing with reason and to have a commitment to dialogue that achieves reciprocal understanding" (p. 8) can transform classrooms into sites of vibrant intellectual and communicative activity.

The 10th paper in the literature review is by David Geelan's (1997) titled, *Epistemological anarchy and the many faces of constructivism.* Geelan assumed when teachers first encounter constructivism it could appear as a simple, but superior epistemology, which has implications for teaching. The reality was, constructivism presents in a multitude of complex different forms.

Geelan overviewed 6 different forms of constructivism that have been placed into a two dimensional epistemological framework, referred to as *cartesian coordinates*. Each different form presented something varied about teaching and learning. Geelan's personal understanding of the different forms of constructivism was selected from various constructivist papers rather than from the authors who can change their perspectives over time. New papers on the topic were categorised to fit within the parameters of this epistemology framework. The framework briefly described (a) individual versus social learning and (b) objectivist versus relativist views of the nature of science.

Geelan's 6-form framework is postulated from Feyerabend's (1975) anarchist theory of knowledge. Feyerabend suggested there are numerous ways scientific knowledge can be obtained and therefore a pluralistic methodology

should be adopted. Feyerabend also believed there are ever-increasing mutually incompatible alternatives and each theory is part of a collection, all contributing, that ultimately lead to the development of our consciousness. He postulated there is no single methodological framework that can describe the multiplicity of complex ways in which we acquire knowledge. Geelan (1997) suggested in the richness of educational practice derived from incorporating different forms of constructivism and the inclusion of other perspectives. This results in "the most powerful theoretical engine that can be used to develop educational theory and practice" (p. 27).

Geelan's (1997) succinct deconstruction of the 6 different forms of constructivism included the main principles associated with each form. There has been deliberation for names to match the different forms of constructivism for example, Piaget (1972) and Kelly (1955) cognitive development has been changed to personal constructivism. The main emphasis of this form of constructivism is on the individual's construction of knowledge where knowledge is individual and adaptive. Piaget suggested an adaptive nature of cognition was evident and referred to as accommodation and assimilation.

Geelan's second form of constructivism is Glasersfeld's radical constructivism. Geelan also included Bettencourt (1993)'s paper, "*The radical constructivist view*" as being a leading supporter of radical constructivism. Glasersfeld's (1989, 1993) used two principles to describe constructivism. "Principle A: Trivial constructivism recognises that cognising subjects actively build up knowledge. Principle B: The function of cognition is adaptive and serves the organisation of the experiential world " (p. 17).

Geelan included social constructivism with leading protagonists Solomon (1987), Tobin (1990) and Vygotsky (1978). Solomon claimed there are two domains of knowledge, socially acquired life-world knowledge and symbolic school knowledge. The social nature of science learning is a key factor, which leads to other developments such as, contextual constructivism and social constructionism. Solomon (1994) recently described constructivism as, "being

in gradual decline and suggested there was no single perspective, which will provide a final description of science education" (p. 18).

Geelan introduced Gergen's (1995) social constructionist position. Gergen was a prominent figure in social psychology who took a more extreme social position. Gergen argued, the "consensus processes of language-use and meaning making are social in character and these processes constitute all of knowledge" (p.18). He stressed meaning in language is achieved through social interdependence and is context dependent where language mostly serves as a communal function. Gergen (1995) believed there are four significant departures from traditional educational practice that included, "diffusion of authority, vitalisation of relationship, generation of meaning in practice and multiplication of voice" (p. 19).

The epistemology theory of critical constructivism (Taylor, 1994b; Taylor & Campbell-Williams 1993) associated a synthesis of constructivist interest with the interaction of students' prior knowledge with new knowledge. Critical constructivism intermeshed with two strands of Jurgen Habermases' (1972, 1978) philosophy, "knowledge, human interests, and communicative action" (p. 19). By weaving a critical perspective into constructivism teachers are able to make visible the social, and emancipatory components within their pedagogy. Failure to reform teaching practices lay in the repressive myths of cold reason and hard control. Teachers, however, working in collaboration have the potential to transform the social structures within their school communities.

Contextual constructivism is the sixth and final form of constructivism outlined by Geelan. Cobern (1993) is the leading influence of contextual constructivism. Geelan claimed Cobern concurred with Solomon's (1987) position of social influences on learning, however he departed from Solomon by signifying social interactions do not form the entire context of human cognition. Cobern (1993) alleged for learning to take place there should be a relationship between the "culture of science and the culture of the learner that must be explored and understood" (p. 19).

Geelan equated constructivism as representing a complex three-dimensional object where it could be viewed from several different perspectives and is not known until all perspectives have been sampled. Taylor's (1994a) use of metaphor, "constructivism is like an n-sided polyhedron whose faces represent forms of constructivism" (p. 22) provided a useful description of constructivism. Taylor proposed some faces are neighbouring and compatible whilst others are opposite and in tension but can still remain part of the whole. Geelan believed there is a usefulness and viability of all forms of constructivism that could be extended to include other epistemological perspectives.

The 11th paper in the literature review is by Peter Airasian and Mary Walsh. Airasian and Walsh, stressed in their paper *Constructivist Cautions* (1997), constructivism can be seductive and considerably more challenging than might be anticipated. The authors began their paper by asking probing questions:

> On what basis should students justify their constructions? Can teachers be an objective evaluator? What constitutes acceptable student constructions? The influence of the teacher in being able to control the nature of students' constructs. The nature of evaluation standards and criteria independent or dependent on context. The involvement and partnership or parents, teachers and students in developing standards and criteria for student constructs could be an answer to this dilemma. Placing teachers in the position of sole determiner of standards and criteria allows them to be the primary influence on the nature of classroom constructions (p. 444).

Airasian and Walsh conceptualised constructivism as an epistemology, a philosophical explanation about the nature of knowledge, which provided educators with only a descriptive model. The authors maintained constructivism is only a theoretical framework, which broadly explains human activity of knowing and offers teachers very little detail in the art of teaching.

The authors believed most constructivists foster interactions between students' existing knowledge and new experiences, which is different from the traditional transmission model. The authors also claimed that two important versions of constructivist theory are available regarding the process of cognition development and sociocultural. The more traditional constructivist framework as presented by Piaget, acknowledged the student as the meaning maker and their personal knowledge is the main goal of learning. Critics of the developmental theories of cognition argued we should take account of the cultural and political nature of schooling, the race, class and gender backgrounds of teachers and students that influence the type of meaning made within the classroom.

The second version of constructivism assumed a social context where the emphasis is on social construction of knowledge and rejected the individualistic orientation of Piagetian theory. Airasian and Walsh (1997) stipulated in the sociocultural context "knowledge is constructed by individual's interaction with a social milieu, which results in a change in both the individual and milieu" (p.445). In this version, knowledge has a social context and is not generated by an individual acting independently of his or her social context. Social and cultural influences therefore are the prime motivators for constructed knowledge.

Individual's social and cultural contexts differ; therefore peoples' understandings and meanings will be different. This conflict of theory between the two versions of constructivism can translate to a dichotomy of tension within classroom practice. Teachers face the dilemma of emphasis on individual versus social learning and the definition of successful instruction.

Constructivist theory also puts the onus more on the student to construct their personal meanings and interpretations in order to achieve understanding. In recent years, schools have become more autonomous, which assumed teachers are able to construct their own meanings and interpretations of what constitutes good classroom practice.

Another problem arising from using constructivism as a referent for teaching and learning is the issue of time. To establish strong student constructions, teachers need to listen, respond and teach often individually, which can be time consuming. Student learning often becomes the student's responsibility where teachers serve as initiators of activities. These activities need to stimulate student interests, which in turn can develop new constructions. Airasian and Walsh believed where teachers provide additional activities to match student interests the resulting constructs often become the teachers not the students. Finding a balance between teacher involvement, non-involvement, the type of content large amounts at a shallow level or smaller amounts in greater depth can be a learning challenge in itself. Constructivist theory however, would translate to the latter choice, where personal meaning and understanding are paramount, rather than shallow understandings, for example, rote learning.

If teachers accepted constructivism as a referent for their teaching practice, where individuals construct knowledge and that knowledge and experience are subjective, then truth and meaning are sometimes compromised. Teachers should decide on how much emphasis can be placed on viable and meaningful constructions. It would appear for students to construct their own meanings from personal experiences there could be many feasible constructions. The role of the teacher would therefore be to challenge students to justify and refine their constructions.

If knowledge is context-specific, then it follows using a common standard for evaluation purposes are reduced considerably. When evaluating constructions Airasian and Walsh (1997) suggested teachers, students and parents create standards and criteria collaboratively where they can be interpreted as being meaningful and therefore more effective. If the "teacher however, is the sole determiner of standards and criteria then they become the primary influence on classroom constructions" (p.449). Students often have difficulty constructing viable constructions on their own especially when using teacher created standards and criteria, thus compromising constructivism. The authors argued

a problem arises for teachers in finding an appropriate balance when guiding a clear evaluative process that allows for variance within their students.

Airasian and Walsh (1997) proposed there is a difference between the nuances and problems of a theory and its practical application as implementing constructivism can be more challenging than the constructivist rhetoric. The authors recognised the importance of constructivist viewpoints and the positive role constructivism plays in altering educational practice, however, there are important issues that need to be addressed before attempts are undertaken to implement constructivism into classroom settings. The issue of what constitutes better constructions than others, "the problem of guiding and evaluation students without undermining their constructivist activities" (p. 449) and the development of appropriate standards and criteria that has meaning, relevance and equal input.

Fogarty in his paper, *The Intelligence-Friendly Classroom* (1998) acknowledged there are intricacies and complexities that drive the teaching and learning process. Fogarty, however, believed a bridge could be forged between the rhetoric of theory and practice with the implementation of 8 specific guidelines, which have been derived from various theories of intelligence. These guidelines included, "a safe emotional climate, the creation of a rich learning environment, teach the mind tools and skills of life, develop the skilfulness of the learner, challenge through the experience of doing, target multiple dimensions of intelligence, transfer learning through reflection and balance assessment measures" (p. 10-11). Assumptions derived from Fogarty's intelligence-friendly classroom included, what it would mean? Look like? Sound like? And would you know one if you saw one? Fogarty believed we could visualise this type of classroom, as there is no enigma. The intelligence-friendly classroom draws on the creative minds of both the teacher and students. If educational practitioners adopted Fogarty's 8 guidelines as a way into constructivism then Airasian and Walsh's constructivist cautions would not be interpreted as alarmist.

Teachers need to translate the rhetoric of constructivism into classroom practice. The following chapter outlines how teachers can unpack constructivist rhetoric and make it visible and meaningful within the context of the classroom.

CHAPTER 6

TEACHER AS RESEARCHER

Airasian and Walsh's paper assumed a dilemma existed between the translation of constructivist epistemology theory and its application into the classroom environment. I believed constructivism could be made visible through students' engagement in various activity choices and the consequent transformations in their understandings. A critique of my planning methodology is therefore needed to ascertain whether constructivism is visible.

There can be various procedures teachers can utilise to indicate the visibility of constructivism within the classroom context. This can be done through, video analysis where colleagues are used as critiques, teaching demonstrations from exemplary practitioners, personal reflective journals, student teacher discussions about a lesson, teacher performance indicators, classroom observational scoring manuals, instructional rubric frameworks and questionnaires such as, the Constructivist Learning Environment Survey (CLES). I have utilised most of these procedures and therefore have engaged in critical constructivism, to disclose weaknesses in my pedagogy.

Kilbourn (1998) suggested the application of a family of principles that consist of, subject matter, student enjoyment, technique, morality and aesthetics can reveal constructivist ideals. The family groups and corresponding principles are assembled accordingly:

Family Group   Principles
Subject matter: (substance, rigour, saturation, significance
                                    and connection)
Student enjoyment: (results, ownership, appearance, and
                                    accomplishment)
Technique: (duration, momentum, timing, and closure)
Morality: (trust, sincerity and reasons)

Aesthetics: (situation, integration, and proportion)

In June 2001 as part of a professional learning session, I used Kilbourn's (1998) family of principles to critique a mathematics lesson in my Preparatory class, using videotape analysis. My professional learning colleagues viewed the videotape and provided feedback on whether Kilbourn's family of principles had been utilised during this lesson.

The mathematics lesson initially was done with the whole class and later students were divided into groups of two. The lesson consisted of oral counting in sequence to 20 using numeral cards, measurement and pattern. I used the counting sequence done earlier to link to measurement using unifix blocks as a standard measure. After the practised counting session students were split into groups of two. Each group of students was required to find objects in the class, which would weigh 2 or 4 unifix blocks. This allowed students to be inventive with their choice of object selection. One group found a plastic object, which weighed exactly 2 unifix blocks, whilst other groups found this task more challenging. Some students had problems locating any objects within the classroom weighing either 2 or 4 unifix blocks.

I felt the measurement task would extend students, as they were required to approximate the weight of objects and also engage in counting. During counting and numeral identification students were asked to demonstrate to the class by writing the numeral on a small white board. After a student completed the numeral, the class acknowledged if the numeral was correctly written. I would then proceed to model the correct way of writing the numeral if it was done incorrectly. Later in the lesson, patterning was also incorporated into the number sequence, such as 1, 2, 3, 1, 2, 3, 1, 2, 3….

After viewing the videotape, colleagues' discussions revealed a depth to the mathematics lesson, which I was not aware of whilst undertaking the lesson. Colleagues commented that I used, in the family group of subject matter, the principles of saturation and connection. In the family group of student enjoyment, colleagues suggested some ownership was witnessed, as students

were free to choose any object in the room that weighed either 2 or 4 unifix blocks. Finally in the family group of aesthetics, the principle of integration was witnessed, as counting linked to measurement and pattern.

I felt the lesson lacked content whereas my colleagues were more generous in their appraisals by stating; the intent of the lesson was evident in the counting sequence and identification of numerals. Colleagues suggested, however, I did not provide a purpose for the lesson to my students. The purpose of why they were doing number sequence. The purpose could have been articulated as a question to the students prior to the lesson, such as, 'why are we doing this?'

The feedback provided from my colleagues especially the inclusion of a purpose for an activity was a valuable insight. This also could extend into other subject areas and may enhance students' motivation to learn. Solicited rather than imposed ongoing collegial feedback, as demonstrated during this professional learning session, did provide valuable feedback to include in my pedagogy. I would further suggest for many teachers the exercise of critiquing a lesson would prove invaluable in refining imperfections in their pedagogies.

Demonstrations or visiting other schools to witness exemplary practitioners can be beneficial to inform teaching practice. Witnessing exemplary practitioners in action allows teachers an opportunity to apply a technique/s into a classroom context. Demonstrations also provide colleagues with valuable feedback on problems that could arise that are not always included in the literature. I have been in a position to demonstrate lessons and also offer feedback especially to student teachers who are still developing their pedagogy. The feedback provided to these student teachers allows them to improve, change or disregard teaching practices that are not always effective.

A daily reflective journal has been incorporated in my planning methodology for the past 15 years. The reflective journal forms part of my daily planning book. In this section I scribe details of student performance, behaviours, lesson imperfections or other incidentals, which form part of a teaching day. The provision for reflection can act as a stress release as well as documenting

details to be used for future reference to improve teaching practice. My reflective journal has been modified especially in recent years with the inclusion of headings to give direction to my thoughts. In 2005 a colleague who shared a Preparatory class with me, adopted my planning book format. Her reflections section, however, included a section for each student in the class. During the course of the week each student would have received a comment, which meant observations and record keeping became focused and routine.

The website http://learnweblharvard.edualps/refect/index.cfm (2005) outlined why teachers need to reflect; it stated:

> We draw conclusions everyday from our experiences. Are our conclusions reasonable and helpful to us as we plan future experiences? How can we know? Through reflection we can assess our conclusions, actions and work process itself to further our personal and professional development. (p. 1)

The website also outlined sets of questions that could direct teachers' reflective thoughts. Questions included:

1. How do I want students to interact in my classroom?
2. In what ways is it important for students to interact with the community in which they live?
3. What resources should be available to my students?
4. How can I use the wall space in my classroom to further active learning?
5. What was the most important thing I tried to teach my students this week?
6. What is/are the most important thing(s) my students will learn from me this year?
7. What did I learn from my students this week?

8. What was I thinking? (p. 2)

Teacher performance indicators can be used to critique practice. Performance indicators make judgements about performance using various criteria deemed pedagogically important. The criteria include lists of primary tasks that could be performed by teachers in the classroom. It could also be argued these criteria represent strong acts of constructivism. Performance indicators could be used as a referent to reflect constructivist ideals, especially tasks chosen at the outstanding level. These performance indicators have developed from pencil and paper teacher scoring sheets (1998) to computerised online school improvement review staff surveys (2005) where teachers have the opportunity to rate their school and their leaders according to various criteria. Computerised staff performance surveys list criterion statements from strongly disagree to strongly agree where criterion can be worded positively or negatively. Schools, which have high scores, are assumed to engage in high levels of democratic decision-making and thus be deemed constructivist. The results of online staff or leader performance surveys are usually forwarded to school leaders who attempt to improve deficiencies highlighted in these surveys.

The Hartz District Teacher Performance Indicators (1998) is an example of a performance indicator I have used. The criterion mentioned on page one of the performance indicator identified evidence of current knowledge of curriculum and teaching methodologies. Indicators that provide evidence of outstanding teacher performance included:

> Students are excited about being in this class.
> There is a wide repertoire of teaching strategies practised such as, co-operative learning, whole child focus, high quality of activities, individual instruction, incorporates information technology into all learning areas as appropriate, develops and successfully implements individual learning plans.
> Creates a stimulating learning environment
> Provides regular feedback to students (p. 1).

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Comparable to teacher performance indicators are classroom observation scoring manuals. The Queensland Education of Department (1997-2001) produced; The Queensland Scoring Manual. This scoring manual was a longitudinal study for school reform where each standard of practice or dimension gave a statement and a rating from 1-5. Some dimensions included, students' direction, knowledge integration, cultural knowledge and depth of knowledge and understanding. In the scoring categories the 4th and 5th rating assumed a constructivist agenda. The 4th and 5th rating stated:

4th Rating: Some deliberation/negotiation between teacher and students over the activity for the period, including the range of options and procedures.

5th Rating: Students' determination of their activity is appropriateness and context. This may be either independent of, or dependent on teacher regulation (p. 2).

A problem when using these manuals as a referent is of ownership. Airasian and Walsh (1997) discussed a similar dilemma in the design of student based standards and criteria. The authors believed a more desirable outcome is achieved when the stakeholders have ownership. In most instances, departmental bureaucrats have designed these documents using a theoretic framework. Questions often arise when using these manuals to inform practice; do stakeholders have an input into their design? Are these manuals manageable in a classroom context? Would teachers use this information regularly?

An assessment tool has been recently introduced within the Tasmanian Education Department, referred to as, the rubric framework. This framework has been used to inform students or it could be utilised to inform a teacher's practice.

The rubric framework consists of short descriptive statements along a continuum of excellence and listed vertically are criterion developed either by

students or teachers. Students or teachers could instantly see which degree of excellence represented their chosen study. *The Planning, Learning Sequences* (2004) booklet (p. 18) provided a model for teacher planning. A snapshot of the planning rubric framework consisted of:

Criteria	Misses developing deep understanding	Identifies some opportunities for deep understanding	Positively builds understanding
Throughlines	The througlines are not relevant to the school's design plan for the Essential Learnings and concepts are not incorporated.	The throughlines do not clearly include concepts or they do not clearly reflect the Essential Learnings design plan for the school.	The throughlines clearly incorporate concepts and link to the school's design plan for the Essential Learnings.
Generative Topic	The topic is popular with either students or teachers but not significant within an Essential Learnings framework.	The topic is not clearly significant to the Essential Learnings or disciplined inquiry, and may suggest a thematic rather than an inquiry approach.	The generative topic focuses on a significant issue, concept or idea and is central to one or more of the disciplines.

The Planning, Learning Sequences (2004) booklet and accompanying CD-rom have promoted the use of a learning sequence planning rubrics as a reference for teachers to assess their own understanding of learning sequence design. The criteria used in the booklet included:

Throughlines, generative topic, focus and supporting Essentials and standard, understanding goals, learning sequence, pedagogy of inquiry, conceptual understanding, ongoing assessment, culminating performance and assessment, inclusive (cultural including Aboriginal, gender, age, ability, circumstances, etc) and resources (pp. 18-19).

Reflective pedagogy is another method to make visible elements of our pedagogy. It requires time and effort to document details of how lessons have transpired. The Essential Learnings have encouraged the use of reflective practice, which has the potential to create change. For some teachers the inclusion of reflective practice can be daunting especially if changes need to be implemented. *Ed.Lines* (2005) a union publication reported, "the last 18 months have seen unprecedented levels of change and increased demands on teachers and teacher workloads" (p. 8).

An effective instrument to make visible constructivism in the classroom environment is through the Constructivist Learning Environments Survey (CLES). The following chapter details the use of this survey as a referent to transform pedagogy to match constructivist ideals.

CHAPTER 7

CONSTRUCTIVIST LEARNING ENVIRONMENTS SURVEY (CLES)

The *Constructivist Learning Environment Survey (CLES)* (Taylor, Dawson, & Fraser 1995; Taylor, Fraser, & Fisher 1997) was developed to assist researchers and teachers to ascertain constructivism epistemology in their classroom environments. The *CLES* also "assists teachers to reflect on their epistemological assumptions and reshape their teaching practice" (p. 535). Fraser and Tobin (1991) believed combining qualitative methods such as, reflective annotations and quantitative methods using the CLES, provided valuable insights into teachers' pedagogy, perceived from the students' viewpoint. In an attempt to ascertain whether constructivism had been practised, from a student's perspective, I included the CLES in two studies, one study in 2000 and another in 2003.

The original version of the CLES (Taylor & Fraser, 1991) was developed essentially on a psychosocial perspective that focused on students as co-constructors of knowledge. This provided teachers with insights into classroom learning such as, students' prior knowledge in their development of conceptual understandings and the need to be reflective in the negotiation of meaning. The original version, however, lacked consideration for the cultural context embodied within the classroom environment and showed only a weak program of constructivist reform.

The original CLES, Taylor and Fraser (1991) was guided by 4 criteria. These consisted of; conceptual foundations as consistent in the literature, personalised response format where students indicated their own perceptions of their classroom experiences, economy of use as the CLES can be undertaken in a relatively short time and salience to researchers, teachers, and students.

In the original version of Taylor and Fraser's (1991) CLES, there were 58 items with scales ranging from 9 to 20 items. Due to extensive field-testing that involved, 12 secondary schools, 508 students in 26 science and mathematics classes a more economical and refined version of the CLES was developed. The revised CLES introduced in 1994 also incorporated important parameters of constructivism as reflected in critical theory perceptions. Critical constructivism valued self-knowledge and provided a way to communicate openly and profoundly, which fostered understanding. Geelan (1997) believed critical constructivism was "the process of teaching and learning that was socially constructed, and that certain socially developed repressive myths such as, cold reason and hard control can lead to the failure of constructivist reforms" (p. 19).

Taylor et al (1997) revealed early versions of the revised CLES were trailed with small-scale qualitative studies in two classroom-based collaborative research projects. These studies provided an insight into the conceptual soundness and psychometric structure of the CLES and determined whether students made sense of the questionnaire. Some anomalies, however, were noted during the trailing process such as, learning activities and the wording in some items. In one mathematics class the activities did not reflect directly to the world outside the school. This correlated to a lack of relevance to students undertaking these activities. Another problem was the positive and negative wording of some items where some negative-worded items confused students. The arrangement of the items into a cyclic order, as found in traditional approaches to questionnaires, was thought to make the agenda invisible to the respondents. It was discovered, however, the presentation of items did not affect the respondents' sense of meaningfulness. The authors concluded that more reliable responses could be obtained if the CLES focused on students' interests and made the responding process a more meaningful activity.

Communication between teacher and student became an important goal in the development of the revised CLES. Research by Habermas, (1972, 1984), indicated open discourse between student and teacher provided a better

understanding of concepts and respected the meaning perspectives of others. Important changes were made to the content and format to the revised CLES by rejecting items of a complex nature and decreasing negative items.

The revised CLES now contained 30 items altogether with 6 items for each scale. The 5 scales of, Personal Relevance, Shared Control, Critical Voice, Student Negotiation and Uncertainty, represented the key dimensions of critical constructivism. The revised questionnaire enabled teacher researchers to obtain measures of students' perceptions in these key dimensions of critical constructivism. Each item had a 5-point scale response with alternatives of never, seldom, sometimes, often and very often, where scoring was reversed for approximately half the items. A synopsis of the 5 key scales of the revised 1994 CLES included:

Personal Relevance: Indicated how school experiences in science and mathematics are relevant to out-of-school experiences.

Shared Control: Specified how students share with teachers the design and management of learning activities, assessment criteria and social norms of the classroom.

Critical Voice: Ascertained whether students feel it legitimate and beneficial to question the teacher's pedagogy.

Student Negotiation: Determined opportunities for students to explain and justify their ideas and to test the viability of their own and other students' ideas.

Uncertainty: Ascertained opportunities for students to experience science or mathematical knowledge and how it was culturally and socially determined. (Taylor et al., 1997)

The revised 1994 CLES developed two versions, *preferred* and *actual*. The preferred version commenced each item statement with the words, '*in this class I wish that*' followed by a descriptive constructivist statement. A statement included; "*in this class I wish that*… followed by, *I could learn things at home about the world*". The actual version, however, specified what actually happened in the classroom.

In the first instance the preferred version of the CLES would be given to a designated group of students. The results of the preferred version are used to assist the teacher researcher to implement constructivist ideals into their practice as referenced in the preferred CLES. At a later date the actual CLES would be given to the same group of students to determine whether these constructivist ideals have been realised. If these constructivist ideals had not been included, then it would be the intention of the teacher researcher to implement a change in pedagogy to match these constructivist ideals.

The revised 1994 CLES has continued to be modified in various educational settings to address the needs of a particular group of students. In Johnson's 2000 study of beginning teachers, teaching in K-12 schools in the U.S.A., the CLES, interviews and observations were used to map their teaching progress. Johnson mentioned the CLES was used to "get a sense of the perceptions of both teachers and their students" (p. 2). The CLES was administered to a variety of participants. Participants included, in-service and pre-service elementary and secondary science-mathematics teachers, and elementary and secondary science- mathematics students. The participants also responded to items, which were deemed difficult and misleading. "The result was a more economical form of the CLES, which contained 20 items, 4 items each in 5 scales, depending on the researcher. Some items were eliminated due to confusion and some items were rewritten to ensure that different aspects of each scale's construct were addressed" (p. 7).

The revised 1994 CLES used a 5-point scale response of, never, seldom, sometimes, often and very often. A modification of this response was done in both my 2000 and 2003 studies. In the 2000 study involving students aged 9 years, I felt this presented too many options and consequently narrowed the 5-point response to a 3-point response. The responses included, never, sometimes and always. In the 2003 study students were aged between 6-7 years. In this study the responses became a series of faces, a sad face, depicting no, a straight face, depicting sometimes and a happy face, depicting yes.

The revised 1994 CLES was designed for science students and therefore some items; items 7, 8, 9, 10, 11, and 12 referenced the word, science. In my early childhood classes I rarely use the word science, but use the generic term of, class-work. In the 2000 study I reworded items, which referenced science and used the words class-work. Other items in the revised 2000 version remained in congruence with the 1994 revised CLES.

In the year 2000 after students completed my preferred version of the CLES, 53% of students noted ambiguities in items 1-9. Items 10-30 were understood better as the language related to previous experiences. Approximately one month later the same group of 9-year-old students did the actual CLES. On this occasion their understandings had improved. Confusions were noted with only 17% of students for the same group of items. The sentences, "*understanding the world outside of school*", "*how to solve problems outside of the school*" and "*learning interesting things about the world outside of the school*" (p. 1) were ambiguous. On items 7 and 8 approximately 39% of students had problems understanding the concept of "*class-work not providing perfect answers*" and "*class-work changing over time*"(p. 1). When the CLES was reintroduced in 2003 to a younger cohort of students, I needed to significantly modify the wording of the revised CLES to match their level of understanding. A summary of word changes included:

My 2000 Version   My 2003 Version

Learning about the world

1. I learn things about the world outside of school.   I learn things at home

2. My new learning starts with problems   I can work things
about the world outside of school.   out at home.

3. I learn how class-work can be part of   I can do reading,
my out-of-school life.   writing and other
                                                        school work at
                                                        home.

4. I get a better understanding of the outside of school.	At home I learn world about the world.
5. I learn interesting things about the world outside of school.	The things I learn at homel are interesting.
6. What I learn has nothing to do with my out-of-school life.	What I learn at school I can also do at home.

The 6th item of the revised 1994 version has been negatively worded whereas I retained the same positive wording to reduce confusion. I also retained the same 5 scales as listed in the revised 1994 CLES. I also included 6 items per scale making a total of 30 items for the whole questionnaire. On reflection in the 2003 study with younger students, items should have been reduced to 3 items per scale. This would have given a total of 15 items, and therefore limited the time taken to complete the survey. Most students in the 2003 study needed 2 to 3 sittings before they completed the survey.

The rigorous validation procedures undertaken with the original and revised versions of the CLES were not necessary in my own research study as the information would only be relevant to myself and guide my own teaching practice towards a more inclusive constructivist epistemology.

In September 2003, one year prior to the introduction of the Tasmanian Education Department's Planning Learning Sequence Rubric, I developed a teacher self-assessment rubric. In the teacher self-assessment rubric the key constructivist dimensions, as outlined in the Constructivist Learning Environment Survey (CLES), were used. The modified CLES teacher self-assessment rubric would allow the teacher researcher to give a rating of 1 (never) to 5 (always) at the completion of a lesson to indicate degrees of constructivism used. The teacher self-assessment rubric using the key dimensions of constructivism, included:

Criteria	Rating: 1 never - 5 always
Personal Relevance Connectedness of schoolwork with students' out of school experience. Students' everyday experiences being meaningful	
Uncertainty Opportunities: for inquiry, past experiences which make sense.	
Critical Voice Establishment of social climate: students able to ask questions. Question teacher pedagogy, concerns about impediments to their learning.	
Shared Control Share control with the teacher. Include students in articulating their own learning goals. Design and management of their learning activities. Designing and applying assessment criteria.	
Student Negotiation Students justify and explain to others their ideas. Listen and reflect on other students' ideas and reflect self-critically on their own ideas.	

Teachers giving themselves low ratings for a dimension would indicate improvements should be implemented in their practice to incorporate constructivism. The use of self-assessment tools such as, the Planning Learning Sequence or the teacher self-assessment CLES rubric could be more valuable to teachers than the laborious note taking of a reflective journal. Teachers would be given instant feedback where new directions should be undertaken in their practice to reflect constructivist ideals.

In the 2000 and 2003 research studies the CLES was used to gauge a constructivism reform agenda in my classroom practice. The subsequent chapter details these research studies and the utilisation of the CLES.

CHAPTER 8

RESEARCH STUDIES (2000 and 2003)

Procedure for Introducing the CLES

In the 2000 study each item of the CLES was dictated to the whole class. Articulating each item meant every student received the same information and it was not dependent on student literacy skill levels. Unfortunately I was not able to witness each student's response and when the survey was assessed later some students marked more than one response. These students were later questioned about their responses and corrections were made.

To avoid this problem re-occurring in 2003 I took small groups of 3-4 students aside and read each item and explained any anomalies students would experience. The survey was done in the morning before class instruction commenced to minimise classroom disruption. Reading through each item was necessary, as the literacy skills for this age cohort had not yet developed sufficiently for them to read or understand the items. Isolating small groups meant that some group members were able to witness how others were scoring and often scored similarly.

The introduction of the preferred and actual CLES was an important component in the research methodology. Timing related to the age cohort of the students and the intended introduction of environment units of study. In 2000 the preferred CLES was dictated at the commencement of the school year in week 4. I felt these older students would understand the configuration of a survey as their literacy and comprehension skills had developed sufficiently by week 4. The preferred CLES in the 2003 study, however, was introduced in week 11 as literacy and comprehension skills were still developing.

My teaching contact time also had altered between the years 2000 and 2003. In 2000 I was the sole classroom teacher and therefore managed classroom

procedures entirely. This allowed me to implement a constructivist reform agenda when appropriate. In 2003 my class time had been halved. The other half of my teaching load was devoted to training and teaching in the *Reading Recovery* program. In the Reading Recovery program, instruction was done on a one to one basis where each student received a 30-minute lesson of intensive literacy tuition. In the Reading Recovery program I had 4 Grade-1 students, which meant that 2 hours per day was devoted to this program.

Dividing my time between the Reading Recovery program and as a classroom teacher was very challenging, especially meshing my teaching practice with another teacher, whose practice was different to my own. In 2003 when students completed the preferred and actual CLES, their perceptions of what happened in the classroom wavered between the second teacher and myself. The constructivist reforms, which I intended to implement, were not as strongly enforced, as I tended to compromise my teaching practice. My intentions were not to overly confuse the students with totally dissimilar teaching practices, especially as I would be sharing the class for part of each. By compromising my pedagogy accordingly caused a great deal of stress during 2003.

The 2000 Study

The first detailed research study occurred in 2000 with a Grade 3 class involving 28 students aged between 8-9 years. Students came mostly from an affluent semi-rural to rural background. The school also reflected affluence with the addition of new larger brick classrooms that included a shared open wet area for art activities. A shared office space was also provided where interaction between teachers could occur. This shared configuration was conducive for teachers and classes to engage in collaborative planning, behaviour management and have a common understanding of class and school routines. These new classrooms were equipped with new carpets, 3 computers and an assortment of games and puzzles to enhance learning. The configuration of the school was predominantly divided into sections of two

classroom blocks. In each school block, the classrooms consisted of students of similar age and student numbers. In the block I occupied, I had a Grade 3 and the other class was a Grade 3-4.

The research study commenced at the start of the school year in late February 2000. The research study involved a unit of work titled, '*Safety in the Sun*'.or *Sun Safety*. The unit had relevance to the whole school policy of sun safety and therefore reflected important health and environmental issues. The unit also included a collaborative planning process involving the Grade 3-4 teacher. Collaborative planning occurred prior to the commencement of the school year in mid February 2000. In 2000 neither the school nor the state education department had endorsed a collaborative planning process as a preferred planning option. The process of collaboration therefore occurred in our own time and was not provided for in the school timetable.

Our collaborative planning integrated key aspects of the CLES, such as, having personal relevance, how to solve problems outside of school, learning about the world outside of school and learning about people from different countries. Important aspects in the unit were covered over a 7-week period culminating in a major assembly presentation where students shared their information about sun safety. The unit however, did continue for a further three weeks following the assembly presentation.

My individual planning followed the *Science Teaching and Learning Planning Guide* (1995), developed by the Department of Education and the Arts, Tasmania, whereas my colleague teacher had her own planning methodology. The learning cycle outlined in the guide followed closely a constructivist model of knowledge and understanding building. The four stages built onto previous stages and included, engaging, refining-input, extending students' ideas and reflecting.

My planning included three aims, 1) For students to be able to show that the sun is unsafe in the hotter seasons. 2) To encourage students to use safe practices in the sun. 3) For students to be able to identify skin types, eye and

hair colour that can contribute to skin cancer. During the initial collaborative planning period we perused the unit plan. This would show how we could develop understandings about our skin, how to care for our skin, what is skin cancer and the inclusion of guest speakers from the Cancer Council to speak about skin cancer and skin care.

Using the Science Curriculum Teaching and Learning Planning Guide as a reference, the engaging stage of my planning included tasks such as, discussions about the sun's harmful rays, the effects of too much sun on our skin, first aid procedures for sunburn, basic safety whilst outside, recognising behaviour which encourages sun safe practices and school rules designed to keep us safe in the sun.

After discussions with my colleague teacher, we decided to initially engage in the topic using brainstorming and videos available through the Tasmanian State Library Media Collection and the Tasmanian Cancer Council. My colleague teacher had negotiated to have a guest speaker from the Cancer Council to speak to our classes about sun safety issues. The guest speaker also suggested a book to be read to the students to tune into the activity.

The second part or refining or input stage of my planning included tasks such as, an experiment to show the effect of the sun on butcher's paper, summaries of sun safe practices, paintings and drawings about sun safety and an exploration of student questions. My colleague teacher also suggested an experiment using cut fruit to show the effects of the sun on exposed fruit.

The third stage or extending students' ideas included, a technology challenge where students invented a device that would keep them safe in the sun. Students would also research sunscreen brands; types of skin damage and identify sun safety procedures associated with outdoor work. Both my colleague teacher and myself were not able to generate any further ideas during this stage of our planning.

The fourth stage or reflecting consisted of, poster designs on how to be sun safe, dramas of sun safe practices, advertisements describing a new sun screen, and a presentation of information at a whole school assembly. In consultation with my colleague teacher, we decided to include a further brainstorming session in the reflecting stage to ascertain any improvements in student understanding about sun safety. My colleague teacher also included a brochure design on sun safe practices in this stage for her own class.

These discussions and subsequent alterations to my original plan followed closely the description of the Lewinian spiral in action research projects. Kemmis and McTaggart (1998), described action research as:

> A form of collective self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of these practices and the situations in which these practices are carried out. The approach is only action research when it is collaborative, though it is important to realise that the action research of the group is achieved through the critically examined action of individual group members (p. 5).

On day one of the school year, the Grade 3 students were given a class newsletter, which outlined various requirements for 2000. These requirements included, the school's policy of sun safety, which required students to wear hats during term one and an outline of my research project. Attached to the research project outline was a parent permission slip for parents to sign.

Description of the Unit: Safety in the Sun

In the second week of the 2000 school year, in late February, the whole class commenced the unit by brainstorming what they knew about the sun and our skin. This session took approximately 20 minutes with 14 understandings

scribed on paper. Some of the more pertinent understandings included, "*the sun is strongest between 11 am and 3 pm, the sun can cause skin cancer, the sun is deadly, heat can cause muscle melt down, the sun is a giant star, the sun can dehydrate us, looking at the sun makes us blind, skin peels, the sun can help us by making vitamin D and it can cause moles and freckles*". These understandings indicated that the students already had acquired some important concepts about the sun and our skin.

Following the brainstorming session students individually wrote in their workbooks what they knew about sun safety. The written task gave an account of each student's understandings about the topic rather than the whole class perspective given during the class brainstorming session. Three students' work samples were collected with varying degrees of academic ability and understandings about sun safety. These students have been given fictitious names to conceal their identity. The first student referred to as Rose, is the middle child in a family of three girls. Rose usually performs at class average. Her understandings included:

> *You can get skin cancer. The sun is strongest between 11.00 and 3.00. You can get moles and muscle meltdown. You can get brown and you can peel sometimes. The sun is deadly. It can burn things from far away. You can get dehydrated and you can get sun burnt in the water too. You can get waterproof sun block.*

The second student, referred to as Elizabeth, lives on a farm and her parents are egg producers. Elizabeth's mother regularly visits the school and takes an active interest in Elizabeth's education by helping with the class reading program and LOTE (languages other than English). Elizabeth usually performs above class average. Elizabeth's understandings included:

> *You can get muscle meltdown and skin cancer. The sun is strongest between 11.00 and 3.00. You can get moles. The sun is deadly and burns are of different degrees. Some people go brown. Some people when they are hot get cold ears. You can get dehydrated.*

The third student referred to as Erin, is the eldest of two siblings. Erin puts in maximum effort into her schoolwork however, she finds class work challenging. Academically Erin performs below class average. Erin's understandings about sun safety included:

The sun can make you have moles, which are little brown dots on your skin. If you have too much you might get skin cancer. If you have too many you have to go to hospital and get them removed.

These written interpretations from three female students suggested that they remembered some information from the brainstorming session done prior to the written task. One piece of information gained before the introduction of the unit came from a television news item that mentioned a baby who had been left in a car on a very hot day. The baby consequently died due to muscle meltdown. Some students in the class had remembered this news item and linked that information into their knowledge about safety in the sun.

An extensive discussion occurred the next day, following a poster display and booklet reading. The poster published by the Tasmania Cancer Committee titled, *Spot the Difference* (1993) and a booklet titled, *Skin Cancer and You* (1989) showed graphic photographs of skin damage due to sun exposure. The poster, book graphics and discussions appeared to have a shock effect on these students. Comments recorded during this time included, *'I'd hate to have that'*, and *'they look awful'*. During the discussions our school's grounds person made an unexpected visit into our classroom. Our grounds person had a mole removed from his back as a result of excessive sun exposure during his youth. The removal of the mole had produced a large visible scar, which was shown to the students. The groundsperson reiterated the message about being safe in the sun as he had not taken care of his skin and consequently had to have this large mole removed.

A series of videos were shown at the end of the same week. The videos included, *Safe Sun, Safe Skin* (1989) 42 minutes and *Your Skin and the Sun* (1988) 13 minutes. The videos gave students additional information regarding

sunscreens and their sun protection factor (SPF) numbers, skin cancer types for example melanomas, moles and freckles, the ozone layer, the heat produced by the sun due to explosive gases resembling atomic bombs, eye, skin and hair colour and how these factors can be linked to contracting skin cancer. Following the viewing of the videos extensive discussions occurred that allowed students to unpack questions and further their understanding on aspects of the videos. The issue of skin, eye and hair colour raised in the videos also directly correlated to students in this Grade 3 as 68% of the students had fair skin with blue, green or grey coloured eyes. All students were therefore at risk of contracting some type of skin cancer later in their lives if protective measures were not taken during these formative years. It was therefore imperative that the information about being sun safe had an impact on these students at this stage of their development.

At the commencement of week 3, I decided to change my class routine. A list of activity choices were attached to the class white board for students to undertake after 11.00 am. Prior to the change, students did not have a choice of activity due to the establishment of basic classroom routines. Basic classroom routines consisted of, packing up times, monitor jobs, keeping the room tidy, labelling and how to use the various assigned exercise books, standards in work presentation and expectations. Students also needed to select activities from the activity choices to undertake. Activity choices included, recording information on one of our three class computers about sun safety, story writing, painting a sun safe picture, reading from the class readers, spelling and spelling games, the technology challenge of designing and making a sun safe device, mathematical games, and jigsaw puzzles.

After a trial period of one day it became evident students had too many choices, some students became confused and many activities were not completed. I decided therefore to split the activities into two separate sessions. The first session began at 11.00 am and went until 12.30 pm and the second session commenced at 1.30 pm and went until 2.45. After 11.00 am students commenced activities related to improving literacy skills such as, spelling and reading. After 1.30 pm, activities related specifically to the unit of study,

'safety in the sun'. Activities integrated a range of curriculum areas such as, information technology, designing and making technology, paintings and posters (visual arts). The revised program with a split in activity choices, between morning and afternoon sessions, allowed students to complete most activities with less confusion.

In technology students were asked to design and make a device that would keep them safe from the sun. Students needed to be shown via teacher modelling, how to write a procedural text before commencing. During the teacher modelling session it was emphasised their device should include parts on it to protect them from the sun. The procedural text required students to list the materials required, step-by-step instructions on how to make their device and a diagram on how it would look when it was completed. After their device was completed students were then asked to write an appraisal on how it went including modifications made on the device during its construction.

Painting and poster designs were also added as activity choices during this week. Students were asked to paint what they knew about sun safety. Teacher modelling was also done for this painting activity. It was important to demonstrate to students the correct procedure for using art materials for example paint quantities, mixing paint, students' name on artwork and cleaning up procedures. Many students undertaking this activity in the first instance unfortunately reproduced the painting I did. To alleviate this copying problem, students were asked to peer assess these paintings. The peer assessment indicated that the copied paintings lacked individuality and looked similar to my painting. Future groups of student did express their own creativity and understandings in their paintings.

On Thursday of week 3 we had a representative from the Cancer Council to speak to both classes about being sun safe. Photographs depicting animals with skin cancer were shown during this discussion. The information presented by the guest speaker had an impact on these students, as skin cancer now involved animals and not just humans. An 8-minute animation video called *Skin* (1985) available from the Cancer Council was shown during the guest speaker's visit.

The guest speaker also provided the class with a copy of a book titled, *What's Wrong with Casey's Cat* (1997) by Purcell to read and discussed.

Wednesday of week 4 the school scheduled all classes to be involved in a parent information session. During my parent information session I mentioned to the parents our sun safe unit and also that our school could no longer offer the L.O.T.E. (languages other than English) program to students due to funding cuts. Parents at this meeting suggested we use the expertise of two of our Grade 3 parents to give students some basic understandings about their countries. One parent was from Germany and the other from France. The inclusion of a personalised L.O.T.E. program that focused on these countries addressed the CLES dimension of, "*we learn about people from different countries*". The sun safety unit was now linked to the L.O.T.E. program where students could relate problems about sun safety in Tasmania to France and Germany.

During week 4, What's Wrong with Casey's Cat was read and discussed. Casey the child in the story had a white cat that contracted a skin cancer on its ear. Casey consequently took her cat to the vet to be treated. Students became connected to the text especially as most of them had pets and had deep feelings for them. Also during week 4 students continued with their technology challenge of creating a sun safe device, paintings, posters and were also introduced to story writing. The students' story writing needed to involve characters that became sunburnt and consequently received medical attention. Story writing needed to comply with editing conventions, which included, a plan of the story, a beginning, a middle and end.

To ascertain whether constructivism was a characteristic of my teaching practice I incorporated the preferred Constructivist Learning Environment Survey (CLES) on Friday morning, week 4. I presented the survey to my students orally item by item. This allowed the less literate students the opportunity to understand the language in the questionnaire and therefore their answers would represent a more accurate interpretation of the survey.

I had modified the preferred CLES by excluding the word science and replacing it with the words, class work. Another modification I included in the preferred CLES was to limit the number of responses to 3 rather than 5, which existed in the original preferred CLES. The three responses included, never, sometimes and always. Limiting the responses to three meant less confusion for these young students. A teacher assistant gave the modified preferred CLES orally to two special needs students who worked with her individually. These particular students required a more personalised approach to match their individual needs such as, repeating items or explaining an item in another way.

During weeks 5, 6 and 7, students completed the sun safe device in technology, story writing, word processing on the computer, paintings and posters. Incidental discussions continued during this time about sun protection, first aid procedures for sunburn and the problems of excessive sun exposure.

During week 6 a new unit of study was introduced which required students to observe moon phases. The school science curriculum outlined areas of study for each grade sector and for Grade 3 a study about moon phases was included as part of that curriculum. I felt introducing this unit to coincide with the equinox leading to Easter would be a befitting time for this study to commence. Unfortunately students were now confronted with two different units of study, completing the unit on sun safety and the introduction of moon phases.

In week 7 our Grade 3 students were required to host and present at the next whole school assembly. In this school an assembly roster had been issued whereby each class was required to host. It was traditional for the hosting class to also incorporate a special presentation as part of the hosting procedure. Our Grade 3 students decided to display their understandings about sun safety. This presentation was a culmination of all the work compiled by the students during the past 6 weeks. Students chose their own work samples and information for this assembly. Information discussed at the assembly would demonstrate their understanding of the topic.

At the beginning of week 8 students rehearsed their assembly information both in the classroom and at home. Some modifications were necessary as some students' information was too lengthy and therefore required editing to conform to time constraints. The assembly took place in the school hall on Wednesday of week 8. The school student population of 350 along with interested parents and friends witnessed our presentation. Our presentation on sun safety took approximately 10 minutes to complete and was very well received by the student and parent body. At the completion of the assembly, prior to the lunch break, our students had a short debriefing session. During this debriefing students made comments related to their particular item such as, remembering the details of their presentation, having a loud voice and not being nervous. Parents who joined the class after the assembly were praiseworthy of our students' efforts. They were also pleased their particular child remembered what to say as they had practised their information as a homework task.

In week 9 a second brainstorming session took commenced to ascertain students' new understandings of the topic. During this brainstorming session I again scribed students' understandings on paper. The second brainstorming included similar information to the first brainstorming session, however, there emerged some new understandings. The second brainstorming included the following understandings:

There is an ozone layer which helps block the sun's rays. People with red hair are more likely to get sun burnt. The sun is made of gas and it is like atomic bombs going off. Slip on a tee shirt, slap on a hat, slop on sunscreen. A sunspot is a cooler part of the sun. If you get burnt on the ears or back of the neck you could get cancer. The core of the sun is the hottest part of the sun. We have natural protection when our skin goes brown. If you want tanned skin you will also get sunburnt. People with brown skin have more protection than people with white skin. Sun reflects off the water. It is best to put fifteen plus or more sunscreen on. The force of gravity on the sun is very high and you could get squashed.

In addition to the second whole class brainstorming students were asked to write in their workbooks what they now knew about safety in the sun. This task allowed me to gauge whether students' had acquired further understandings of the topic from their first writing. Rose's new understandings included:

Dogs and cats can get sun burnt too just like us. When you think that there is not much sun you should still put sunscreen on. Freckles can turn into moles so watch your freckles they might turn into moles. The ozone layer helps us not get sun burnt. Tasmania does not have very much ozone layer. The sun is like lots of nuclear bombs, if you went near a nuclear bomb your skin might fall off but only sometimes. Thirty plus sun block is the best sun cream you can get from shops. If you are going to the swimming pool you should wear waterproof sun cream but if you don't put sun block on and if it is not waterproof then when you come out of the pool put more on.

Elizabeth's new understanding about sun safety included:

Protect yourself with sunscreen. Freckles can turn into skin cancer and check your skin daily for moles. Skin cancer is caused by one bad cell then it destroys all of the healthy cells. The ozone layer is gas that stops the sun from going to earth. Dogs can get sunburnt too so can all other pets like cats, rats and birds. People can't get wrinkles because of old age it's because they have been in the sun for too long. The heat on the sun is caused like nuclear bombs like what happened in Japan. The sun can make you blind. There hardly is any ozone layer over Tasmania because of other countries sending gas up to us. People with brown eyes are more protected than blue-eyed people.

Erin's new understanding about sun safety included:

Don't stay outside too long. Dogs and cats can get skin cancer on the nose and ears, which are the main parts. If they are white then they can get skin cancer very badly like people if they have blue eyes they can get skin cancer. If you have orange hair and freckles you can get cancer.

A common theme for these students' was the reference to animals also getting skin cancer. This understanding can be linked to the reading of What's Wrong with Casey's Cat and subsequent discussions. It appeared a book and discussions had an impact on what these students' remembered and understood. The first two students also included a reference to the ozone layer, skin type and sun properties. It appears with these students their understandings were most strongly linked to books, videos and discussions. Understandings promoted through other work products such as, paintings, construction technology, story writing or science experiments, was mentioned. In future writing sessions it would be interesting to gauge which activities impacted most on students' understandings. For these particular students, books, discussions which included a guest speaker and videos were the predominate source for retention of information.

Another method of assessment at the conclusion of the unit could have been through reflective questioning. Unfortunately this was largely ignored in 2000. Questions could have been asked by my colleague teacher or myself such as, did the activities presented to these students constitute effective constructivist ideals? Alternatively had the students been presented with different activities would they have developed a deeper understanding of the unit. The main assessment tools used to ascertain the effectiveness of student constructions included, brainstorming and written information. These activities provided the colleague teacher and myself with insights into their understandings of sun safety.

On Friday of week 9 at the conclusion of the unit, Safety in the Sun, the actual modified CLES was given to the same group of students. I presented the questionnaire orally as occurred with the preferred CLES. On this occasion students were more familiar with the format and language of the questionnaire and therefore less confusion occurred on certain items.

The 2003 Study

A subsequent study occurred in 2003 with a younger cohort of students. Students in this study were aged between 6-8 years and were in a Grade 1-2 class. The 2003 study occurred in a different school to the 2000 study. The 2003 school is located in a semi-rural, to rural area similar to the 2000 school, however it is further from the city of Hobart. Students in the 2003 study came from mixed backgrounds of rural to urban environments similar to the previous study. In the 2003 study 30% of the students came from one-parent families and 73% were on welfare assistance. Parent participation in school functions and interest in their child's learning did not match that of the previous school. For example during the parent information session in 2003 no parents attended our session. In the previous school approximately half the students' parents came to a similar information session. Parent participation within the classroom also was less than in the previous school.

The 2003 school had undergone a major refurbishment in 1995 whereby 10 new classrooms and a library complex were added to the original school. Each of the new classrooms consisted of an outside timber decking where students could engage in art and craft activities and eat. These new classrooms overlooked a rural setting of pastures and a wetlands area. Classrooms were linked with a common quiet room for student group interactions. This resembled the structure in the 2000 study, as those classrooms also shared a common wet area. The classrooms could also be expanded into one large classroom by removing a partitioning wall, however, this was rarely done as most teachers preferred to teach in isolation.

In the 2000 school it was not an expectation for teachers to engage in a collaborative planning process. The collaborative planning process however was utilised, which brought depth, new ideas and activity choices, such as, the inclusion of a guest speaker into our planning. In 2003 collaborative planning had become mandated in my new school. Collaboration allowed teachers to engage in different planning group options such as, same grades, colleagues sharing similar philosophies, or colleagues who worked in close proximity.

For the 2003 study my collaborative planning team consisted of, a Grade 1-2 teacher located in the adjoining classroom and my colleague teacher who shared the same class as myself. The teacher from the adjoining classroom suggested the topic of, *Waste and Recycling* for the two classes to collaborative plan together.

In 2002 and 2003 I was a member of the school's Essential Learnings Management Team. In this role I had undertaken additional professional development sessions that provided an understanding of the key planning references and methodologies contained within these references. I felt my prior understandings of the Essential Learnings combined with my affinity to environmental studies would equip me as a valued member to this planning team.

Our first collaborative planning meeting occurred prior to the Easter holiday period in mid April 2003 during a school timetabled collaborative planning time. The outline of the unit was written onto a school created proforma, accessed through the school's computer. The school planning proformas linked to the work of Kath Murdoch (1998), Tina Blythe (1998) and the Essential Learnings Framework 1 (2002). Major headings on the proforma included, the title of the topic, the generative topic, throughlines, guiding questions, understanding goals, key questions, Essential Learnings focus, tuning in, guided inquiry and drawing conclusion activities, assessment details and culminating performances.

All teachers at the 2003 school had completed extensive professional learning sessions during the past 2 years to unpack the language and requirements of the newly introduced Essential Learnings. These professional learning sessions had made teachers aware of the planning requirements necessary to plan units of work that took into consideration all phases of the planning process such as, commencing activities, activities to inspire thinking, activities designed to engage students into deeper levels of understanding and culminating performances that assessed students' understanding of the topic. Teachers were

assisted in their planning with suggested references located within the school's library, senior staff members who had undertaken additional professional learning in the Essential Learnings and key departmental personnel who were available to support collaborative planning teams. Our planning team used the recommended references and to a lesser degree senior staff personnel assisted in clarifying terminologies and written expectations contained in the proforma.

The title of the topic changed from, Waste and Recycling to, 'Don't Waste, Recycle' and the generative topic developed an awareness about waste and recycling. *Classroom Connections* (1998) by Kath Murdoch and the Essential Learning Framework 1, (2002) and 2, (2003) formed the basis for our activities choices. The planning sequence commenced with throughlines adopted from the work of Blythe (1998), who suggested, throughlines should connect all our planning units. One school I visited in 2004, as part of a professional learning session, used concepts such as safety, responsibility, citizenship or problem solving as whole school throughlines to underpinned their units of study. *The Planning Learning Sequence* document (2004) stated, "Throughlines identified key concepts from the Essential Learnings. Throughlines are written as questions or sometimes referred to as 'essential questions' and as statements using the stem, 'Students will understand'…" (p. 8)

The inclusion of whole school throughlines had not been extensively discussed in my 2003 school. Our planning team therefore, chose our own individual throughlines of, we care for others, our environment and ourselves and we solve our problems in a kind way and make sensible choices. The wording of these throughlines came from our individual class rules and we felt could also be incorporated into this topic. The guiding questions, which informed the topic were, what is waste? And what can we do to look after our environment? It was important that guiding questions remained open ended and have multiple responses. Key questions that linked to the guiding questions and directed our enquiry included, 1) what is waste? 2) What is recycling 3) Why do we need to recycle our waste? 4) In what ways can we care for our environment by recycling? 5) How can we take personal and collective action for the environment?

Our planning also needed to include an Essential Learnings focus especially as the Essential Learnings became the engine that drove our planning methodology. Our planned unit had the potential to involve four fundamental components of the Essential Learnings, world futures, communicating, thinking and social responsibility.

Our planning proforma had a teaching and learning sequence, which consisted of, tuning in, guided inquiry and drawing conclusions. Our collaborative planning team devised specific activities related to each learning sequence. In the tuning in phase activities included, think-pair-share, visual representations, discussions connected with specific books and videos and linking the school playground to the community environment. The think-pair-share activity consisted of, a posed question, which students needed to think through individually, and then share their thinking with a partner. Combined partner ideas were then shared with the rest of the class. Visual representations were also used as activity choices and included, drawings, paintings, diagrams or models to represent the students' understanding of the topic. Discussions related to specific introduced books and videos about recycling and waste management. Discussions were a fundamental component of the tuning in process. The inclusion of detailed graphics contained in both the books and videos combined with discussions helped link students' pre-existing understandings to new understandings. The videos detailed different materials that could be recycled, such as glass, aluminium, paper and metal and how these materials are recycled in factories.

Utilising the school playground environment and linking it to the community commenced with the issue of litter. This link allowed students to see how an improvement in the school environment could also be transferred into the wider environment of the local community. Teacher made board games where students moved tokens along a segmented track would be introduced during the tuning in phase. Sections of the track contained information related to waste and recycling and if students moved their token to these locations their

token could be moved forward a number of spaces. These games involved concepts related to the topic and included the mathematical concept of chance.

The next phase in the planning proforma was guided inquiry. During this learning phase the activities were designed to be more challenging and for students to enhance their understanding of the topic. Our collaborative planning team compiled activities that would help develop deeper levels of understanding. These activities included, an excursion to the local community recycling depot and a council representative to speak about community recycling, photographic displays about waste and recycling, the introduction of a classroom composting system where materials from the environment could be composted, the school groundsperson to speak about the school's paper recycling program, playground rubbish collections and graphing the results, sorting students' lunch box items into recyclable and none recyclable items, adopting a section of the school playground for students to manage litter, poems and songs about rubbish and observations of materials exposed or buried in the school grounds. The inclusion of the key questions during this learning phase would help identify students' understandings. The initial key questions would be expanded to include, how could we make our playground free of rubbish? From poster or picture presentations asking what could be recycled? Or what could not be recycled?

The last component of the planning proforma was reflection or drawing conclusions. Students could also extend their understanding of the topic by going further. This could be achieved using the school wetlands and linking the students' understandings about waste and recycling and transferring prior information into this environment. The wetlands regularly required weeding and this could be done in conjunction with older students. Students could use their prior knowledge of the classroom composting system to compost weeds from the wetlands. Other weedy sections of the wetlands could be mulched using newspapers and pine bark. Poster presentations and reports about what had been understood in waste management and recycling would form an important assessment task.

A major section of the proforma was devoted to ongoing assessment and culminating performances. Ideas generated in our collaborative discussion team listed activity ideas for ongoing assessment. These included, concept maps before and after the unit, self assessment and setting goals or check lists of skills, oral or written peer assessments, work samples before and after the completion of the unit and individual journals with frequent entries containing new understandings. Culminating performances required students to be able to apply skills or knowledge to unfamiliar situations. Ideas generated in the culminating performances phase included, role-plays that demonstrated an understanding of waste and recycling, visual arts, individual written work and assembly presentations. Lists of useful resources used in the unit were also added at the end of the proforma. Members of our collaborative planning team worked consistently and managed our time wisely; consequently we completed the sequence of activities during three after school sessions.

Description of the Unit: Waste and Recycling

We commenced the unit in the last week of April 2003. In week 1, students were introduced to my modified preferred CLES. Due to previous ambiguities on certain items observed in the 2000 preferred CLES, I decided to work with smaller groups of students where problems could be monitored. I orally delineated each item in the questionnaire and observed closely how each student filled in the questionnaire, especially marking only one response. The questionnaire was completed by all students over a period of one week and was done before lessons commenced to avoid interruptions in the daily program.

Occurring also in week 1, students were asked the questions, 'What is waste?' 'What is recycling'? These questions were used to ascertain students' prior knowledge or understandings of the topic and were done using the think-pair-share activity. Two separate sessions were used to record student responses, one session for the first question and another session for the second question.

In 2004 exactly one year later the same group of students were asked what they remembered about 'what is waste' and 'what is recycling' and which activity helped them the most. If the general question did not provoke a response then other questions sometimes helped students remember. I have included responses for 2003 and also 2004 to indicate comparisons in student's memory of the topic. For student responses I have used fictitious names to conceal their identity.

The transcripts from the students revealed many remembered information about the unit one year later. It also appeared their understandings had improved from the initial transcripts taken at the beginning of the unit in 2003. It could be argued many of the activities undertaken during the unit had added to student's constructions about waste and recycling.

Student's 2003 and 2004 Transcripts to the Question, 'What is Waste'?

Andrew *(Grade 1, 2003) Socks when they are broken are thrown out.*
(2004) Don't eat the food and then throw it in the bin. You have to eat it first. I can't remember anything else that happened.
Brent *(Grade 1, 2003) Waste is when you waste food.*
(2004) I remember, we watched a video. I can't remember anything on the video. We went to the tip. He showed us what could be recycled. He let us choose which ones could be recycled and which ones couldn't. Waste means if you don't eat all your food and you chuck it into the bin
Charles *(Grade 2, 2003) When someone gives you something and you don't want it.*
(2004) Don't waste water, keep recycling. When you finish with your old cans they make new ones. They take the stuff to a place to be remade. When we went to the tip it made me remember the most.
Don and Erin *(both Grade 2 and had the same response): (2003) When you get breakfast and you don't want it, it is called waste.*
Don *(2004) I can't remember much. I can remember we can recycle stuff with little triangles on the bottom. We went to the tip and we watched videos. The man at the tip said he is going to make a crusher and have a*

tip shop. He has already made the crusher. On the video I can remember you can recycle.

Erin *(2004) We went to the tip and looked at the rubbish and stuff. We sorted the rubbish out to things that can be recycled. It was the excursion that made me remember.*

Fred *(Grade 2, 2003) When you buy something and you don't want it, it is a waste of money.*

(2004) Fred took a long time to think and then said he couldn't remember. He did remember going on the excursion but that was all.

Gregory *(Grade 2, 2003) You make a mistake on paper and it is a waste. Gregory had left the school in 2004 and therefore there was no response.*

Hannah *(Grade 1, 2003) Empty cans and bottles are taken to the tip and it is a waste.*

(2004) Prompt, what can you remember about waste and recycling? What is waste? Like you waste your food. Prompt, What is recycling? People recycling cans and bottles. It means people drink out of a bottle or can it's then all gone and they recycle it. We went to the tip and the people recycled bottles and cans and milk bottles and coke cans. I can't remember the videos.

Ian *(Grade 2, 2003) When you go to have your lunch and you don't want it, it is a waste.*

(2004) I remember not to throw rubbish on the ground and do not throw rubbish in the water because it can kill animals because it ties around their necks and they also eat it. (Asked what type of rubbish tied around the animal's neck, Ian replied plastic). You put the rubbish in the tip. Cows eat rubbish and they can die because it happened to me. I remember watching videos, drawing the tip with rubbish in it. At the tip we saw crushed cars and refrigerators. There was rubbish and they showed us where to put the rubbish and beer cans.

Jane *(Grade 1, 2003) When you have your tea and you eat half of it the other half is waste, and then you give it to the cat and dog and if they don't eat it, it is called waste.*

(2004) Waste is where paper goes into the recycling and you can't use it. Prompt what is recycling? I can remember going to the tip. This boy

showed us that a can could go into a bin. They showed us around this big container with rubbish inside, people threw it down into the container and it went down into a big hole. Prompt, what can you remember about the video? Sometimes when cans get chucked out they use cans sometimes for food to go into.

The Following Transcripts are from the Question, What is Recycling?

Brooke *(Grade 1, 2003) It is scrunched up paper, work you have made a mistake on then this goes to the tip and then it is made into new paper. (2004) We watched a video about a boy who had some animals. The boy dumped his rubbish in the river and the animals got stuck in the river, he had a skateboard. We watched the video with Mrs. Q's class. We did some pictures about people picking up rubbish and taking it to the rubbish bin. We shared our pictures with the class in a circle. We went picking up rubbish we went around the playground. We wrote about picking up rubbish. We had a recycling bin to put paper in it. We watched a video that had crushed cans and it told us about when we take the paper to the recycling bin it goes to a truck, it gets dumped into a big machine and it comes back to paper.*

Brent *(Grade 1, 2003) You can use stuff all over again.*

Erin *(Grade 2, 2003) You can use cans over again and they are melted and made into new cans.*

Charles *(Grade 2, 2003) Clothes, which don't fit any longer go to the opp. shop for people to buy.*

Jessica *(Grade 2, 2003) Your bike, which gets broken goes to the tip to be buried. (2004) The people can re-use bottles, plastic and stuff. An activity we did I can't remember.*

 Anna *(Grade 1, 2003) Paper goes to the tip and gets crushed up and gets into new paper. (2004) Very slow to respond to the question, what do you remember about waste and recycling? Needed a further prompt about her memory of going to the tip. When we went to the tip we had to sort out bottles at the tip to*

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see which ones could be recycled. Prompt - what is waste? Where we can't recycle things. Prompt - what is recycling? you can make stuff into other stuff. Prompt - can you remember the videos? On the videos they showed us a big crane thing that crushed up cars.

***Gregory** (Grade 2, 2003) An idea from television involved making something all over again.*

(2004) One day we tipped out the rubbish bin and put all the recyclable paper into the recycling box. We walked around the playground and picked up rubbish and we picked up rubbish in the wetlands. Sometimes when we went onto the classroom deck we grabbed paper that was out there. We took an excursion to the tip. We looked at a big tank with bottles and different sorts of things in them and we looked at stuff to re-build microwave cords and washing machines. They build things from the cords and metal that was there, we could build machines and other microwaves and washing machines.

***Jenny** (Grade 1, 2003) and Fred (Grade 2, 2003) Paper you have used it is sent to the tip and (Fred – goes into a machine) gets melted down then made into new paper.*

 ***Jenny** (2004) When you go to the park you have to pick up the rubbish you see. Some rubbish can be recycled and some rubbish can't. If you see any rubbish you see around the playground you pick it up. If paper does have something on it you don't put it in the recycling bin you put it in your tub or the bin. I can remember a book the teacher read when you pick up rubbish you have to wear gloves. Egg cartons can be recycled. Glass is melted in a furnace. Wood can be recycled and some can't. Plastic can be made into blocks and duplo.*

***Emma** (Grade 1, 2003) Plastic bags are melted down to be made into new bags.*

(2004) Prompt – What is waste? wasting paper. Prompt – What is recycling? I keep forgetting I can remember going to the tip. We looked at milk cartons and paper. I can't remember the videos.

***Andrew** (Grade 1, 2003) Your rubbish stuff is made all over again.*

***Jane** (Grade 1, 2003) Find a rubbish bin put it in the rubbish bin it goes to the tip to be made into new paper.*

(2004) Prompt – What is waste? It's where paper goes into the recycling and you can't use it. Prompt – What is recycling? No response. Prompt – Can you remember going to the tip? This boy showed us that a can can go into a bin. They showed us around this big container like bin, paper bags with rubbish inside and people throw the rubbish into the container; it went down into a big hole. Prompt Can you remember the videos? Sometimes when cans get chucked out they use cans sometimes for food to go into.

Don *(Grade 2, 2003) Left over food is given to the chooks.*

Ian *(Grade 2, 2003) There are special trucks with pictures on the truck for recycling.*

After the students' initial responses to the questions, of waste and recycling two videos were shown towards the end of week 1. The first video filmed in 1991 outlined the recycling process and went for 22 minutes. This video outlined how aluminium cans, glass, concrete, paper, iron and water are recycled. Although the commentary in this video was sophisticated, the visual information provided these students with some understandings as later discussions revealed. The second video filmed in 2001 described the impact of rubbish on our environment. This video went for 15 minutes. Featured in the second video were people who removed rubbish and how the environment could be assisted by planting trees and making bird feeders to encourage bird life into the local environment. The word environment was often referenced throughout these two videos but not always understood by these students. An explanation was later given to our students by two older students visiting our classroom. Their explanation was, '*that it is the space around us'*.

Feedback from the videos indicated the degree of understanding students had at this stage of the unit. It appeared in the first video on recycling the visual information had an impact, as the following transcripts suggested:

 "*machines crushed up cars, cans scrunched up, recycled water can come from the sewerage, paper can be put into hot water and recycled, sump oil is made into lubricating oil, concrete is crushed and used for road fill, glass is sorted*

and crushed up and put into a furnace to be melted into new glass. The new glass is poured into a mould to make new bottles".

A collection of library books about waste and recycling was displayed within our classroom reading corner. I often read these books and discussed their contents during the course of the unit. These books were accessible to the students at all times where students frequently studied them. Two big books featured prominently during week 1. The first big book, *Rubbish* (1996) by Sandra Iversen illustrated how people disposed of their rubbish. Each page contained colourful illustrations of different positive disposal methods along with an easy to read text. This book provided a valuable resource for discussing the variety of rubbish disposal methods. The second big book, *Let's Look After Our World* (1994) by Diana Noonan and Keith Olsen discussed how a school could solve its pollution and waste problems. The illustrations contained on each page featured students and teachers solving waste problems both positively or negatively. A series of statements were provided on each page to a conservation issue such as, ways to save water, ways to save electricity or ways to make our school grounds look better. The text and illustrations in these books provided provocative discussions, which engaged more students than did the videos shown later in the day. Each page contained issues and in some instances discussions were prolonged especially on ways to make our school grounds look better.

A series of simple board games were played at the end of week one as a mathematical activity to assist with the topic. The games involved the mathematical strand of chance. Students moved a token a number of places until they came to a space on the board that made them aware of a waste or recycling issue. When on the specified space the student either advanced their token or went back depending on the message contained within that space. Adults who assisted in the classroom also helped students with these games by reading the messages or overseeing the movement of their tokens.

The beginning of week 2 included an excursion to the recycling depot, located within the community waste disposal site. This excursion also involved my

colleague teacher's Grade 1-2 class and some parents. The excursion incorporated a council representative who spoke to the students about recycling and how the council manages the site. Students were shown materials at the depot, which could be recycled and told what these materials were transformed into. The council representative also had a collection of objects, which groups of students had to place either into a waste or recyclable container. A debriefing occurred back in the classroom to assist students' memory about specific details in the excursion. A series of digital photographs were taken during this excursion and these along with written information were displayed in the entrance to our classroom. This visual display often inspired parents to read the students' reports and discuss the excursion with their child.

The following day, after the excursion, we discussed recycling and spoke about green waste. Green waste was observed at the recycling depot and only briefly discussed. Observations in the school grounds revealed evidence of where green waste had been deposited and used as mulch in the school's garden beds. After the observations the class went back into the classroom where I introduced a small worm composting system. I explained how the small composting system operated and the role of worms and other mini beasts (spiders, beetles, slaters, snails and slugs) in an environmental recycling system. This small composting system contained, worms and their castings, mini beasts, and some vegetable matter and therefore was already a complete working system. Worm castings was discussed along with the nutrient benefits castings provided for healthy plant growth. Students added further vegetable matter to this composting system such as, leaf litter, grass, vegetable peelings and straw to supplement the dwindling organic supplies already there.

It was necessary to explain the need to keep the composting system moist and covered, as mini beasts preferred a dark moist environment. Students undertook close observations of the mini beasts to get an understanding of their role such as, eating the organic matter and recycling it by way of castings *(worm poo)*. This observation and explanation of the small composting system allowed students to see a connection between environmental recycling and

people recycling, as waste products are converted into something new and useful. After the introduction of the composting system, I asked students to summarise and include an illustration on how to make a compost system. The summary and illustration activity provided an insight into students' understandings. Three students' transcripts included:

Don; Get a container, get some worms put them in the container, put food scraps in it. They eat it, they poo. It is good for the garden.

Erin; Get some scraps of food and you get some dirt. You get some worms and some worm's poo, then you get some spiders.

Gregory; 1) You put some holes in a box. 2) Then you put some carrot peelings in it. 3) Then you put some compost in. 4) Then you put some leaves in it. 5) Put some worms in. 6) Put some wet paper then you have made a compost. Worms eat the leaves and carrot peels they make poo and this is good for the garden.

The composting system remained in the classroom for 4 weeks and during this time frequent observations were made on how quickly the worms and other mini beasts decomposed the organic matter. Additional organic matter was added to the composting system if the organic matter was low. This task was usually given to two enthusiastic students who were concerned about the welfare of the worms and other mini beasts and therefore maintained the function of the composting system.

The inclusion of music depicting waste and recycling was also incorporated into this unit of study. The school music teacher provided the music to the *Compost Maker's Work Song*. The music teacher also designed lessons that focused on how to make compost from the information gained through our class focus.

From the introduction of the composting system and the identification of the components of that system my teacher colleague decided to hone in on a more detailed investigation of mini beasts. Students were asked to decide on a mini beast to investigate for a project. In technology students made that mini beast

out of an assortment of boxes and other materials. Our Grade 3-4 buddy class was asked to assist our Grade 1-2 students with their projects. These students helped collect information about their mini beast and extract important details for written compilation. The information along with diagrams was entered onto large sheets of white paper and the finished projects displayed within the classroom for parents and visitors to peruse.

Located in most classrooms in the 2004 school were food scrap buckets for collecting students' waste food. The waste food was then collected by the school cleaner at the end of each day and taken to a local poultry farm. The school cleaner was invited into the classroom at the end of week 2 to explain its function and the type of food students could place into it. Food items not suitable for recycling such as, banana skins or apples and other lunch box rubbish were placed in the rubbish bin. The school cleaner's discussion about waste food was of particular relevance as hitherto the bucket had been used incorrectly. After the discussion students were more aware of what to place into this bucket and would on occasions say that a particular item was placed into the wrong container. The students were now demonstrating their understanding in a practical way by vocalising the difference between recyclable food and waste food items.

On the last day of week 2 we included an Aboriginal perspective into the Waste and Recycling unit. Our Indigenous School Assistant presented information to our students about past Aboriginal practices and how they disposed of their waste. Aborigines used shells not only as a waste product but also as receptacles for food and water. Discussions followed the presentation where students usually clarified points or asked pertinent questions related to this discussion. A display of posters and books showed students Aboriginal middens, which consolidated the extensive discussion done previously.

An additional technology activity was incorporated in the program during week 2, which was to design and make a recycling machine. Students could use 3-4 recyclable boxes to make their machine and could be assisted in the

making of it by an adult helper. The students were asked to describe what the machine recycled to the whole class when it was completed.

The school's groundsperson was also invited into the classroom at the end of week 2 to speak about the school's special paper recycling boxes and collection points. Contained within each classroom were large cardboard boxes designed to recycle discarded white paper. Students, however, used these boxes to dispose of general waste and not the correct paper. The groundsperson discussed in detail the correct paper to place inside these boxes and were taken to the central collection point. Class recycling paper was then transferred into large yellow recycling receptacles located at a central point within the school grounds. Paper placed into the yellow receptacles, was then collected by special trucks. Some students had witnessed the recycling trucks collecting the paper from the yellow receptacles and described these trucks to the class. The location of the large yellow recycling receptacles was important information for our class student recycling monitors, as it was their responsibility to empty the recycling box once a week. Recycling paper featured on a video shown earlier and the recycling program implemented by our school and discussed in detail provided a connection to the video's information.

Some students appeared to be developing a deeper understanding regarding the recycling information. Deeper understanding about recycling was observed during a show and tell session at the end of week 2. One student described how he had recycled an old table belonging to his grandmother into a small stool for himself. In the same week some older students from our class buddy program presented our class with a recycled plastic milk container. The recycled milk container was bought at the local high school fair as a special gift for our class to store small items. These impromptu situations provided an ideal opportunity to reinforce the information we had acquired during these two weeks and celebrate the achievements of these students' regarding recycling initiatives.

In week 3 we continued to observe the composting system and further our discussions about waste and recycling. In addition to the discussions some students continued their technology challenge of creating a recycling machine out of small boxes. For the last two days of week 3, I was involved in a professional learning conference and therefore the class had a relief teacher. An outline of the Waste and Recycling unit was given to the relief teacher who planned additional activities to compliment the class program. The relief teacher brought into the classroom some items for the students to graph. The items included, newspapers, cans, brown bottles, green bottles, clear glass, vegetable scraps, plastics and recyclable plastics. The items were categorised into recyclable or none recyclable. Students were asked to count and record on a prepared graph sheet the number of items in the recyclable and non-recyclable sections. On the reverse side of the graph sheet the students were given two questions, what does my family recycle? And does my family have a compost heap? The more literate students were able to answer these questions comprehensively to indicate a link between learning at home and its relevance to school learning.

In week 4 discussions continued about waste and recycling. During one discussion session a class member told us about the death of a relative. This discussion then evolved into types of interments including cremation, animal deaths involving roadside kills and the death of pets. Students who had witnessed roadside kills spoke about organisms that had eaten the animal until only bones were left. This discussion provided an opportunity to link composting and their observations of roadside kills with their previous understandings. After this discussion students were asked to write or draw on a sheet of paper their understandings now regarding waste and recycling.

At the end of week 4, I read the book, *My Patch* by Nel Smit. This book used detailed observations and reflective thought to describe the various changes that take place in a square metre patch of land located within a school's playground. I asked our students to adopt a patch within the confines of our school playground. They were asked to observe and care for this patch in a

similar way as mentioned in the book. We then proceeded to go outside and locate our special patch.

During week 4 our Grade 1-2 class visited our Grade 3-4 buddy class. The buddy class shared their written information from personally compiled books about our school's wetlands. Their information used different modes of thinking depending on the hat colour as described in *de Bono's Six Hat Thinking* (1992). During this information session further discussions informed our students about the content of these older students' books. The inclusion of de Bono's Six Hat Thinking introduced our students to think in divergent ways about a topic. The information conveyed by our buddy class however, was mostly beyond our students' understanding. It appeared some of the information came from out-of-school sources such as, European carp's impact on the environment. The following extracts using Six Hat Thinking are from four, Grade 3-4 students. Their names have been altered to conceal their identity:

> *Gabriella:*
>
> *Red Hat Thinking (feelings, emotions). How I feel about our school wetlands? I feel great about our school wetlands we have been taking good care of our school wetlands. We have taken all the weeds out and we are going to plant new plants. We have also been studying the wetlands. Most of the native plants were being strangled by the weeds. We all picked a native plant and unstrangled them. We go into the wetlands each Monday and some of the mothers and fathers come in to help us with the environment it's fun, we have almost made it look like it did not have any weeds in there.*
>
> *Black Hat Thinking (negative, caution). What is not working in the school wetlands? Before we started to take all the weeds out we had to go along the fence line and in the long grass to pick up all the rubbish, we found lots. We have cleaned it up heaps, it looks much better than before and our water is not very clean.*
>
> *Mary:*
>
> *White Hat (information). Many species of animals and plants some of which are endangered depend on wetlands for their survival. The water spider's long legs spread its body weight widely so it is able to stand on the water surface to catch*

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its prey. A wetland is an area that is covered by shallow water either all of the time or most of the time. Beneath the water surface of some Australian rivers live a destructive animal the European carp.

Yellow Hat (benefits or good points). The duckboards are good for walking on. Our class is pulling out most of the weeds and the rubbish. There is a fence around the wetlands so no animals can get in.

Violet:

Green Hat (creativity, new ideas). Our wetlands looks great as it is but it does need constant attention and I think there might need little arrangements here and there. I think there should be a bridge to the island in the middle of the water there should be a gazebo where you can relax with a pencil or paintbrush and have art classes. It would be lovely to encourage some of the elderly to enjoy themselves to have a look at our wetlands.

Black Hat.(negative, caution) Our wetlands has heaps of weeds such as blackberries, sticky weed and cumbungi. They strangle the native plants that are in the wetlands. And also on the other side of the fence there are cows sometimes they get into the wetlands, which is bad so they destroy the native habitat. It appears to be a dumping ground for peoples' rubbish.

Lucy:

Green Hat. (creativity, new ideas) Maybe I think that if we all got together and got enough volunteers we could clean up all the wetlands on a certain day like Clean Up Australia Day.

Black Hat. (negative, caution) Introduced species are taking over our wildlife and native plants. Animals are dying out because of other animals are taking the air, water and nutrients they need.

Early in week 4 a class newsletter was sent home detailing to parents our work about waste and recycling. Included in this newsletter was a note to ask parents to supply their child with garden gloves and sturdy shoes. These items were needed for a weeding program in our school's wetlands for that week and the following week. The weeding program was an ongoing school enterprise and our class combined with our buddy class helped control weeds in this environment. Our buddy class also had an environmental focus and often worked in the school wetlands performing tasks such as, water-testing and ongoing weed management. Our buddy class usually put weeds into large receptacles for collection. Due to the information gained through the waste and

recycling unit we decided to heap the weeds into piles similar to a composting system. Worms and other mini beasts living in the wetlands would hopefully decompose the vegetation and recycle the weeds into nutrients.

An environmental focus in the wetlands continued throughout 2003. Students continued the weeding program and also incorporated water testing and macro-invertebrate observations. In term 3 2003, Green Corp, an organisation that provided volunteers for community based projects and coordinated by the local council, worked in conjunction with our 2 classes. The Green Corp volunteers showed the students water testing procedures and assisted our students to mulch the worst affected weed areas. A series of digital photographs were taken during this project and displayed in the council pavilion at the local agricultural show held in mid November 2003. Parents were also informed about this project via the school newsletter. Two students from our Grade 1-2 class provided information about this project:

> *Jane: We tested water and we found bugs in the water. And we did some mulching. We did some weeding. And we looked at the water. They filled in the pine bark into the wheelbarrow and put some cardboard on top of the pine bark. I know why we went to the wetlands because we talk about water. There were little boxes you had a little scoop and tried to catch bugs.*
>
> *Anna: We tested water and we found bugs in the water and we did some mulching. We did some weeding. And we looked at water and found bugs in the water. We tested the water to see if the water was polluted. And we weeded to get the weeds out.*

Week 5 of the Waste and Recycling unit was also the last week of term 1. Many planned activities were not commenced due to end of term school programs such as, a talent show, cleaning and packing up furniture, sorting and returning library books, games and equipment to various store rooms. One planned activity, lunch box rubbish, was undertaken in this week. I firstly modelled to students how to do this activity using the contents of my own lunch box. My lunch box revealed items that could be recycled or constituted rubbish. Students then completed a worksheet detailing the contents of their

lunch boxes indicating what can be recycled and what cannot be recycled. Students also graphed the results of their lunch boxes and discussed what they could do to have less lunch box rubbish. This activity could also be classified as an assessment task as it indicates student's understandings about waste and recycling. Two Grade 1-2 students' results included:

> **Fred:** _What can be recycled?_ _My lunch box, my drink bottle_
> _What cannot by recycled?_ _A chip packet, my orange, my yoghurt and my cherry ripe._
> _What could you do to have less lunch box rubbish?_ _Plastic can be used again. You can go the canteen and buy stuff with out wrappers on it._
> **Gregory:** _What can be recycled?_ _Yoghurt container, plastic bag, spoon, lunch box._
> _What cannot be recycled?_ _Chip packet, mars bar packet, chocolate stick packet, teddy packet._
> _What could you do to have less lunch box rubbish?_ _You could use plastic bags, you could use little containers, you could ask your mum not to buy things with plastic on them._

On Friday, the last day of week 5, students continued to weed in our school wetlands, this went for approximately 40 minutes. Students were keen to continue this enterprise with support from a small group of students in our Grade 3-4 buddy class. Our buddy class became proficient at identifying common weeds and assisting our students with their weed identification and the handling of garden tools.

A period of 5 weeks had been exclusively designated to promote this unit of work however, various activities and discussions concerning waste and recycling continued throughout 2003. Students also heard via the media advertisements using catchy jingles about waste and recycling. Information conveyed via the media reiterated the information our teaching team had provided during the course of this unit. Parents also practised some types of waste management at home and informed their children not to waste food. Many students had already visited the local community recycling depot with their families and participated in home recycling, which linked home learning

to school learning. At school students were constantly reminded about the need to pick up their rubbish and place it into a rubbish bin and use the recycling box for paper and the recycling food bin for waste food. When school resumed after the first term holiday break in mid June 2003 the actual CLES was given to the Grade 1-2 students. Students were again given the questionnaire in small groups before the commencement of daily lessons, which reduced intrusion into class time.

The following chapter, Chapter 9, gives an interpretation of both the 2000 and 2003 studies and the selection of activity choices that appeared to match constructivist ideals.

CHAPTER 9

INTERPRETATION OF THE 2000 STUDY

The principle objective of the environmental programs undertaken during 2000 and 2003 was to evaluate the effectiveness of constructivist-based teaching in changing students' environmental attitudes. A number of questions were asked in the original thesis proposal such as, when and why did constructivism become popularised? What teaching strategies reflect constructivist theory? Does constructivism change students' perceptions about fundamental environmental concerns such as, being sun safe, recycling and waste? Are these perceptions transferred into students' out of school lives?

To answer some of these questions a revision of the constructivism literature is required. Noddings (1984) suggested a philosophical shift during the 1960s and 70s from behaviourism to various forms of structuralism and cognitivism produced changes in psychology, sociology, linguistics and anthropology. This consequently stimulated a field of study known as psycholinguistics. A renewed interest in concept formation, problem solving and the connection between cognitive structures and behaviour arose. One variation of cognitivism translated into constructivism.

Piaget aligned his philosophy to Kant (1780). Succinctly Kant's underlying philosophy suggested experience is created by our existing conceptions and by objects of the outside world. Piaget however, distinguished between empirical knowledge and logico-mathematical knowledge by describing cognitive structures as products of development rather than being innate. Von Glasersfeld (1990) also acknowledged the contribution of Piaget as being the great pioneer of constructivism who published for more than half a century on a range of topics.

Taylor (in press) suggested in the late 1970s science education (re) discovered epistemology, a branch of philosophy dedicated to theories of knowledge.

During this period and in the milieu of cognitive psychology, evolved constructivist epistemology theory. Constructivist epistemology theory explained that cognising beings actively construct knowledge by way of experience and where prior knowledge is important. Throughout the 1980s teachers were alerted to research programs that investigated science curriculums and conceptual change within their students. The use of viable teaching models became vitally important to enable students to deconstruct their unsophisticated concepts or misconceptions into valid scientific constructs. During the late 1980s constructivism theory took into account the social aspect of knowledge construction where for example small group situations became a valued teaching methodology.

Taylor (in press) argued the process of critical inquiry and critical understanding of historical and cultural possibility of scientific knowledge should also be incorporated into constructivist theory. Tobin and Tippins (1993), believed constructivism used as a referent could be conceptualised as a set of beliefs. These beliefs have the possibility to facilitate different ways of thinking about education, of framing problems and formulating answers to problems. Taylor (in press) recommended constructivist theory provided teachers with the opportunity to take account of students' own ways of making sense of their experiences of the natural world and to build upon these experiences. Taylor proposed teachers could transform their classrooms into sites of vibrant intellectual and communicative activity. This has particular value when critical self-reflection inquiry has been established within the classroom environment. Taylor (in press) argued that a "critical discourse should involve, 1) teachers and students negotiating shared control over planning, conduct and assessment of classroom learning activities, and 2) students exercising a critical voice to contest pedagogical practices that could hinder learning" (p. 6).

The literature (Noddings 1984; Ernest 1995; Tobin & Tippins 1993; von Glasersfeld 1990; Solomon 1992; Taylor 1996, in press) outlined the evolvement, characteristics and popularisation of constructivist theory. The literature (Noddings 1984; Ernest 1995; Tobin & Tippins 1993; von

Glasersfeld 1990; Cobb, et al. 1992; Taylor 1996, in press) referenced pedagogical practices that could be described as being constructivist.

The question of, 'what teaching strategies reflect constructivism', can often remain elusive. Tobin and Tippins (1993) suggested however, teachers provide a variety of opportunities for students to represent their knowledge. These opportunities would include, "writing, drawing, using symbols, and assigning language to what is known. Students thinking needs to be stimulated by providing time to think: students need time to engage in the processes required to evaluate the adequacy of specific knowledge, make connections, clarify, elaborate, build alternatives, and speculate" (p.11). Taylor (in press) believed the power of critical thinking or critical reflection, where learners are engaged in an active role can facilitate learning and therefore represent constructivism. Noddings (1984) advocated in educational settings cognitive constructivism translated to pedagogical constructivism, which implied a way of teaching that acknowledges learners as active knowers. Understanding therefore is derived from learners' active involvement in their learning. Blythe (1998) proposed students should develop deep understandings of a topic and teachers should rethink their classroom practice to develop this principle. Blythe asked the questions, "How does my current practice help students to develop those understandings?" "What else could I try?" and "How can I know how well my students understand what I am teaching?" (p. xiii). Blythe's belief in developing deep understanding of a topic could translate to strong constructivism as opposed to trivial or weak forms of constructivism.

The Essential Learnings Framework 1 (2002) placed an emphasis on values, purposes and also incorporating inquiry or reflective thinking into the curriculum to develop deeper understanding. Including especially a student driven purpose/s and value/s into a unit of inquiry gives the task meaning and reasons for learning. Once students have a purpose for their learning, which also accommodates thinking in various ways then it would be presumed strong acts of constructivism are taking place.

The environmental units undertaken during 2000 and 2003 needed to be examined to ascertain whether elements of thinking, participation, values and purposes were included.

My 2000 planning followed the Science Curriculum Teaching and Learning Planning Guide proforma (1995), which developed a constructivist model of learning by engaging students, refining-input, extending students' ideas and reflecting. Activities associated with these phases of learning were designed either by myself or in discussion with my colleague teacher. During 2000 our understanding of questioning to elicit deeper understanding, which often leads to further enquiry, was not yet fully understood. We therefore used teaching pedagogies known at that time where some activities did have a degree of thinking and problem solving attached to them, such as, designing and making a sun safe device in technology.

During the engaging stage in the unit 'Safety in the Sun', discussions, and brainstorming were used as an effective task to gauge students' prior understanding and promote further understanding about the sun's effect on us. The inclusion of videos, books, posters and guest speakers had the effect of engaging students in lengthy discussions that also encouraged thinking. During these discussions concerns were expressed by the students regarding the graphic illustrations displayed in the booklets, posters and videos about different types of skin cancer. Guest speakers, the information contained in books or posters or by myself usually addressed students' questions during discussion sessions. The use of emancipatory dialogue where concerns and anecdotes about sun safety were expressed openly provided a measure to ascertain student understandings. For students who did not always contribute to discussions the rich conversations between class members, guest speakers and myself allowed most students to think more deeply about the topic.

During the brainstorming session approximately half the students in the class contributed their understandings about sun safety. The documentation, which followed the brainstorming session, suggested that the three students whose comments were recorded incorporated new understandings obtained through

the brainstorming session into their written work. One understanding gained during the brainstorming session came from a television news item, which mentioned muscle melt down on an infant left in a car on a hot day. The students had adapted this news information to link with other understandings about sun safety. The two videos shown during the engaging stage provided an important stimulus for further discussions. The discussions involved the use of sunscreens, sun protection factor numbers, skin and eye colour and the ozone layer. More in-depth discussions resulted from the inclusion of guest speakers who spoke about the sun's affect on the body and how it could be treated. The booklets produced by the Cancer Council included graphic skin cancer illustrations, which had a scare affect on the students where questions and further discussions emanated.

The use of discussions encouraged students to link prior understandings such as, the sun can make you have moles and the sun is deadly and link to new understandings. New understandings were derived through the whole class brainstorming session, videos, guest speakers and books. The use of discussions can be an effective way for teachers to assess in the first instance whether students have misconceptions and if those misconceptions are still apparent at the end of the unit.

The Essential Learnings Framework 1 (2002) stipulated thinking is an important component of the curriculum. Thinking allows students to be flexible, creative and fulfil a role as an active citizen. Apart from the extensive discussions that provided reflective thinking another thinking component existed in the 2000 planning; the students' technology challenge. This challenge required students to make a sun safety device that would combine existing information and transfer it into a new situation. Students were also asked to write a procedural text on materials they needed, a step-by-step method on how to make their device and how it would look when completed. When students had completed making their device they were required to do an appraisal in their books on how it went including modifications.

Students were also required to do a self and peer appraisal. This type of appraisal was usually done when students sat in a circle formation. Selected students displayed their device and made pertinent comments about its design and function. Students from the class group asked questions about a device and gave valuable feedback on modifications, which often related to improvements or redesign considerations. The inclusion of peer appraisals often assisted students in solving problems encountered during the making of their device. Using the technique of appraisal resulted in students engaging in reflective thinking especially to the effectiveness of their device in keeping them safe in the sun.

Story writing was another area that allowed student to extend their thinking skills. Story writing needed to comply with pre-existing editing procedures of a plan of how the story would develop and character descriptions. Stories usually included information already acquired and integrated new ideas. For students who were not active participants in oral discussions story writing provided a forum for them to express their ideas, information about sun safety and indicate a degree of thinking.

The inclusion of discussions, technology challenges, writing tasks, visual art products all contributed to students' further understanding regarding sun safety. Blythe (1998) believed understanding is being able to carry out a variety of actions or performances, which show that a student has grasped the topic and can also advance further. I felt in 2000 the products these Grade 3 students produced did show a level of understanding. Blythe however, would ask the question, was it deep understanding? Blythe maintained students needed to build performances of understanding around the topic. Activities suggested by Blythe should be thought provoking, where elements of explanation, making generalisations and ultimately applying these new understandings into a variety of situations. There also should be appropriate feedback, which would assist students to improve on their understanding. Feedback for these Grade 3 students was usually by the appraisal system done either in oral or written form.

The inclusion of the CLES made visible important dimensions of constructivism that could be implemented into my practice. Students provided me with feedback on items where constructivism was weakly practiced and consequently I needed to rethink my planning methodology. The CLES came in 2 versions the preferred and actual. The preferred was usually given at the commencement of the unit and the actual given at the end of the unit. During week 4, the preferred CLES was administered to these Grade 3 students. Due to the wide range of literacy abilities within this Grade 3 cohort, I read each item to the class. Confusions however, did exist with 53% of the class in the understanding of the first 6 items. Approximately 39% of students had problems understanding items, 7 and 8. The remaining items contained in the preferred CLES were generally better understood. Item 10 referred to '*learning about people from different countries*', this item scored highly. This could have been due to discussions held prior to the questionnaire regarding the introduction of French and German into the class.

A tabulation of the 2000 preferred CLES included.

Table 9.1

A Collation of Class Mean Scores for Each Scale on the Modified 30 Item Preferred CLES:

_____

Personal Relevance	2.3
Uncertainty	2.25
Critical Voice	2.25
Shared Control	2.34
Student Negotiation	2.36

In the scoring process, a score of 1 was designated to a never response, a score of 2, for a sometimes response and a score of 3 for an always response. A similar scoring system operated for the 2003 CLES.

The class means for each scale revealed the constructivist ideals perceived as important by these Grade 3 students and included, to share control on what they learn, to negotiate with the teacher and other students about their ideas, to solve problems and talk to other students. To accommodate for these preferred CLES preferences meant an alteration to my program. One alteration I did include was the scale of *Shared Control*. This scale was incorporated by students thinking of their own activities for me to write on the white board. From the list of suggested activities students then chose an activity. I had developed this procedure of student-negotiated activities in previous years and found it to be successful. To return to this procedure would demonstrate student ownership of the tasks.

To be able to tell the time had been a practised exercise from week 1. The completion of tasks often correlated to recess, lunch and home times and therefore tasks needed to be completed by these times. Students often negotiate the time for tasks to be completed and used the class clock as a reference. Telling the time and gauging task time encouraged independence, ownership, understanding and responsibility.

The student preferences of, sharing ideas, talking with each other, negotiating activities and selecting time frames for activities were now being practised in the class program. After week 9 the actual modified CLES was given orally to the whole class. Confusions that existed in items 1-6 were now less confusing, as students were not asking to repeat or explain what these items meant.

Table 9.2

A Collation of Class Mean Scores for Each Scale on the Modified 30 Item Actual CLES:

_____
___

Personal Relevance	2.3
Uncertainty	2.25
Critical Voice	2.25
Shared Control	2.02
Student Negotiation	2.05

Table 9.3

A Comparison Between the Class Mean Scores of the Preferred CLES and Actual CLES.
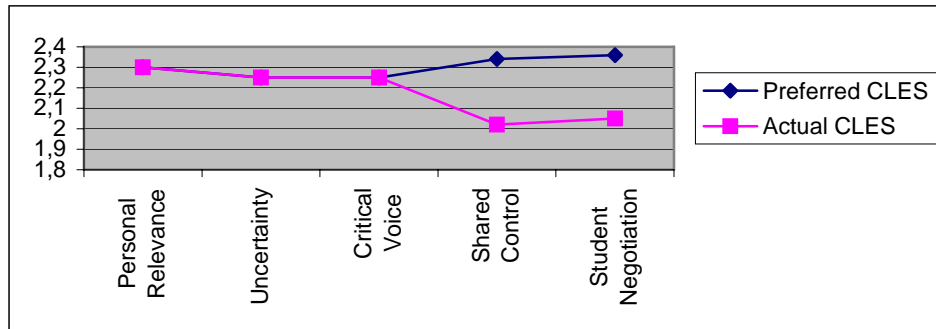
_____
___

	Preferred mean	Actual mean
Personal Relevance	2.3	2.3
Uncertainty	2.25	2.25
Critical Voice	2.25	2.25
Shared Control	2.34	2.02
Student Negotiation	2.36	2.05

Figure 9.1

Graphed comparison of preferred and actual class mean scores of the 2000 CLES.

The mean scores on the graph indicated my program was still lacking the adequate inclusion of the scales, Shared Control and Student Negotiation. My practice therefore needed further refinement, adjustment, more time to implement various scales and promoting achievements such as, student negotiated activities for students to give a satisfactory assessment for these scales. An intention therefore would be to provide opportunities for students to help plan what they are going to learn, which activities they do, help students decide how well they are doing in their learning, have a chance to talk to other students, speak about their ideas and students can speak about their ideas to them.

The study of the 28 Grade 3 students using a 30 item modified version of the preferred and actual CLES, indicated confusion and ambiguity in items 1-9 with approximately 53% of the class. These items mentioned learning about the world and learning about class work. Ambiguity could be assumed in the words, 'I learn how class work has changed over time', 'what I learn has something to do with my out of school life' and 'I learn how class work can be part of life outside of the school'. Items 10-12 were better understood, as these items related more to students' experiences within the classroom, where students could give a clear opinion, such as, 'I learn about people from different counties' or ' I learn that class work is about having new ideas'. Items

13-30 related more to the democratic nature of the classroom, such as, speaking out, learning to learn and learning to speak to others. Approximately one month later the actual CLES was give to the same group of students and misunderstandings had improved with only 17% of students reporting confusion on the same group of items.

Key research questions were asked at the commencement of this thesis such as, what teaching strategies reflect a constructivist approach? Do these approaches change students' understandings? Are these understandings transferred into the real world? The inclusion of the CLES did give an indication as to whether particular teaching strategies reflected constructivist approaches and where improvements could be made in my teaching practice. The scales of Personal Relevance, Uncertainty and Critical Voice showed a positive correlation between the two questionnaires. This indicated for this group of students my pedagogy did follow constructivist theory according to these scales of the CLES.

CHAPTER 10

INTERPRETATION OF THE 2003 STUDY

The 2003 study was taken in a different school with students aged between 6-8 years. These students were in a composite Grade 1-2. The socio-economic status of most families in the 2003 class was lower than in the previous class, as family welfare recipients made up 73% of the class population. In the 2003 school over 40% of the school population was on student support.

Planning methodologies in 2003 had commenced in the previous year with extensive professional learning programs. These programs showed teachers how to plan units of work using the important references of the Essential Learnings Frameworks 1 (2002) and *2* (2003) and other recommended texts available from the school library. It was mandated that the teaching staff in the 2003 school work collaboratively to design units of study together. Each collaborative team needed to have a consensus on the planning proformas used, and a shared common understanding of the terminologies used in these proformas. Most proformas had similar headings such as, guided questions, throughlines, understanding goals, tuning in, guided inquiry, drawing conclusions, culminating performances and ongoing assessment. Each collaborative team's planning, however, featured a variety of activities for each of the different phases of the planning proforma, a range of thinking strategies, and supporting Essential Learnings such as communicating.

It appeared the craft of pedagogical constructivism was being practiced in the 2003 school. All teaching staff was now engaged in constructing their understandings of how the new curriculum units could be utilised and implemented in their class. The Tasmanian Department of Education advocated a co-construction approach to the new curriculum with stakeholders being teachers, parents, schools and curriculum personnel. These stakeholders explored what the new curriculum meant for them and how practice could

change as curriculum implementation proceeded. Being a co-constructed document meant establishing a common understanding of the processes, terminologies and requirements the new curriculum espoused. Getting this common understanding was often very challenging and confusing for many teachers.

The collaborative team undertaking the unit, Waste and Recycling, consisted of three teachers including myself. The unit developed over a 5-week period and it was envisaged students would develop an understanding of the key questions of, what is waste? Why do we need to recycle our waste? In what ways can we care for our environment by recycling? And how can we take personal and collective action for the environment?

This unit resembled other units of study already undertaken in previous collaborative planning sessions, especially using similar language and ideas for activities. Our planning proforma consisted of the title of the unit, throughlines, guiding questions, understanding goals, key questions, Essential Learnings focus, tuning in, guided inquiry and drawing conclusion activities, ongoing assessment ideas, culminating performances, a list of resources used throughout the unit and reflective comments. Initially our collaborate team met for two separate half-hour planning sessions to draft and expand activity ideas. Our planning was done on a computerised proforma where activities and questions were typed in the appropriate sections. A previous unit on Friendship had already been typed and saved into the proforma along with appropriate activities for that unit. Our collaborative team recommended we utilise the rich collection of activities within the Friendship unit as they followed the Kath Murdoch (1998), Tina Blythe (1998) and Essential Learnings Framework 1 (2002) and 2 (2003) activity models for integrated learning. These activities were subsequently re-worded to match the new unit of Waste and Recycling thus making our planning easier.

Although our planning time had been reduced due to re-adapting activities from the Friendship unit, on reflection we did not allow enough time to ratify how the ideas had materialised or difficulties encountered during the unit.

Reflection of units from either the past or the future became an ongoing problem with collaborative planning. It appeared the school needed to timetable a reflection session after units had been completed where teams could ascertain the effectiveness of their planning and in particular the relevance of their selected activities and whether these activities strived to maximise student understanding.

In 2003 my on-class teaching load was shared with another teacher. The structure of the timetable meant I taught at various time slots during the day and for a full day on Friday. This mishmash of teaching between class and the Reading Recovery program meant I did not feel in control as I did in 2000. The colleague teacher had a different approach on how the classroom should function and was often not prepared to incorporate the planning ideas we had formulated during our initial planning session. The colleague teacher did have an activity session every afternoon and during this time delved into mini-beasts. This was a deviation from our original planning and was inspired through the composting system introduced during week 2. The students chose a mini-beast to study in depth and were helped in their research by our buddy class students from the Grade 3-4 class.

In week 1, small groups of students were orally taken through the preferred CLES. During this time I did record comments made by some students. One student needed to have item 18 explained in detail, which states, '*It could be OK for me to speak up when it is not fair*'. This student responded negatively to the question and when I explained to her what the question meant, her response was changed to a positive response. This same student felt in item 25, which stated, '*I got the chance to talk to other students*', thought it wrong to talk to other students and responded negatively to this item. Another student also felt it inappropriate to talk with other students about how to solve problems and responded negatively to item 28. The negative response by these students towards talking to other students could have been in response to my colleague teacher who preferred a quiet, orderly classroom and allowed for minimal interaction between students. Doing the preferred CLES in small groups where students sat in close proximity also meant that some students

copied the responses of other students. I alerted them, by stating, *'it was their thoughts not of others that counted'*. A total of 30% of students needed items clarified and consequently recorded a change in their initial response.

In the preferred CLES the responses were altered to a series of faces for these younger students. In order to equate the faces to a number, I designated the number 1 for a sad face, 2 for a straight face and 3 for a happy face. Totals were added and divided by the total number of students in the class and then divided by the number of items in the scale. This calculation achieved the class mean score in each of the scales.

Table 10.1

Class Mean Scores for Each Scale on the Modified 2003 Preferred CLES.

_____

Personal Relevance	2.62
Uncertainty	2.81
Critical Voice	2.72
Shared Control	2.76
Student Negotiation	2.69

Most students responded positively to all 5 scales on the preferred CLES. My intension would be to adopt the constructivist methodologies outlined in each of the 5 scales.

During week 1, the guided question asked, what is waste? This was an important component to our planning and was not included in the 2000 planning. Asking students open-ended questions ascertained an initial understanding of the topic and then asking the same question later showed whether students had acquired additional understandings during the course of the unit. Fifty three percent of students wrote about food as waste, while 43% of students thought other things such as, paper, bottles, plastic bags, diesel

fuel, pencils, or water were items that sometimes could be used again depending on their quality. I felt the student's statements regarding food as waste and recycling could be attributed to comments made out of school and therefore learning at school linked to out of school learning. Consequently our unit on, Waste and Recycling matched the first scale of the CLES, learning about the world, where item 6 stated, *what I learn at school I can also do at home*.

At the start of week 2 students wrote about, what is recycling? In this instance, students had already viewed 2 videos that contained information about waste and recycling and students had visited the local council-recycling depot. The students' written information therefore related to these experiences. Some of the comments about recycling included, *recycling cars, cans are melted to make new things, items taken to the tip shop, glass melted to make new glass bottles and glass put into a furnace and melted*. One student wrote recycling *is where you use them over again and they go to a special place*. Another student wrote a similar comment, '*recycling is when a machine makes something over again*'. In hindsight the question, 'What is recycling' should have been incorporated with the waste question, as these new understandings were now evident in the students' comments. Students' prior understandings therefore should have been obtained prior to the introduction of new understandings about recycling, where an assessment task could have been undertaken.

The excursion did prove to be a valuable learning experience as some students remembered factors from this activity one year later. The spokesperson who delineated information about recycling, as part of the excursion, had an impact for some students. Students also had visited the local council depot on other occasions with their families as suggested from informal and formal discussions, while on the excursion and later in interview. The photographic display in the classroom foyer and comments students had written regarding their initial information on, waste and recycling provided a graphic reminder about the unit. Parents who waited for their child at the end of the school day also saw this visual display and often made comments to their child concerning their work. During week 2 the inclusion in the classroom of the portable

composting system also offered a practical and visual stimulus for environmental recycling. Few students however, remembered its significance when asked about their memory of the unit one year later. Many students did comment while doing the unit that they also had composts at home, therefore the inclusion of the composting system did link with their home lives. Recycling food waste was also introduced into week 2 along with discussions on where the food waste was destined. Many of these students already had poultry as some lived on large house blocks in the township or on farms and they often fed their poultry food waste. The excursion to the council recycling depot, the inclusion of a composting system and recycling food waste did have personal relevance for these students and linked their home lives to school learning and therefore fulfilled the CLES objective stated earlier.

The technology challenge of designing and making a recycling machine was ongoing over a 3-week period. Students were supported in the making of their machines by either a teacher aid or parent. Most students were able to describe how their machine operated and what it recycled. This indicated that students had a degree of understanding about recycling. I did not include the structured step-by-step procedural text writing for this age group as occurred for older students in 2000. Given the literacy levels of most these Grade 1-2 students, I felt this writing task would be too challenging. Peer and self-assessment procedures occurred after the completion of their recycling machines. This procedure assisted students to tease out their understandings regarding recycling especially when asked about how their machine worked or what it recycled.

Incorporating the school wetlands into the unit was incidental and not part of our original planning, however, the wetlands did prove to have a valuable connection to recycling. Students enjoyed the physical activity of pulling or cutting weeds and piling them into heaps to be composted. The wetlands component was an ongoing activity throughout 2003 and therefore consolidated and linked information gained earlier in the Waste and Recycling unit. Our Grade 3-4 buddy class shared De Bono's Six Hat Thinking in week 4, using the wetlands to use divergent thinking skills. This type of thinking,

showed a high level of sophistication, which our Grade 1-2 class had not yet encountered and therefore did not match their understanding. I hoped later discussions would unpack some of the ideas conveyed by our buddy class, however, confusions still persisted and consequently Six Hat Thinking was not pursued. In 2003 only our class and our buddy class utilised the facilities of the school wetlands. I felt in time these students may forget information gained whilst they were in these classes, unless they are exposed to future learning opportunities the wetlands can provide.

An activity integrated into weeks 3 and 4 was the adoption of a patch within the confines of the school playground. The purpose of this activity was to provide students with the opportunity to be responsible citizens by keeping a designated area of the school grounds free of litter. Students selected their patch in week 3, however, this activity was not rigorously followed through and the momentum and learning opportunities were consequently lost. Two explanations for not extending this activity more fully was the disjointed timetable where I was not always on class and an emphasis placed on literacy and numeracy activities.

The inclusion of frequent discussion sessions allowed students to verbalise their understandings about waste and recycling. One discussion that occurred in the latter part of the unit involved animal road kills. Most students had witnessed dead animals on the road and from these discussions students were able to make connections between composting vegetable matter and composting that included dead animals. It did answer the question, 'What happens to animals when they die'? Discussions also resulted following a book reading where concepts and information were usually unpacked. Each page of the big book, *Rubbish and Let's Look After Our World* (1994), provided students with additional information on waste and recycling. The use of literature provided students with additional understanding of the unit by relating information already acquired and linking it to students' own experiences.

In week 4 the activity of lunch box rubbish, indicated students' level of understanding about waste and recycling. Students were asked to assess their lunch boxes to show what can be recycled, what cannot be recycled and what they could do to have less lunch box rubbish. Recycled and waste items were later graphed. I firstly modelled this activity using my own lunch box items in order for students to gain an understanding. I also briefly showed how to do the accompanying work sheet where students needed to record their information. This activity, however, proved to be more challenging than first anticipated. In the class of 21 students, 33% required maximum assistance, 47% required some assistance while only 19% were able to proceed without assistance. To repeat this activity I would include fewer questions on the work sheet or alternatively students would use illustrations to show their understandings.

After the June holiday break students were given the actual CLES. This was done in small groups over a period of 1 week. Students had completed the preferred CLES at the commencement of the unit and therefore understood the procedure for the actual CLES. For the actual CLES I was more prepared to gauge whether students filled in the required 1 response rather than 2. One student made a comment when filling in the critical voice scale, item 16, which stated, '*It is OK for me to complain about anything which stops me from learning*'. The student's comment was, '*that complaining is not good*' and he responded negatively to this item. This comment suggested the interpretation of items could have different meanings for some students. A description of the included:

Table 10.2

Class Mean Scores for Each Scale on the Modified 2003, 30 Item Actual CLES.

_____

PersonalRelevance	2.70
Uncertainty	2.63
Critical Voice	2.65
Shared Control	2.60
Student Negotiation	2.70

Figure 10.1

Graphed comparison of 2003 preferred and actual class mean scores of the CLES.
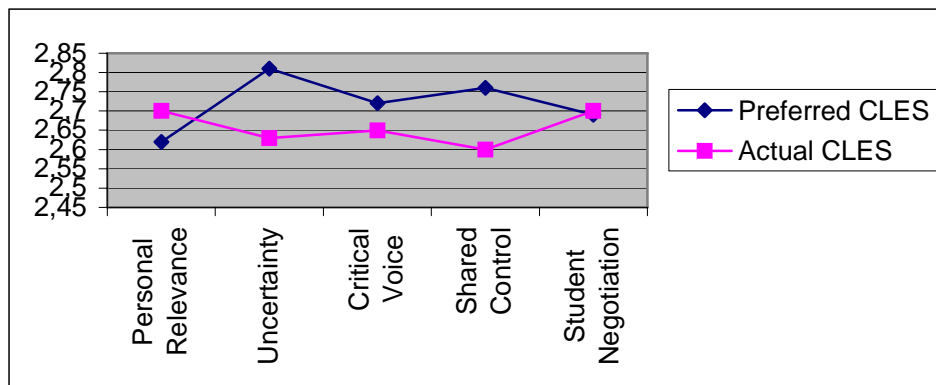
Table 10.3

A Comparison Between the Class Mean Scores of the 2003 Preferred CLES and Actual CLES.

_____

	Preferred CLES	Actual CLES
Personal Relevance	2.62	2.70
Uncertainty	2.81	2.63
Critical Voice	2.72	2.65
Shared Control	2.76	2.60
Student Negotiation	2.69	2.70

Interestingly the scores in the 2003 study are higher than in the 2000 study. This could be partly due to the perceptions younger students had on the classroom environment where they scored more often in the happy face section. It could also be due to the wording of the items where more concise language was used. Another interpretation could be a tendency for younger students to create a more positive outcome when directly in the presence of the teacher researcher.

The mean score results showed students perceived a personal relevance in their learning according to the actual CLES. The relevance would suggest the learning done at home related mostly to reading and writing. Reading and writing are encouraged for this age cohort of students to do at home. The Student Negotiation scale scored higher on the actual CLES than on the preferred CLES. This may be due to the encouragement given to students to discuss their problems or ideas especially in a whole group setting. In the scale of Uncertainty, students responded to items that included, making mistakes, a change in their work, change in work due to others, learning about people from other countries and getting new ideas. Information generated in this scale had not been covered in depth, especially learning about people from

other countries, which could explain the low score for this scale. In the scale of Shared Control, there was a steep decline in the preferred CLES score to what students perceived actually happened in the classroom. This scale stated, *students help plan activities*, *decide which activities are best for them and help the teacher to see how well they are going in their learning*. The colleague teacher who shared my classroom did an assortment of activities every afternoon. During activity time it was the colleague teacher who assigned the activity choices to our students. Activity choices mostly consisted of painting, cutting, gluing, drawing or needlework. When questioned, students generally explained how they had improved in the activities of drawing, painting or gluing.

The subsequent chapter detailed limitations experienced when using the CLES during the 2 studies. Mentioned also are the limitations experienced in other educational settings.

CHAPTER 11

LIMITATIONS OF THE CLES

A limitation I experienced using the CLES to gauge constructivist reform was the age cohort of the students in both the 2000 and 2003 studies. The age of students often limits their understanding especially understanding the language contained in some items. I felt more reliable results could be achieved with older students where their comprehension especially in items 1-9, would be more sophisticated. For example, in the Personal Relevance scale the wording of item 1 is similar to item 4. These 2 items could be interpreted as being repetitive. The items read:

In Learning about the World.

Item 1, '*I learn about the world outside of school'*.

Item 4, ' *I get a better understanding of the world outside of the school'*.

Another limitation in both the 2000 and 2003 CLES was the number of items. In both questionnaires a total of 30 items were used. This could have been reduced to 4 items per scale, giving a total of 20 items altogether. This would have reduced the time taken to complete the questionnaires and also address the issue of their limited attention span. I would recommend before younger students undertake questionnaires such as, the CLES, teachers give clear and meaningful explanations to each item and what that item means. This could clarify any misunderstandings in interpretation. The wording of item 1, *the world outside of the classroom* could be seen as ambiguous for younger students. The words *home life* were consequently substituted to represent a more meaningful interpretation of life outside of school. Along with a change in emphasis from the *world* to *home* decreased the amount of words used in the sentence therefore simplifying the language and improving understanding.

Table 11.1

Examples of Word Changes in the Two Studies.

_____

	2000 CLES	2003 CLES.
	1) I learn about the world outside the school.	I learn things at home.
	2) My new learning starts with how to solve problems outside of the school.	I can work things out at home.

An intention of the CLES was to disclose teaching practices that could improve instruction according to constructivist principles. A limitation for using the CLES could be the number of participants in both the 2000 and 2003 studies. A larger participation response could have altered the concluding results due to more divergent opinions. However, as this survey is intended to gauge the opinions of a particular class of students their judgments are central to the teacher researcher and what is achievable in that classroom setting.

The results of these 2 studies indicated how individual classes could differ in their interpretation of items due to comprehension and class structure. Differences in student perceptions were also demonstrated in Dawson's (1994) action research study of 2 Grade 10 classes, referred to as class B and class C. Dawson undertook a collaborative action research project as part of a professional development program in a Perth metropolitan independent all girls secondary school where Dawson taught science. Part of Dawson's teaching requirement was to design a compulsory Grade 10 biotechnology course and provide students with the opportunity to discuss important ethical issues associated with human organ and tissue transplantation, policies and practices.

A fundamental tenet for Dawson was the reshaping of her pedagogy to incorporate key principles of constructivism and critical theory. Some of the strategies employed by Dawson was the abandonment of end of year assessments and course grading and in its place introduce a more emancipatory approach. This was done by reducing the power differential between teacher and student and promoting a caring and sharing relationship with her students. Several students were selected for interview and completion of the CLES. Comparisons were then made between the 2 classes.

Conclusions drawn from Dawson's study were both classes generally had positive learning environment perceptions and were identical on the two scales of Personal Relevance and Critical Voice, however, there was a variance in Shared Control and Student Negotiation. Class C was more in favour of the change in pedagogy than was Class B. Some students in Class B did not appreciate the relevance of the activities and were more focused on factual content. They also perceived a lack of opportunity to control their own learning, responded more positively when the lesson goals were relatively explicit and straightforward and when the class was more 'teacher-centred'. When this occurred there were fewer opportunities for self directed learning activities and fact gathering was considered a better option as it added to their store of knowledge. Class C was more willing to share their private thoughts and realised their views were listened to in an empathetic manner. Generally in this class students felt that they could express their feelings and ideas forcefully and constructively especially about the issue of 'life and death'. Both classes had positive learning environment perceptions and were identical on 2 key dimensions of the CLES, Personal Relevance and Critical Voice. Open discussions therefore became an important component in the implementation of a constructivist agenda.

Johnson and McClure (2000) used the CLES as part of a teacher educators' study into how student teachers performed after leaving five teacher training institutes in Minnesota, USA. The CLES was used in an attempt to find teachers' perceptions of the learning environment of their classrooms. Four versions of the CLES were used, one each for science, maths, teachers and

students. It was administered to a wide range of people, including in-service and pre-service elementary and secondary science and maths teachers and elementary and secondary science and maths students. After an extensive analysis of the data, it established that the CLES provided information about teachers' and students' perceptions of their classroom environment especially when used in conjunction with interviews and observations. As a consequence of the study 2 versions of the CLES were compiled. The first version consisted of 30 items similar to the version undertaken in my study and the second version was reduced to 20 items with 2 items from each scale deleted.

Items were also reworded in version 2 and a negative worded item that appeared in version 1 was eliminated. In version 1 in the scale Personal Relevance the negative worded item stated, '*what students learn has nothing to do with their out-of-school life'*. A similar item in version 2 was positively worded, '*students learn how science is a part of their in-and outside-of-school lives.'* The re-wording of the item from a negative into a positive statement as occurred in version 2, appeared easier to comprehend. This version would also take less time to administer given the reduced number of items. In hindsight, this version would have been a better option to administer to my younger students than the 30-item option given to my students in both the 2000 and 2003.

The CLES provided teachers with some understanding of important parameters of constructivism, which included a critical theory perspective, however; it does not indicate to teachers how students' understandings have improved during a unit of work. The implementation of assessment strategies such as, brainstorming before and after a unit, written information (fiction or non fiction), assembly presentations, dramas, visual art presentations and science experiments could all be used to assess students' understanding. The introduction of a rubric grid designed to match negotiated criteria for a curriculum area can be a powerful assessment tool especially if students are influential in creating the criteria. It is important to have a measure of students' understandings before the introduction of the topic and then a

measure on completion to ascertain any gains in understandings or misconceptions.

In the 2000 study observations, discussions, and written information formed the basis of whether these Grade 3 students had increased their understandings about being safe in the sun. A similar procedure occurred in the 2003 study where brainstorming and written information for the guided questions formed the basis for ascertaining prior knowledge. At the completion of the unit, 4 weeks later, a second brainstorming session and written information was not undertaken due to time constraints. By not including these activities valuable insights into student understandings was not realised. In an attempt to follow up the 2003 study students were asked 1 year later what they remembered about the unit, Waste and Recycling. Transcripts of the interviews indicated some students did remember aspects of the unit whereas other students remembered very little. It can be deduced from these studies that understanding is tentative and undergoes constant re-construction or elimination depending on whether that knowledge is purposeful or not.

A detailed analysis of both the 2000 and 2003 units is described in the following 2 chapters. Flaws in their design are disclosed and alternative activity choices are suggested.

CHAPTER 12

ANALYSIS OF THE 2000 UNIT

In 2000 my lesson and unit planning followed the Science Curriculum Teaching and Learning Planning Guide proforma (1995). The activities for this unit were developed in conjunction with a colleague teacher. The design of the unit, Sun Safety, closely followed other units planned that year and in previous years. Activities were generally activities my teacher colleague or I had previously done and found successful, had located in teacher references, or compiled during professional learning programs. Assessments undertaken in 2000 at the commencement and then at the end of the unit indicated that students had acquired additional understandings about sun safety and therefore degrees of constructivism had occurred. Assessments included, brainstorming before and after the unit, written information during the unit, artwork and an assembly presentation. The use of questioning and activities that promoted deeper levels of thinking such as, Six Hat Thinking was only vaguely known in 2000. I felt my planning in 2000 generally went beyond the expectations required of most teachers during this period, as informal and formal written comments suggested. My 2005 principal, when presented with my full years planning at the start of 2001, suggested I share my planning methodologies with other staff members, as it showed depth. I declined the offer as my planning contained extensive documentation, which many teachers would have refused to undertake.

Detailed in my planning on Sun Safety were 3 aims: 1) to be able to show that the sun is unsafe in the hotter seasons; 2) to encourage the use of safe practices when in the sun; and 3) to be able to identify skin types, eye and hair colour which contribute to skin cancer. During the duration of the unit I was unaware of linking these aims to the designated activities, which was an important component in the 2003 planning. An activity used during the 2000 planning which did not link activities to the aims included, identifying peoples' work associated with sun safety. This activity could have been more closely linked if

reworded. The new re-worded question could have been written, how can people who work outdoors protect themselves especially on hot days? An activity linked to this question would be, students interview various people who work outdoors to ascertain their sun safe practices.

An alternative to brainstorming could include students in a positive, minus and interesting (PMI) activity, where critical thinking would be involved. For this activity, students give positive, negative and interesting reasons for sun safety. This would allow students to operate at the analysis and evaluation levels of Bloom's Taxonomy. Social interaction could also be achieved through a place mat activity where students are seated at a table and write on a large sheet of paper, in a designated area, their understandings regarding the topic of sun safety. When group members had completed their information then dialogue would be encouraged to share these understandings. Each group would then select important information to share with the whole class. Alternatively, students can rotate between groups adding information already compiled on the paper and then this additional information is discussed at a whole class level. This type of activity would therefore involve the CLES scale of Student Negotiation, where students' thinking is shared both at a group and class level. Using these types of activities enhances students' recall of information and augments their knowledge or understandings about a topic.

The extended use of thinking and questioning I felt was a failing in my 2000 planning. Using Bloom's Taxonomy, however, could provide a reference to develop deeper levels of thinking and questioning. In Bloom's Taxonomy, thinking levels range from basic recall of knowledge to activities that promote higher order thinking skills. According to McGrath and Noble (1994), Bloom's model fall into 2 broad classes. The first class contain activities and questions that involve remembering, checking on understanding and applying what students already know. In Bloom's model these levels are knowledge, comprehension and application. The second class contained higher order critical and creative thinking. McGrath and Noble (1994) described questions educators could use to induce thinking at the various levels. These included:

Bloom's Levels	Types of Questions
Knowledge	What is..? Where is…? When did….happen?
Comprehension	How would you compare? What is meant by?
Application	How would you use? What would result if?
Analysis	How is .. related to? What ideas justify?
Synthesis	How would you improve? Can you predict…?
Evaluation	How would you test? What would you recommend? (p. 22)

The website *(http://emifves.iservfer.net/fromnow/nov97/toolkit.html) Online Toolkit* (1997) stated questioning should be introduced as early as Kindergarten to allow students to improve their repertoire or techniques of questioning. Questions, which are essential questions, help define what is meant to be human and most essential questions are interdisciplinary. All other questions serve the purpose of casting light upon or illuminating the essential question. Extending from the essential question are subsidiary questions that combine to help build answers to the essential questions. New knowledge is therefore constructed by the skilful use of questions where big questions lead to smaller questions. Subsidiary questions could involve brainstorming a list of questions from the essential question or taking a list of question categories to generate questions for each category.

Using this technique of generating smaller questions from a big question and thus probing more deeply into a topic could be interpreted as reconstructing misconceptions into more valid conceptions. The reconstruction of misconceptions, conversely can be challenging, as stipulated in Taylor. Taylor (1996) believed students find it difficult to change entrenched misconceptions.

Engaging students in epistemological inquiry, that makes sense of the world, could be a way of achieving a reconstruction of misconceptions.

My planning in 2000 did not adequately allow students to engage in epistemological inquiry by using different levels of thinking or questioning. Activities were mostly done in isolation and were not linked with a common understanding, such as using a concept that allowed students to build understanding or reconstruct misconceptions into more valid concepts. In 2000 I planned units of study according to topics outlined in the school's 1996 science curriculum design. The science curriculum correlated to the 1994 National Curriculum, where topics linked from 1 year to the next. Most teachers, however, in the 2000 school did not follow the same curriculum pathway and often engaged in their own personal planning preferences. This meant there was not always a continuum of understandings from 1 year to the next. My 2000 lesson planning was therefore a culmination of prior lesson planning attempts, which appeared to incorporate elements of constructivism. My planning however, lacked the essence of questioning and thinking as described in my 2003 planning methodology.

CHAPTER 13

ANALYSIS OF THE 2003 UNIT

In 2000 most teacher's planning entailed a personal perspective, which had elements of self-doubting, isolationism, internalising and diminutive professional feedback. In 2003 planning enlisted the collaborative efforts of educational personnel from senior staff members at a school level to personnel with specific expertise in planning at a district level. The introduction of the Essential Learning Framework 1 (2002) and 2 (2003) emphasised the inclusion of questioning and thinking into our lesson planning, which had the potential to enhance students' understanding of a topic. Planning using the Essential Learning focus emphasised the inclusion of, values, purposes, links to the curriculum, clear interpretations of performances of understanding, reflection of our planning, and an extensive resource list. In 2003 individual schools were also attempting to link concepts and their associated understanding from 1 year to the next, which indicated a concerted effort towards stronger forms of constructivism. The planning journey was now a shared journey where educationalists became embroiled in the same dilemmas and where these dilemmas could be voiced openly and equally.

The collaborative planning team in 2003 consisted of 2 other teachers and myself. Planning was done mostly after school during a specified planning time. This time however, was not always conducive, as team members often had other commitments and therefore planning comprehensively and thoroughly was not always achieved at a considered level of proficiency. In 2003 activities needed to link to a guided question and also to the understanding goals. Details of activities from previous units were retained on the computer and therefore could be modified to form a new unit. This had occurred using the unit on Friendship, which had been completed earlier. Our collaborative team felt it unnecessary to retype activities and therefore adapted activity ideas from the Friendship unit for the new unit of, Waste and Recycling.

Our collaborative team had not thought through a description of the main purpose for this unit. The Essential Framework 1 (2002) implied we share our purposes of ensuring our students learn to relate, participate and care. The framework also outlined that students should learn to think, know and understand. On reflection at no time during the course of the unit was a purpose for doing this unit mentioned to our students. This appeared to be a recurring failure in my teaching practice. I first became aware of this failing during a 2001 professional learning session. In this session participants were shown a videotape of a Preparatory mathematical lesson. Participants at that professional learning session critiqued the lesson and suggested I include a purpose for the mathematical activity.

Our collaborative team in 2003 had not made provision in any of the activity choices to engage students in any decision-making before, during or at the end of the unit. Decision-making formed an important component of the CLES scale, Shared Control. This scale recommended students help the teacher plan what they are going to learn, how much time is spent on activities, help the teacher decide how they are learning and activities that best suit their needs.

The inclusion of explicit teaching of concepts was also a failing in our 2003 planning. This was a failing across the whole school where most teachers' planning had not included or isolated key concepts, which are encapsulated in the Essential Learnings. The inclusion of concepts as part of a whole school focus had been discussed in staff meetings however, getting a whole staff consensus was difficult. I felt all teachers needed to plan around common concepts, which would be agreed upon before the start of each term. Some Tasmanian primary schools had already structured their whole school curriculum to include concepts.

One inner city Tasmanian school had attempted to isolate key concepts to unite teachers' planning. In a July 2003 professional learning session titled, '*Using Rich Concepts as a School-Wide Thread for Working with the Essential Learnings'* participants were shown how to include a concept-based

curriculum into their school. Participants were told concepts provided a lens to view the big picture within a topic and are central to our understanding of the world. Participants were also taken through the procedures on how this school's staff arrived at a whole school approach to a concept-based curriculum.

Firstly, participants were given an example of a 1 word concept such as, *responsibility* however, in a whole school situation this concept would have been derived through a democratic decision making process. Open-ended questions were then devised from that concept. Participants were paired to share their responses. For the concept of responsibility, the types of open-ended questions could include, what is responsibility? What does responsibility look like? How can we get responsibility? Where can responsibility be found? The paired groups amalgamated into a larger group where 2 open-ended questions were agreed upon and shared with all participants. A subjective analysis of the displayed questions was then grouped into like categories. A group discussion agreed on a throughline that became the essential question in a whole school context. In this session, the fundamental question became, *who and what are we responsible for?* This question would then become the focus for a whole school throughline and unite all teachers' planning. In a school context, this process would undergo many discussions before a consensus was agreed upon for a specified throughline. Participants at the professional learning session underwent a brainstorm to list topics that correlated to the specified conceptual question. These topics included, civics and citizenship, local government, environment, animals or pets, recycling, people in the community, voluntary organisations, refugees, personal responsibility or personal safety.

Once a consensus for a common whole school throughline had been achieved, teachers formed collaborative planning groups usually corresponding to their grade group. Planning groups then negotiated a selection of age appropriate understanding goals, which would become the driving force for their unit. Teachers were then free to choose a topic incorporated within the conceptual question, which would be appropriate to their teaching expertise and to the

interests of their students. Teachers were also not limited to taking just 1 topic during a term but could undertake several topics all with the same throughline. It was also suggested the same throughline be revisited in consequent years to provide the essence of a school-based curriculum that built upon these conceptual understandings.

Using concepts as a school-wide curriculum thread was still a work in progress for this school and modifications or alterations were constantly under review. Further questions arising from the professional learning session included, what concepts would be considered as important or rich? How does the school ensure that all students are exposed to or understand all the rich concepts during their seven years at a school?

The inclusion of a concept-based curriculum also became apparent during a further July 2004 professional learning session, titled, '*Why is thinking at the heart of the Essentials*? It was stated at this session the Essential Learnings was a concept-based curriculum that takes students beyond the facts. Embedded in the outline of each element of the Essential Learnings was a collection of concepts, which needed to be unpacked. The Essential Learnings Assessing Guide (2005) outlined what individual teachers' plans should reflect:

> Individual teachers' plan should reflect the whole school curriculum design plan. It is also important for teachers to keep records of the scope and sequence of their curriculum plans and how these might be developed over time into studies that build cumulative understanding about a significant concept. From teachers' records, schools can plan for a balanced and sequenced program from year to year, ensuring that students learn about the key concepts over the period of their schooling (p. 30).

Unpacking concepts however, can be subjective. I attempted to unpack the concepts within the element *Creating sustainable futures* and compiled the

following list, economic decisions, individuals, communities, nations (laws and policies), making careful choices, ecological sustainability, personal action, worth of natural environment, sustaining biological diversity, sustainable development, enhancement of our physical resources to maintain quality of life, interconnectedness, interrelationships, cycles, diversity and change.

It was also stated at the July professional learning session, education in the past had become fragmented and for deep understanding to be achieved our brains need to make connections between information. The inclusion of a concept-based curriculum had the potential to develop understanding by connecting information via concepts. It appears constructivism would exist in the design of a concept-based curriculum where concepts are used to build understandings from one topic to another.

Erickson (2002) suggested, "using a conceptual lens in a topic of study creates a metacognitive study that goes beyond the evaluation and memorization of information" (p. 66). Thus the focus of teaching and learning can encompass many topics with each topic having the same basic concept where understanding can be developed. The topic becomes the vehicle or as Murdoch (1997) suggested, "concepts provide an umbrella to allow students to apply new knowledge to past knowledge" (p. 18).

In the July professional learning session it was suggested teachers could plan multiple topics and include the same concepts selected from the whole school throughline. Topics could include, water, mining, forests or dinosaurs. Concepts that connect each of these topics could include, personal safety, conservation, survival, interdependence, interaction, interconnectedness, interrelationships, cycles, diversity, change and well-being. In the 2003 unit, Waste and Recycling, concept examples could include, citizenship, conservation, environment, imagining and constructing a better future, living and non-living, personal safety, resources, roles, rules and laws, survival, change, cycles, personal action, making careful choices, maintaining quality of life, interconnectedness, interrelationships or well-being. From an early

childhood perspective, it would be beneficial to include only one concept at a given time. Multiple concepts would create confusion with younger students hence jeopardising their understandings.

Contained within our planning, 'Waste and Recycling' were 3 key understanding goals. These goals included, 1) accepting responsibility for the care of the environment 2) to understand how changes impinge on the environment and 3) to make careful choices regarding the environment and future needs. In retrospect these understanding goals were too extensive as they included 3 concepts, personal action, changes and making choices.

Limiting concepts would be an intention of future planning. This would allow planning to be more focused with the inclusion of fewer activity options. Listed in the Waste and Recycling unit were 8 tuning in activities, however, only 5 of these were completed. Tuning in activities did not always reflect the intentions of our understanding goals, as three completely different understanding goals were listed. In guided inquiry 18 activities were listed, however, only 7 of these activities were undertaken. Those activities undertaken did not always encourage deep levels of understanding as shown by the lack of sophistication in the work products. Drawing conclusions, the final phase of our 2003 planning, 9 activities were listed but only 4 were completed. For these activities students were not always totally engaged in a deep level of understanding nor did the activities match our understanding goals. In total 43 activities were listed in our 2003 planning however, only 20 were accomplished. Only 10 of the 20 activities undertaken were done satisfactorily, this indicated that we over planned and included activities, which were not purposely inspired.

Another dilemma that existed in our 2003 planning was assessment. A brief gauge of initial students' understandings included, brainstorming, written work, art products and oral presentations however, there was a lack of concluding assessments to ascertain improved understandings.

When the 2003 students were asked in 2004, what they remembered about waste and recycling, some students had vague or no memory of the unit although we had spent 5-weeks on it. Sewell (2004) argued, "teaching does not necessarily equal to learning and the constructivist theory informs us that teaching does not equal learning" (p. 22-5). In Sewell's 2002 study of Year 9 students at a middle school in Western Australia, on the topic of magnets, she found students make a choice what to do with the new information and often they reject the information outright especially if it does not fit with pre-existing knowledge. Sewell's study indicated when students come into a learning situation and are presented with new information that differs from their pre-existing information, students deal with it in 4 different ways. Firstly they delete the pre-existing knowledge, second they modify the pre-existing knowledge so that it fits the new information, third the modified new information will fit the old knowledge and fourth students reject the new information. Sewell suggested, as teachers we also undertake the same process as our students, we either disregard new information especially if it conflicts with what we already know or accept it if agrees with pre-existing information.

Sewell believed learning involves choices and should be active where students are actually doing something with the new information. Active learning promoted by Sewell included a focus on problem solving, creativity, gathering evidence to find answers, open ended investigations, that allows students to find out their own information from various sources and with the teacher acting as guides or facilitators rather than imparters of knowledge. Sewell also suggested teachers need not have all the answers and there should be a shift in focus away from content.

Given the information outlined in the preceding chapters it follows that I plan units that are in congruence with the Essential Learnings Framework 1 and 2 and guiding principles of constructivism. Chapters 14 and 15 consequently attempt to improve the 2000 and 2003 units and include elements that could be described as constructivist.

CHAPTER 14

REVISED PLANNING OF THE 2000 UNIT

The activities and methodology described in my 2003 planning incorporated collaboration with other teachers and ideas from the latest documents however, it also resembled past planning efforts. The intent of the 2003 planning was to incorporate the reform agenda espoused by the Essential Learnings Framework 1 and 2, but this was poorly accomplished. I therefore propose a strong purpose in this thesis is to re-create lesson and unit planning that can be used for future reference and reflects the intentions of constructivism and the essence of the Essential Learnings Framework 1 (2002) and 2 (2003). Dewey (1963) suggested:

> A genuine purpose always starts with an impulse. A purpose is an end-view. That is, it involves foresight of the consequences, which will result from acting upon impulse. Foresight of consequences involves the operation of intelligence. It demands in the first place, observation of objective conditions and circumstances (p. 67).

Redefining the units done in 2000 and 2003 using the intentions of constructivism, ideas obtained through professional learning programs, the collective ideas of colleagues and the guidance of the Framework documents has lead to the following reconstructed units. Both units have undergone extensive revision, however, I stress these units are by no way perfectly transformed and would require regular reflection to ascertain the worth of activities and assessment procedures. Wherever possible the intentions of both the 2000 and 2003 planning have been retained to provide a link with past planning methodologies and new planning methodologies.

The 2000 unit, Sun Safety, was described before the introduction of the Essential Learnings Framework and consequently had to conform to the

language and essence of the new curriculum. The revised unit planning has been divided into sections as described in the 2003 planning proforma and retains the language used in those proformas. The description of the revised unit planning however, has been modified to include a concept as outlined in the July professional learning session. The revised unit planning included references from, Murdoch, (1998), Blythe, (1998) and the Essential Learnings Framework 1 (2002) and 2 (2003). The unit has been described under the key element of *maintaining wellbeing* in the Essential Learnings of *personal futures*.

Revised Planning for the 2000 Unit

Unit suitable for <u>Lower Primary</u> Students.
Time duration for the unit, approximately 6-8 weeks.

Unit Title: *Sun Safety*

Core Value: *Responsibilty*

Core Purpose**:**   *Learning to live full healthy lives*

Essential Learnings: *Personal Futures*

Key Element: *Maintaining Wellbeing*.

Throughline: *What does it mean to be safe? (concept; safety)*

Understanding goals:
   1) How can we decide when the sun is not safe? Students will understand that during the hotter period of the year the sun will be unsafe.
   2) What makes us unsafe in the sun? Students will understand that certain factors contribute to us contracting skin problems associated with too much sun exposure.
   3) How can we be safe in the sun? Students will understand that we need to make wise choices and be responsible in order for us to minimise skin damage.

Thinking and Communicating Goals:

4) Students will clarify their thoughts about sun safety using inquiry and reflective thinking.

5) Students will use listening, viewing, reading, speaking and writing to reflect on the importance of sun safety.

A number for each of the above stated goals has been recorded next to most activities to link that activity with the intended understanding goal/s.
Discuss a purpose for undertaking a unit about Sun Safety. Record student's comments .

Tuning In Activities:

Ascertain students' prior understanding regarding the concept of safe and the essential question, *what does it mean to be safe*? Enter into a short dialogue with students to stimulate their thinking about safety. Use brainstorming and document students' understandings, these understandings will be referred to at the end of the unit using a second brainstorming to ascertain additional understandings.

From the concept safety discuss how could we be safe in the sun. Students either write or draw their understandings about sun safety. The writing and or drawing task could be done in either a designated book such as a learning journal or on paper sentence strips, which are then displayed. At the completion of the writing and or drawing task students then share their understandings with a partner in a think-pair-share activity. Feedback from partner combinations would focus on important points raised during discussions.

Assessment during the tuning in phase would consist of students' written and or drawn work samples regarding their prior knowledge about sun safety. Regular entries in a designated book during the course of the unit would indicate students' evolving understandings.

Introduce a concept attainment activity on sun safety. Have a group of items that are placed in either a section labelled *Yes* or *No*. Items to be included in the *Yes* section: t-shirt, broad brim hat, sunscreen, photographs of shaded areas, all in one swim costume. Items to be placed into the *No* section include, tank top, baseball cap, no protective shade photographs, coconut oil, board shorts or bikinis. After the placement of some of these items into the sections labelled *Yes* or *No* students in consultation with a partner would ascertain why these items have been placed accordingly. The use of questioning to ascertain students' understanding or reasoning of the placed items would therefore be necessary. These items would be retained as an interactive visual display and added to during the duration of the unit. Discussions would be used to further students' understandings about sun safety using the items as a reference at the conclusion of the concept attainment activity. Recorded teacher observations would be necessary during this activity to ascertain students' understanding about the sun safety concept. These recorded observations would be ongoing throughout the duration of the unit.

Finding Out Activities:

* View and discuss the poster titled *Spot the Difference* (1993) and read the booklet *Skin Cancer and You* (1989). Display this book and other material obtainable from the library or Tasmanian Cancer Council. (Relates to goals: 1, 2, 3, 4, 5)

* View and discuss the videos, *Safe Sun, Safe Skin* (1989) and *Your Skin and the Sun* (1988) (Goals, 1, 2, 3, 4, 5)

* Invite a representative from the *Cancer Council* to discuss sun safety. (4, 5)

* Painting/plasticine models on how to be sun safe. (3, 4)

* Design a class questionnaire for home interview. Ask about products or practices at home for sun safety. (3, 4, 5)

Sorting Out Activities:

* Explain what people can do to keep them safe when in the sun. (1, 2, 4, 5)

* From information contained in the videos and from the guest speaker summarize what you know about sunscreens, hair, eye and skin types. (1, 2, 3, 4, 5)

* Students share their information found at home about sun safety and plan for future action. (1, 2, 3, 4, 5)

* Role-play using a scenario of being safe when in the sun. Students ask questions from participants about their role-play. (3, 4, 5)

* Using plus, minus and interesting (PMI) about sun safety products or issues, discussed and then transfer understanding onto paper. (1, 2, 3, 4, 5)

* Technology, design, make and appraise a device that can make you safe from the sun. Enter your findings into a technology book and share your design with other students. Peer assessment of design and possible improvements or modifications to the design. (4, 5)

On-going assessment of activities done in finding out and sorting out phases consist of, observations of skills acquired by students in analysing, co-operating, designing, explaining, interpreting, viewing, questioning, revising, locating information, performing. Retain the PMI activity and use for further direction.

Drawing Conclusions Activities:

Read the book, *What's Wrong with Casey's Cat?* (Purcell, 1997). Engage students in a community of inquiry using the concept of animal safety. Prior to taking a community of inquiry, students would have rehearsed the procedures beforehand on other texts and concepts. In a community of inquiry students think of a question that is puzzling them whilst the book is read. At the conclusion of the book reading student questions are listed, grouped, and then a choice is made about which group they would like to discuss. As the discussion evolves, further questions often will be asked. During the discussion students could be asked to clarify their question, probe assumptions, probe reasons and evidence, probe implications and consequences, viewpoints or perspectives and questions about the question. Some questions could include, how could you change what has happened to the cat? What would

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happen if Casey's cat were a different colour? Suppose you were Casey, what would you do for her cat? (1, 2, 3, 4, 5)

Share suggestions for future action regarding information gathered at home about sun safety. (2, 3, 4, 5)

Reflection Activities:

Students create a poster, board game or brochure outlining how to be safe in the sun. (1, 2, 3, 4, 5) Use a self and peer assessment for the end product.

Culminating Performances:

Revisit the brainstorming done at the commencement of the unit. Add students' understandings and compare their initial understandings to the end of the unit understandings. A further development of the brainstorming could be a place mat activity where large sheets of paper have been strategically placed around the classroom. Groups of students discuss the concept of sun safety and record their understandings on the paper. Students share their understandings after a designated time. (1, 2, 3, 4, 5)

Written understandings about sun safety can be recorded in a designated book. Students would need to give reasons why we need to be safe in the sun, the inclusion of evidence, this could be from previous activities, and make predictions for future actions. (1, 2, 3, 4, 5) Understandings can then be shared and assessed either by themselves, peers or teacher.

Presentation of a succinct presentation item involving specific information students have acquired during the duration of the unit. This could be done as an assembly presentation.

Resources:

Australian Cancer Society. (1989). *Skin Cancer and You*. Booklet. Tasmania Cancer Committee. Hobart.

Australian Cancer Society (1993). *Spot the Difference*. Poster. Tasmania Cancer Committee. Hobart.

Geneva, 111. Learning Seed (Publisher). (1989). *Safe Sun, Safe Skin..* Videocassette (42 mins).

Higgins. A. (Publisher). (1988). *Your Skin and the Sun*. U.S.A. videocassette (13 mins)

Purcell, F. (1997). *What's Wrong with Casey's Cat?* Victoria. Bookworths Printing Pty. Ltd. (Book)

Guest Speaker: From the Cancer Council, Tasmania.

To ascertain whether the Sun Safety unit adequately described the Essential Learnings methodology, I asked a colleague with extensive experience in planning using the Essential Learnings Framework to provide a critique of this unit. Utilising a 'critical friend' to provide feedback on planning units was also described as an option on the Tasmanian Education Department website with links to the Learning, Teaching and Assessing Guide. One Project School had used the critical friend option in their planning process, rather than always using the collaborative planning group process. A critical friend could provide feedback for planning, teaching and assessment and therefore the aim of collaboration could be substantiated. Establishing a critical friend partnership, as suggested in *Schools for the Future* (2004) had a number of stated purposes such as:

- Critically examine a teacher's own practice.
- Reflect on their continued professional learning.
- Receive informed, in-depth feedback.
- Fine-tune planning, teaching and assessment.
  The critical friend should also look for opportunities to ask questions that encourage their partner to delve deeper to clarify their own goals and understandings. The critical

friend should also provide opportunity to articulate issues surrounding planning, teaching and evaluating the context of their own classroom program and make explicit:

- The goals they have for their planned teaching sequence.
- The reasons why the content they are teaching is 'Essential'.
- How the unit promotes deeper understanding.
- How they will know whether students have developed deep understanding (p. 2).

The critical friend did find omissions, questions, sequencing problems and a need for clarification in my revised planning on Sun Safety. It was suggested activities follow the sequence of, tuning in, finding out, sorting out and drawing conclusions. This allowed evolution of understanding through the different phases. Throughout the unit the critical friend recommended students be informed about the purpose of an activity, add their suggestions or recommendations, be involved in their own assessment and question the influence of the media on their thinking.

My critical friend alerted me to omissions within the unit, the first omission was not linking a key element outcome into the appropriate standard for the element maintaining wellbeing. The Essential Learnings Framework 2, (2003) described standards as:

The 5 standards, together with the Foundations for each Essential Learning, cover the period from birth to 16 years. Each describes what students should know, understand and be able to do (p. 4).

In the unit Sun Safety, intended for lower primary students, the appropriate element outcome would be standard 3. Standard 3 describes outcomes suitable for students aged between 8-10 years and spans Grades 3-5. The key element outcome for standard 3 provided an assessment objective to ascertain student's understanding and guide my planning. The Essential Learnings Framework 2

(2003) described the maintaining wellbeing key element outcome for standard 3 as, "students understands the scope of personal choice in weighing up competing factors when making wellbeing decisions for themselves and others in their immediate environment " (p. 8).

Another omission my critical friend found was the wording of the questions in the understanding goals. In the first three listed understanding goals I commenced two of these goals with a *how* question. It was suggested that the first understanding goal be changed to a *why* question such as, why do we worry about the sun? This type of question would promote divergent thought.

The wording in the thinking and communication goals also needed to become more specific. My critical friend recommended I use mostly inquiry thinking and to make thinking more visible within the classroom by using a wider range of words to describe thinking. The Essential Learnings Framework 1 (2002), described inquiry thinking as asking good questions, setting goals and planning and following a course of action. Students needed to understand the value of inquiry when dealing with issues, events and actions and evaluate relevance, reliability, truth, accuracy and effectiveness especially in the age of consumerism and with information access. Inquiry thinking also incorporated the ability to identify problems and their context, purpose and have a desirability to improve the problem.

The second goal of communicating, needed to be more specific. For the purpose of assessment my critical friend felt that students speaking about their understandings would allow me to gain insights into what they knew. The explicit teaching of oral presentations would need to be addressed and rehearsed by the students before a final assessment could be undertaken. Collecting written or visual art samples throughout the unit would also provide me with evidence of students' understandings.

During the tuning in phase I had stated brainstorming would be a way of stimulating students' thinking about safety. In past brainstorming sessions I would ask all students what they knew about a concept and then scribe their

understandings on a large piece of paper, sometimes asking for clarification if their answer was obscure. Generating as many ideas as possible using one idea to stimulate other ideas could enhance this procedure. At the conclusion of this procedure a review of ideas would be done to evaluate their value or merit.

My critical friend emphasised the need for ongoing assessments, which would be explicit to the students, have a defined purpose, and be authentic. The unit I presented to my critical friend was deficient in the detail of ongoing, authentic assessments. I therefore needed to research more deeply into the types of assessments that could be utilised. The recording of student assessments on a specially designed computer report program would form a fundamental focus in 2005 to inform educators and parents about students' learning and progress. Assessments for 2005 would be matched against the key element outcomes of inquiry, communicating (literacy, numeracy) and maintaining wellbeing. In 2009, it would be an expectation that teachers would report against 9 elements in the Essential Learnings.

Reports in The Mercury newspaper on three consecutive days in late October 2004, alerted readers to the concerns teachers had about the introduction of both the new curriculum and new assessment procedures. The Mercury (21/10/04) stated:

> Teachers are unprepared for the radical overhaul of Tasmania's educational system. New assessments for students from Kindergarten to Year 10 will be enforced next year. Traditional subject divisions have been replaced with topics of Thinking, Communicating and Social Responsibility. A survey of 1334 teachers across the state by the Australian Education Union, 92% said they did not have a good knowledge of the marking system. More than half of primary teachers and three-quarters of secondary teachers surveyed said they had little or no knowledge of the new system. ….. If teachers are struggling with this new, obviously bureaucratic driven reporting system, how does the minister expect parents to make head or tail of

their child's report cards? Commented the opposition shadow minister for Education. (p. 1)

In my 2005 school, teachers expressed similar concerns with the reporting system. The teachers felt they were also not prepared to assess adequately in the areas of thinking and maintaining wellbeing. In preparation for this new reporting system the Tasmanian Education Department allocated 5 full professional learning days during 2005 for teachers to familiarise themselves with the new reporting procedures. During these introductory professional learning sessions, teachers were given opportunities to engage in the computer report program to gain further understanding.

It therefore became apparent I should understand the types of assessments to give to my students, which would be accurate and easily transferred onto a computer report program. Earl (2003) expressed there are 3 types of approaches to classroom assessment that include, assessment of learning, assessment for learning and assessment as learning" (p. 21). Earl conceded that all three types of assessment have their place in our classrooms, however the dominant type used in most classrooms and especially secondary schools is assessment of learning. In this type of assessment a strong emphasis is placed on comparing students and their relative positions compared to other students. Assessment is typically done at the end of a unit or course and given as tests or exams and include questions drawn from the unit of study and are expressed as marks or letter grades. Assessment of learning often does not give an indication of mastery of particular ideas or concepts as the test is usually too limited and scoring is simplistic. This type of testing has had a long history in education and has been widely received by the general public. Earl, however, argued scepticism is increasing about its fairness and its accuracy especially as teachers can weight assessments differently.

Earl (2003) outlined assessment for learning as:

> an alternative perspective to traditional assessment where the shift has been to collecting a wide range of data. Data can include, teacher observations, worksheets, questioning in class, student-teacher conferences, art products, photographic evidence or whatever product can supply information that would be useful for planning and teaching (p. 23).

In assessment for learning, teachers are central, however, their role is different as their personal knowledge of students can target particular learning needs. Teachers are interactive with students and provide feedback to scaffold the next step of the learning process. Assessment for learning usually happened during the course of the unit and not at the end as for the previous assessment description. Record keeping included, checklists of student progress, artefacts, portfolios of student work over time and worksheets that show progression within a learning continuum.

The third type of assessment mentioned by Earl was assessment as learning. Earl advocated in this type of assessment, students can be enhanced in their learning by contributing to their own assessment. Assessment as learning appeared to comply to a constructivist agenda, as students are active, engaged, need to make sense of the information, relate prior understanding to new understanding and where students monitor their own learning. The feedback from their assessments allowed students to make adjustments, changes or gains in their understandings. The advantage for this type of assessment empowers students to ask questions and consider a range of strategies for learning and acting upon these strategies. Record keeping in assessment as learning, is personal where teachers and students decide together the artefacts of importance to be retained as evidence of a student's learning. Students would need to reflect on their work and make judgements about what they have already done. The critical reference points are the student's prior work and aspirations and goals for continued improvements in students' learning.

Earl also argued all 3 approaches can contribute to student learning needs, however, getting the balance right is critical. Earl believed an emphasis should be placed more on assessment for learning and assessment as learning, as these assessments link students to their own assessments and therefore added a purpose and value to their learning. Merrick (2001), however, believed the greatest challenge was teaching and programming to outcomes to suit all students' individual needs and the accompanying assessing, reporting and recording required for parents and school use. Many outcomes are broad and far-reaching that required the teacher to breakdown outcomes and list possible indicators to work towards within an activity.

In the unit, Sun Safety, it would be envisaged the types of assessment for learning would include, my observations of student understandings obtained through discussions and written work samples such as, learning journals written at various intervals during the unit, worksheets, various visual art and technology products or photographic evidence showing students engaged in a specific learning activity. Before engaging in a unit of study students would need to be informed about the purposes for ongoing record management of their work samples. Individual work samples would need to be saved periodically to provide evidence of a student's understandings throughout the duration of the unit.

Merrick (2001) suggested teachers should be engaged in a collaborative process to decide on the types of products to be placed in a progress folder. These products would be aimed at an audience that involved parents and other staff members. Choosing work products would be done in conjunction also with students. This would involve students in decision-making thus empowering them to choose work products that showed their understandings. Students could place their work products in a progress folder that could be revisited many times. If this approach was undertaken throughout the whole school then uniformity would be achieved. If a work product, for example, was a worksheet then assessment should show whether the student was at the beginning, working towards or had achieved a specific key element outcome.

These outcomes could then be placed on a continuum and in language acceptable to a wider audience.

These products could also be used in discussions or assessments using the class circle formation. After viewing work products students could then decide how their product compared to their peers for a self-assessment. At the completion of a self-assessment, a peer assessment can also provide valuable feedback on work products. Providing the assessments are done according to class protocols this has the potential to refine work products and further student's understanding.

In 2000 the Grade 3 students did engage in peer assessment procedures where students were free to make both positive and negative contributions on other's work products. This provided an enriching experience, as students often listened and responded by expanding or altering in some way their original product according to the advise of their peers. Students often were asked to explain how their product worked, which provided an opportunity to observe a student's level of understanding.

The provision of learning goals has hitherto not been a procedure included in my pedagogy. It would be my intention however, when revisiting the unit, Sun Safety, to allow opportunities for students to set goals. Learning goals could be outlined by students at the commencement of the unit and would be continually revisited throughout the unit to ascertain their validity. Creating and pursuing goals also forms a key element within the Essential Learnings of personal futures. The key element of creating and pursuing goals in the Essential Framework 1, (2002) stated:

> that it will enhance student's capacity for self-determination, learners develop skills in assessing their own learning and how they learn best. They develop skills that enable reflection on their own learning styles and particular strengths and preferences, and the capacity to use this knowledge to improve learning and make beneficial life choices (p. 28).

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Brown (2001) also outlined the provision of personal goal setting. Brown believed students should be given a template with specific questions listed such as, "what things am I good at? What things do I need to improve? How will I achieve this goal? When do I expect to achieve in this goal? Did I achieve my goal? (yes/no) If you did not achieve your goal, what new strategy could you use next?" (p. 16). Brown further suggested the rationale for the inclusion of goal setting is a valuable evaluation technique. The rationale recommended by Brown included,

> students need to know what they are trying to achieve, they are able to be discerning about what is important, they can develop responsibility for their own learning, students can work out their weaknesses and develop ways for improvement, students can also realise their strengths and develop these further, use goal setting to evaluate their own activities and be able to reward themselves for achieving a goal (p. 17).

Another alteration to my planning included the use of a concept attainment activity undertaken during the tuning in phase. My critical friend thought the use of the concept of safety would be more beneficial, rather than sun safety. My new collection of items would therefore pertain only to the concept of safety. Questioning the students on why items are placed in either the sections of yes or no would elicit their understanding about safety. Items would be retained for display as a visual stimulus to constantly remind students about what makes us safe and added to during the duration of the unit. New items could include, a collection of photographs of safe and unsafe practices for example, using cold water first, then hot water in the bath, swimming between the flags at the beach, storing medication in a high place, crossing the road at the pedestrian crossing or having saucepans in safe positions on the stove.

During this phase of my planning I had recorded that an assessment would be undertaken in the form of an observation. My critical friend asked how would I

record my observations? A departmental booklet titled, *Quality Assessment Task* (1998) had a recommended outline, which could be helpful. This booklet recommended observations should be recorded on a class list with three suggested criteria of 1, 2, or 3. Number 1 indicated the criterion had been achieved, number 2 sometimes, and number 3 never. A tick or asterick is recorded next to the appropriate criterion. I have also incorporated Merricks (2001) suggestion, which breaks down the outcomes to list an indicator to work towards in an activity. The observation-recording sheet would resemble the following fictitious concept attainment activity.

Concept: Safety.

Assessment criteria.

1. Correctly identifies why items are placed in the yes section.
2. Has some understanding why items are placed in yes section.
3. Cannot identify why items are placed in the yes section.

Name	Assessment Criteria			Comments
	1	2	3	
John			*	Unable to identify yes items
Sam		*		Knows some items
Ruth	*			Can identify all yes items

Once the recorded observations had been completed then students who had not achieved the number 1-assessment criteria would require further tuition. Further tuition could include whole class discussion where other students could elaborate about the concept of safety. Further individual explanations may need to occur if students are still having problems. Once all students had developed an understanding of the safety concept then the next phase of the planning, finding out, could be implemented.

Most of the activities listed in the finding out phase of my lesson planning were correctly placed. My critical friend, however, suggested the activity of painting or plasticine models, on how to be safe in the sun, would be more

appropriately placed in the sorting out or going further phase. This activity would highlight students' understandings about sun safety given the extensive activity range in the finding out phase such as videos, guest speakers, poster displays and discussions about sun safety.

Listed in the sorting out phase were four activities. These activities however, needed clarification or were listed incorrectly. The first activity required students to explain what people can do to keep themselves safe when in the sun. This activity needed to show a specific situation such as, at the beach or playing in the school playground. An assessment task could be a work sheet that asked the specific questions of, why do we need to be safe in the sun while at the beach? Where could we be safe from the sun? How can we be safe in the sun? And what could we use to make us safe from the sun while at the beach?

The second activity required students to record their understandings contained in the videos and from the guest speaker. Students would record their understandings on paper by either writing and/or drawing. Before recording their understandings students would be informed as to the purpose of the exercise and an expectation of the completed product. After completing the information students would share their understandings with the whole class. This would allow information to be consolidated or contested if the information contained any misconceptions. These written products would be retained in a designated folder for later assessment.

The final two activities of plus, minus and interesting (PMI) about sun safety products or issues and the technology activity would have been better situated in the culminating performance phase. The PMI activity had the potential to develop higher order thinking skills regarding the influence of the media on our thinking. The promotion of visual images of beautiful healthy tanned bodies in glossy magazines would be an example. The technology activity would ascertain student's understanding about sun safety and would engage them in deeper levels of thinking such as, alerting them to various ways of being safe in the sun and why this is necessary. My critical friend also suggested that an oral presentation be given where students would need to

discuss their design with their peers. Peers could then assist a student with constructive feedback.

My critical friend directed me to the assessment element associated with these activities. I should ask, what do I want to observe in all these areas? Do my students know what I am looking for? My critical friend suggested that I would need to be explicit in my explanations when introducing these and other activities and the assessment associated with each activity.

An assessment task suggested by my critical friend was the rubric framework, which could be utilised to assess students' understanding at the culminating performances phase of the unit. Rubrics could be designed by the teacher or in consultation with students. In this unit I felt the need to design the rubric myself, as this would provide an insight into the complexities of its structure. Once I had an understanding of the rubric design I would feel more confident in using it as a co-constructed task with my students. Students would then be given explicit instructions on how to compile a rubric and alerted to the benefits it had to offer in their learning.

The design of my rubric would link with the understandings goals and the concepts of safe/unsafe, future actions for self and others and answering questions. The outline of each quality includes specific words (choice, themselves and others) associated in the key element outcome for wellbeing, standard 3. The assessment rubric would resemble the following example:

Criteria	Quality 1	Quality 2	Quality 3
Safe	Gives few choices on how to be safe for themselves or others.	Gives more choices on how to be safe for themselves and others and includes other safety issues.	Gives many choices on safety in the sun and other situations for themselves and others
Unsafe	Gives few choices of when it is unsafe for themselves and others	Gives more choices on when it is unsafe in the sun also includes other unsafe practices for themselves and others	Gives many examples of when, where, how and who makes it unsafe in the sun and other unsafe practices for themselves and others.
Future Action for self.	Gives little thought on how to be safe in the future for themselves and others.	Gives some thought on safety for themselves and others both in the sun and other situations.	Gives clear directions on future actions of what can be done to be sun safe for themselves and others and in other situations.
Future action for others	Gives little thought on how they can influence others to be safe in the future.	Gives some thought on future actions on how they can influence others when in the sun and other safety issues.	Gives a clear direction on future actions to influence others and includes other safety issues.
Answering Questions	Usually responds to questions with yes or no.	Answers questions but gives brief information.	Answers questions clearly and expands on information.

I included 3 graduations of quality ranging from 1-3, where 3 represented the more competent quality. I would envisage the assessment rubric would be accessible to students by including it in their personal folder or attached to a book such as a learning journal. Students would complete the assessment rubric by either shading or ticking the quality that best represented their work sample. When undertaking the assessment rubric it would be beneficial for the teacher to be in conference with the student to discuss a future course of action if the student was performing at a level 1 quality.

At the completion of the sorting out phase in my planning it would be anticipated that students would be ready for deeper levels of thinking, which would be included in both the drawing conclusions and culminating performance phases. Listed under the drawing conclusions phase was the community of inquiry activity, which focused on the book, What's Wrong with Casey's Cat? This activity appeared to be situated in the appropriate phase. During this activity students would engage in thinking and questioning related to the text. Student questions would be scribed and grouped accordingly. Questions then would be preferentially discussed.

The activity regarding accessing information at home, where students were asked to find out about sun safety required further clarification according to my critical friend. A clarification of the activity would be to encourage students to think of possibilities of sun safety procedures to suit their particular family's circumstance and then share this information with other class members. The presentation of this information would be personalised as it could be represented as a note, pamphlet or special letter addressed to family members alerting them to the problems of excessive sun exposure.

The activity of individual projects, however, would be represented in the culminating performance phase of my planning. The suggestion of individual projects on paper did present a narrow perspective to this activity. My critical friend argued that a multiple intelligence approach could be utilised where students could compose a song, make an advert, paint, write, create a brochure, verbal displays, discuss the impact of the media on our thinking about the healthy tanned body, create a computer presentation, posters or photographic displays. Using this multiple intelligence approach then frees students to engage in their own activity choice especially if they had strengths in a particular area such as, in music, oral, written or visual arts presentations. This approach represented aspects of decision-making and time spent on activities, which focused on items 21, 22 and 23 in the scale of Shared Control. This scale had the lowest score on the actual 2000 CLES and therefore

improvements in my pedagogy were required if constructivist reforms were to become apparent.

The final phase of the unit, culminating performances, assumed students should engage in a performance. I had intended students to present their information in an assembly format however; this would present a problem in terms of assessment. My critical friend suggested the word *demonstration* would be a more apt word and therefore the final phase should be reworded to *culminating demonstrations*. I had also listed in this phase, brainstorming where students' end of unit understandings would be compared with their initial understandings. Leading from brainstorming was a place mat activity where groups of students recorded their understandings on paper. Written understandings were also included to indicate students' progress in the unit.

Some activities that had been included under other phases of my planning my critical friend felt now needed to be included as culminating demonstrations. These activities included, using the activity PMI about sun safety products and issues such as, the promotion in the media of tanned bodies, the technology challenge of designing a device that can make you safe from the sun and individual projects that now incorporated the idea of multiple intelligences such as, music, art, written, oral and technology activities.

During the course of this unit I have included the addition of assessment procedures especially as this will become an important focus for Tasmanian State Schools from 2005. The final component of my planning, culminating demonstration required students to compile their thoughts, ideas, new understandings, confusions and interesting information into a learning journal. A learning journal would be used throughout the unit and used as an important assessment task to make judgements about where to place students in an outcome continuum. Other assessment procedures have included, specific worksheets designed to ascertain students' understanding for example, when people go to the beach and what sun safety precautions they should use. This worksheet could have a specific language focus, which links to criteria and a key element outcome as demonstrated in the rubric p. 224. These assessment

tasks along with the products produced during the course of the unit would be retained in a portfolio. When one phase was completed, a self-assessment or peer-assessment could be utilised during this interval period. The procedure for self or peer assessment used in the past, where students sit in a circle and their work is displayed for discussion, has been successful as it has allowed students to re-think their work products. The introduction of goal setting could also be included within this procedure using Brown's (2001) question outline.

Including a critical friend especially with expertise in planning challenged my methodology and thinking by extending and re-thinking my activity and assessment choices. My critical friend asked me to clarify certain activities, make explicit to students what the activity entailed and the purpose of that activity. I also needed to include students in the assessment process and use multiple assessment techniques. The placement of activities in a phase was also challenged as well as the need to provide choices within an activity such as, using the 8 intelligences.

The unit has consequently been adjusted to incorporate the suggested modifications and outlined on a standardised proforma. The unit has been reduced to 3 sequential phases of introductory performances, guided inquiry and culminating demonstrations. The unit outline now resembled:

Unit Title	Sun Safety
Throughline	*What does it mean to be safe?*
Year level	Grade 3
Focus Essential/s	Personal Futures, Thinking, Being Literate.
Key Element.	Maintaining Wellbeing
Assessment: Standard 3 (lower) *Essential Learnings Framework 2* (2003)	"Understands that to improve wellbeing competing factors need to be considered and uses this knowledge to decide how to improve wellbeing for themselves and others

		in familiar situations" (p. 8).	
Core Values		Responsibility	
Core Purpose		Learning to live full healthy lives	
Unit Long Understanding Goals (UGs)		1. How can we decide when the sun is not safe? 2. What things make us unsafe in the sun? 3. Why do we need to be safe in the sun? 4. Students will clarify their thoughts about sun safety using reflective thinking (transfer ideas from one context into another, making connections) and inquiry thinking (asking questions, set goals, plan and follow a course of action and conduct own investigations) 5. Students will use listening, viewing, reading, oral presentations, and writing to reflect on sun safety.	

Sequence	UGs	Performances of Understanding	Ongoing Assessment
Introductory Performances/Tuning In	1,2,3,4,5	Brainstorm students' understanding, what it means to be safe?	Learning journal to enter prior understandings.
	1,2,3,4,5	Write/draw understandings.	Retain written/drawn products.
	4,5	Concept Attainment. Concept: *Safety* Items retained for interactive display. Items added	Observation record sheet. Goal Setting.

		through unit.	
Guided Inquiry Performances/Finding Out/Sorting Out/	1,2,3,4,5.	Poster and book (Spot the Difference & Skin Cancer and You.) discussion and display.	Enter new understandings in learning journal after viewing poster, videos and discussing questionnaire.
	1,2,3,4,5.	Videos.	
	4,5.	Guest speaker from the Cancer Council to discuss sun safety.	Worksheet plus expectations
	3,4,5.	Class questionnaire for home interview about products or practices at home for sun safety.	Worksheet Plus expectations.
	1,2,3,4,5.	Summarize from videos and guest speaker what you know about sunscreens, hair, eye and skin types	
	1,2,3,4,5.	How can people keep themselves safe when at the beach?	Rubric to ascertain assessment on: Self/others, Future Action/self/others Answering Questions.
	1,2,3,4,5.	Share information from home questionnaire.	
	3,4,5.	Role play using a scenario of being safe in the sun.	
	2,4,5	Discussions concerning additions to safety concept/additions to interactive display.	

Culminating Demonstrations	1,2,3,4,5.	Community of Inquiry, *What's Wrong with Casey's Cat*. (students' questions.)	Continuation of understandings in learning journal.
	2,3,4,5.	Future action from home questionnaire.	Self and peer assessments (display of personal folder products).
	1,2,3,4,5.	Individual projects, (music, poetry, visual art products, plus, minus and interesting (PMI) about sun safety products and issues, technology, role of the media,	Return to original Goals and decide on whether goals have been met.
	1,2,3,4,5	Create a poster/board game/brochure outlining how to be safe in the sun.	Use a self and peer assessment of end product.

Resources:
Purcell, F. (1997). *What's Wrong with Casey's Cat*. Victoria. Bookworths Printing Pty. Ltd.
Booklet: (1989). *Skin Cancer and You*. Produced by the Australian Cancer Society.
Videos: Geneva, 111. publisher (1989). *Safe Sun, Safe Skin*. Learning Seed. Videocassette (42 mins).
 Higgins,A publisher. (1988). *Your Skin and the Sun*. U.S.A. Videocassette (13 mins)

CHAPTER 15

REVISED PLANNING OF THE 2003 UNIT

In 2004 an opportunity arose to revisit and revise the 2003 unit on Waste and Recycling. A colleague teacher within my 2005 school decided to undertake a Waste and Recycling unit similar to the one I did in 2003 and therefore sort to collaborate in planning the unit. This colleague teacher had been involved in our buddy class program in 2003, teaching a Grade 3-4. During the buddy class program our two classes had developed a bond especially in the weeding program in the school wetlands. We often combined our knowledge and understandings in planning as we had a similar vision on environmental issues such as, creating sustainable environments within the school wetlands and waste and recycling management.

The envisaged Waste and Recycling unit would be intended for a Grade 3-4 class in term 3, 2004. It therefore needed to represent my colleague teacher's perspective rather than a rehash of my 2003 planning. The revised 2004 unit therefore underwent a complete transformation unlike the previous unit where I chose to remain closely aligned to my original planning methodology.

Before the collaborative planning process commenced in 2004, I had attended a series of professional learning sessions. These sessions outlined an Italian educational methodology designed for young children referred to as, *Reggio Emilia*. Reggio Emilia a city in northern Italy aspired to create an innovative education system for young children using a network of 33 centres. The importance of the Reggio Emilia system is embedded in its pedagogical thought and practice where the child's perspective is paramount in the lesson planning process. Reggio Emilia philosophy can be described as not a product but an evolving educational system where the focus is on the needs of students, parents and educators who together create an educational community. This educational community builds on reflective practice to both learning and teaching and where programs are continually reconstructed and refined.

Lesson planning in the Reggio Emilia approach begins with the child's perspective. Observing and recording very closely what children are doing and saying in a creative environment is the stimulus and entry point in the teacher's planning.

The principles espoused by Reggio Emilia resembled constructivism particularly the scales represented in the CLES where Critical Voice, Shared Control and Student Negotiation featured strongly. In Reggio Emilia, planning for young children begins with their questions or curiosities, which have been raised during a provocation or stimulation. Adults scribe, tape or video record student questions associated with this particular provocation or stimulation. From the extensive documentation activities are then planned accordingly. Aspects of the Reggio Emilia approach I felt could be utilised for older students. Rather than the extensive documentation used for younger children, older students could write their own questions. For a truly democratic approach the topic would need to come from the students themselves, as it would provide a purpose for their learning. Hitherto the inclusion of student questions had not been included as part of the planning methodology.

The influence of these professional learning sessions had an impact on our 2004 planning methodology. To include students in the planning process, I spoke to the Grade 3-4 students in early July 2004, prior to the commencement of the unit in September. I told the students that they were going to commence a unit on Waste and Recycling in term 3, and asked them to write down what they already knew about waste and recycling and questions they would like to ask to gain more information. The information gathered therefore formed the beginnings to an assessment and their questions provided an entry point to our planning methodology.

The students' questions were later divided into 3 categories, questions related to waste, questions related to recycling and questions that were common to both waste and recycling. From the category questions, common questions were revealed to form key questions. The questions included:

Students' Questions about Waste

1. Why do we litter? Why do people drop rubbish on the ground when there are rubbish bins? Why do people throw cigarettes on the ground? Why do people throw rubbish out of their car window?

2. How much waste is there?

3. How many pieces of rubbish are dropped in an hour?

4. How do people get waste into rivers and ponds?

Common questions: Why do people pollute? How much waste is there?

Students' Questions about Recycling

1. What can we do to stop littering?

2. What happens to the recycled waste?

3. What can we do to help our state?

4. What can schools do to help recycle? What can schools do to clean up rubbish?

5. What are people doing with rubbish? What are people making rubbish into?

6. What other stuff do people recycle?

Common question: What are people doing with rubbish?

Questions Related to Both Waste and Recycling.

1. Do banana scraps go in the waste?

2. What do people do with their waste?

3. Where does the rubbish go from the tip? Where does the waste go after it goes to the tip?

4. What do people do with their waste?

Common question: Where does the waste go after it goes to the tip?

In term 3 2004, the Essential Learnings of social responsibility was introduced to underpin teacher's planning. This had hitherto been an area of the Essential Learnings not yet undertaken in a whole school context and therefore the Essential Learnings Management Team felt a change in focus was required. The Essential Learnings Management Team discussed the importance of key concepts embedded in the outline of social responsibility and felt teachers should become familiar with these concepts. A suggested activity to acquaint

teachers with these concepts was a re-examination of the Essential Learnings Framework 1 (2002) and 2 (2003). Teachers would then list these concepts that would form a link in our planning. At the end of term 2 or the beginning of term 3 senior staff suggested collaborative planning teams meet to commence their planning.

My colleague teacher and I met at the end of term 2, in mid August 2004, to compile our first planning of the unit Waste and Recycling. At the end of this session it was decided to rename the unit, Reduce, Reuse, Recycle, Rethink. During this first session we also discussed how this unit needed to link to social responsibility as mandated by the School Management Team. Social responsibility is subdivided into 4 key element of, building social capital, valuing diversity, acting democratically and understanding the past and creating preferred futures. It was decided at our first planning session to use the key element of acting democratically, as the ideas and suggestions from this particular element had not yet been covered. Our first planning session had a time allocation of 1 and ½ hours, however, this was not enough time to research activities, which would evolve over a 4-5 week period.

My colleague teacher and I needed to re-read the element of acting democratically in the Essential Learnings Framework 1, to tease out the important concepts. The following concepts were unpacked, being socially responsible, rights and responsibilities, formal and informal decision-making, active citizenship, power, freedom, democracy and equality. This element also outlined active citizenship be encouraged, practised and built from an early age, for learners to recognise the ways they can contribute to their communities where their actions can make a difference. The performance guidelines that informed our assessment came from the key element outcome standard 3, Essential Learnings Framework 2 (2003), which stated; "The students understand how to use a range of democratic processes and participates responsibly in school and community groups" (p. 13).

To economise on time, I compiled an A4 planning proforma on the computer, adapted from the Planning Learning Sequences booklet (2004). This A4

planning proforma could be readily accessed and printed from any of the school's printers. An array of planning proformas could be accessed through the school's computers however, the school's proformas were in A3 format and could only be printed through the photocopy machine located in the main school office. This was restrictive and time wasting. Using the A4 size proforma, with an outline of our planning, allowed my colleague teacher to send this document directly to the class computer. Access to our planning was therefore readily available where alterations could be made to any of the listed activities. We also sent a copy of our planning document to a senior staff member who provided feedback on our planning.

My teacher colleague had used the guiding question principle in previous planning and continued this rather than a throughline. A throughline could be used to connect a whole school curriculum or be part of every unit undertaken. My present school had not resolved the issue of throughlines and therefore it was omitted from our planning. Our planning consisted of,

Guiding Question: 'What does it mean to be an active citizen?'
Values: connectedness and responsibility.
Purposes: relate, participate and care for our community.
Understanding Goals:
(A) Why is cooperation and collaboration with others important?
(B) How can I make a difference to the problem of waste?
(C) What does it mean to be a citizen in our school and community?

Linked with these understanding goals were the key student questions. In the first planning session the key student questions had not been re-grouped into common questions. In this first session we briefly perused the student questions and chose the following questions:

1) Why do others litter?
2) What can schools do to help recycle and reduce rubbish?
3) Why do people pollute when there are bins?
4) What can we do as a group to help our community?

In previous years my colleague teacher had undertaken aspects of this topic and therefore had available a rich collection of activity ideas and resources. Many of these activities however, did not match the element, acting democratically and therefore were withdrawn. Ideally teachers should use activities directly associated with a key element. Past planning methodologies used an assortment of activity ideas, many of which did not correlate to the intention of the planning. Teachers need to constantly ask the question, 'did this activity link to my original intentions? This was an important departure from my 2003 planning where I had listed a smorgasbord of activities however; I had only attempted approximately half the activities listed.

Our first collaborative planning session included the tuning in phase and listed the following activities, brainstorming, class mural and a learning journal. In the brainstorming session a specific question was asked of the students, how can I make a difference to the problem of waste? As a prelude to the topic students were assigned the task of doing a class mural of the school buildings and grounds. Additions would be added to this mural as the unit progressed. A learning journal would also be used as an assessment task for students. Students would enter their initial understandings at various stages throughout the unit and continue to enter further understandings.

Contained within the guided inquiry were the activities of, viewing videos on recycling, an excursion to a community tip shop where students could purchase items to the value of $2, a survey done within the school to ask the questions, why do people litter? What can we do to reduce rubbish in our school or community?

Activities in culminating demonstrations included, reading a book to obtain various viewpoints about waste including the school cleaner's perspective, and a sculpture. The selection of a suitable book had not been achieved at this stage of our lesson planning and therefore consultation with the school's librarian was necessary. Including the school's cleaner into our planning provided an important perspective to the issue of waste. The cleaner was eager to speak to

the students on how she felt when confronted with a messy classroom and cleaning up students' rubbish. The inclusion of a sculpture made from recycled objects had been undertaken by my colleague teacher previously. This activity would also provide a link to the school or local community, where it would be displayed. At the conclusion of our planning was a list of resources plus a reflection section.

In the first draft minimal consideration had been given to assessment and linking the understanding goals with the suggested activities. Given the initial planning time of 1 and a ½ hours we felt this part of our planning needed further exploration and would be done at a future collaborative planning meeting.

The first draft of our planning was forwarded to the Essential Learnings Coordinator, a senior staff member. An email from the Essential Learnings Coordinator was sent to both my colleague teacher and myself the following day with some positive comments and also considerations for the second draft of our planning. It appeared the inclusion in our planning of core values and purposes was a valuable addition that other teachers had not yet considered in their planning. The Essential Learnings Coordinator also felt the generative topic of Reduce, Reuse, Recycle, Rethink was very catchy and the recycled sculpture in the culminating demonstration phase of the planning was an excellent idea. Our planning however, needed to consider re-wording key questions to fit with the first understanding goal and a link made with the guiding question and the other unit components.

Two weeks later my colleague teacher and I commenced a second draft to our planning. In the second planning session we were allocated a time of 1 hour to make additions or changes to the first draft. During this session we were introduced to a book from our school library titled, *Reduce, Reuse, Recycle,* (Hill, 2003) which included a variety of activities that could be linked to the school or community concept in our planning. We also had grouped the students' questions according to whether they referred to waste, recycling or

both and found common questions within each group. The common key questions now stated:

1) Why do others and I pollute?
2) How much waste is there?
3) What can schools do to help recycle and reduce rubbish?
4) What are people doing with rubbish?
5) What can we do as a group to help our community?

In each of the planning phases additional activities were added along with linked understanding goals and assessment tasks. In the tuning in phase we included, rubbish collection in our school wetlands. This activity addressed all 3 understanding goal questions of, why is cooperation and collaboration with others important? How can I make a difference to the problem of waste? What does it mean to be a citizen in our school and community? Our assessment listed observations of the students', analysing, classifying, co-operating, designing, explaining, interpreting, considering options, questioning, revisiting our goals and locating information. Unfortunately due to the limited time available ongoing assessment did not receive adequate planning and therefore specific details on how the assessment should be constructed was not finalised. My colleague teacher was eager to use a rubric as an assessment task and as I had already designed a rubric in the previous unit, I felt confident in the design of this rubric. I used the criteria of, responsible, participates, cooperates and citizenship as these concepts were represented in the key element outcome acting democratically and the values and purposes. Three graduations of quality included, number 1 represented the least effective to number 3 the most effective. The rubric design included:

Criteria/Concept	Quality 1	Quality 2	Quality 3
Responsible	Is not very responsible	Can be responsible sometimes	Is responsible most of the time
Participates	Participates only when asked.	Participates sometimes and does not need to be asked.	Participates eagerly without being asked.
Cooperates	Cooperates only when asked and has problems with others.	Cooperates sometimes without being asked and usually gets on well with others.	Cooperates most times and gets on very well with others.
Citizenship	Does not understand how to be a good citizen.	Understands how to be a good citizen sometimes and can often show citizenship within the school and community.	Understands how to be a good citizen most of the time and practises good citizenship within the school and community.

Although I had compiled this rubric, in future units it would be an expectation students in conjunction with the teacher would design their own rubric during the initial phases of the unit. If a problem was identified in the rubric then it could be addressed during the culminating demonstrations phase.

In guided inquiry seven new activities were added to the original first draft. These new activities included, using a CD rom about waste and recycling available from our school library, sorting rubbish collected from the school wetlands, reading information about recycling and relating this to recycling at home, an additional excursion to a council wetlands where storm water had been recycled before entering a local river system, plus-minus-interesting (PMI) about the excursion to the tip shop, asking the question, 'what can we do to reduce rubbish in our school and community'? Investigate families recycling plastics and research an environmental group such as, Clean Up Australia, Greenpeace, Planet Ark or Gould League.

The final phase of our planning, culminating demonstrations, included 3 additional activities. The first activity was to design a school poster on how to make the school tidy and displayed in prominent places around the school. Including a PMI about the excursion to the council storm water wetlands, which would be retained as an assessment to gauge students' level of understanding from the previous PMI. The last activity listed was to enter the class in a national recycling competition.

The second draft of our lesson planning showed some areas that needed refining such as, assessment and activity choices, and linking the guiding question to the unit as mentioned by the Essential Learnings Coordinator. We needed also to ask the questions, do the activities provide choice within them? Do we stimulate students' thinking? Do we include students in the assessment process? Do we introduce student goals? Have we planned too many activities for the 4-5 week duration of the unit and what activities do we cull? Do we need to revise the activities for them to demonstrate the element of acting democratically? I felt another planning session would be necessary for my colleague teacher and I to explore these perplexing questions however, further time was not made available for our collaborative planning process.

The second draft of our lesson planning, which was transposed onto my proforma now included:

Generative Topic	**Reduce, Reuse, Recycle, Rethink**
Guiding Question	What does it mean to be an active citizen?
Year level Approximate length of unit	Grades 3-4 4-5 weeks
Focus Essential	Social Responsibility

Element	Acting Democratically
Supporting Essentials	Communicating, Thinking.
Assessment Outcome: Standard 3 (*Essential Learnings Framework 2*, 2003)	"Understanding how to use a range of democratic processes and participates responsibly in school and community groups" (p.13).
Core Values	
Core Purposes	Connectedness, responsibility Relate, participates and care.
Unit Long Understanding Goals (UGs)	A) Why is cooperation and collaboration with others important? B) How can I make a difference to the problem of waste? C) What does it mean to be a citizen in our school and community?

Key Questions:
    1. Why do others and I pollute? 2. How much waste is there?
    3.What can schools do to help recycle and reduce rubbish?
    4. What are people doing with rubbish? 5. What can we do as a group to help our community?	

Learning Sequence	UGs	Performances of Understanding	Ongoing Assessment.
Tuning In	B	Brainstorm the question: How can I make a difference to the problem of waste?	Learning journals (ongoing) Include goal setting for the unit.
	A,B.	Discuss the meanings of participates, cooperates, citizenship and responsibility.	Observations of, Analysing, classifying,

			cooperating, designing, explaining, interpreting, viewing, considering options,
	B,C	Use a learning journal to write throughout the unit students' understandings.	
	A,B	Commence a class mural of the school buildings and grounds.	questioning, revisiting planning, locating information, performing.
	A,B,C	Rubbish collection in the school wetlands.	*Use of portfolio to retain all products. Use for self/peer assessment.*
Guided Inquiry	C	View videos about recycling, available from school library.	The inclusion of portfolios to retain work samples.
	C.	CD rom – *Ollie Saves the Planet.* (available from school library)	
	A,B,C	Excursion to local council recycling storm water wetlands.	Worksheet.
	B,C	Sorting rubbish collected from school wetlands. Reference: (Hill, 2003, p. 45)	Worksheet with specific questions
	B,C	Read information about recycling, discuss and relate to home recycling. Ref. (Hill, 2003, p.9)	
	A,B,C.	Excursion to tip shop. Purchase items to the value of $2.	Retain PMI for comparisons
	A,B,C	PMI. Related to visit to the tip shop	Worksheet with specific questions.
	A,B,C	Survey: Why do people litter? Or What	

	B.	can we do to reduce rubbish in our school/community? Family recycling plastics Ref. (Hill, 2003, pp 37-8, 41)	Specific research questions related to how they have made a difference in the community.
	A,B,C	Research an environmental group of your choice eg. *Clean up Australia*, *Greenpeace*, *Planet Ark*, *Gould League*.	Introduce rubric. Relate criteria to previous understandings.
Culminating Demonstrations	A,B,C	Read from book collection. Explicitly teach from another point of view/other's perspective for example, school cleaner. Use of recycling box rather than littering in the classroom. Use expository text for students to record from another perspective.	Worksheet/book to show student's understanding of other's perspective.

Self/Peer assessment of finished product. |
	A,B	School posters outlining how to make the school tidy.	Observation record to ascertain degree of participation.
	A,B.	Participate in a recycled sculpture. To be displayed in our local community or school.	PMI to be retained and compare understandings.
	A,B,C.	PMI revisit and add to original PMI, compare understandings.	Revisit rubric to ascertain improvements.
	A,B,C.	National recycling competition. Prize money?? Could be used to beautify our wetlands.	

Resources:
Davies, K. & Oldfield, W. (1990) *Waste*.
Harlow, R. & Morgan, S. (1995). *Rubbish and Recycling*.
Hill, T. (2003). *Reduce, Reuse, Recycle*.
Metz, M. (2002). *Recycling*.
Murdoch, K. (1998). *Classroom Connections*. S.Aust. Eleanor Curtain Pub.
Videos. *The Recycling Challenge*. (School library)
        Kangaroo Creek Gang.

Reflections.
Add comments throughout the unit.

CHAPTER 16

THE ASSESSMENT CHALLENGE

The assessment tasks within the unit, Reduce, Reuse, Recycle, Rethink required further development and refinement however, some procedures in the unit did show elements of insight. The brief mention in the unit of a portfolio, where work samples are retained at various phases of the unit indicated an example of insight. Tobin and Tippins (1993) referenced this assessment approach and advocated, " portfolios can be enhanced by thinking about the process from a constructivist perspective. First it makes sense to think of a portfolio as a means of enabling students to show what they know. In a sense it is a showcase that provides an interface between the displayer and the assessor" (p. 13).

In 2004-5 assessment required further understanding before teachers felt confident on how to document results in the new computer report system. The Australian Education Union at its April 2005 branch council meeting proposed that a ballot be circulated to all teachers asking them the question "Are you ready to assess your students following the *Assessment and Reporting Policy* (yes or no)".

Assessment became a major focus in 2005 where most professional learning programs were designed specifically for this purpose. During the first professional learning day held in late March 2005, teachers from various schools within the district attempted to link work samples to a specific standard in the Essential Learnings Framework 2. Standards ranged from number 1, which represented students aged between 2-4 years to standard 5 representing students aged between 14-16 years. During the first professional learning session, small groups of participating teachers were given documentation that included two student's work samples and the accompanying teacher's understanding goals. Determining where to place a work sample according to a specific standard proved more challenging than

first anticipated, as most groups placed the work samples in different standards.

For the first work sample some participants believed it showed evidence of descriptors in standard 2, while others felt the work sample should be placed in either standard 3 or 4. Participants felt for the second work sample there was not enough written evidence to be able to place this sample in any of the standards, although the sample did show evidence of literacy skill.

It became apparent to me during these discussions the key component, which would assist the task of matching work samples to a standard was the teacher's planning methodology. In both documents the teacher's understanding goals failed to include key words associated with a standard that would link a work sample to that standard. Newly released departmental documents (2004, 2005) alerted teachers to this planning issue. The Planning Learning Sequences booklet (2004) stipulated teachers select an "appropriate key element standard/s for the learning sequence" (p. 16). The Essential Learnings Assessing Guide (2005) informed teachers to plan with the outcomes and standards in mind, it stated:

> Determine the outcomes and standards the students will be working towards.
> Design tasks that will allow students the opportunity to reach the highest standard possible; tasks that are open-ended; have multiple entry points; support student learning through completing the task and allow for demonstrations of understanding against stated understanding goals for the sequence. (p. 16)

The statement in the Planning Learning Sequences booklet however, did not mention the language of the understanding goals should match the language contained within a key element outcome. The Planning Learning Sequence booklet (2004) stated how to create understanding goals:

Establish a small number of unit-long understanding goals. These goals are also written as both statements and questions and are focused on the learning that students should demonstrate at the end of the learning sequence. Where necessary, identify different entry points for learners with special needs and reframe understanding goals to suit their learning requirements (p. 16).

Given the understandings obtained during the professional learning session in March 2005 and information in the Essential Learnings Assessment Guide (2005) it would be my intention to unpack the language within a standard and link this to the intended understanding goals. This would provide a gauge to ascertain whether students have achieved the specific key element outcome within a standard as outlined in my planning. Understanding goals would then become focused and linked to assessment and activities.

Previous documentation recorded in 2003 outlined that our school had already identified two specific goals, which needed attention and included:

(1) Linking assessment to our understanding goals and extending a repertoire of appropriate assessment strategies to support the Essential Learnings
(2) Incorporating the thinking and communicating Essential Learnings into our integrated unit planning.

It appeared as a school the teaching staff needed to revisit our 2003 documented goals, especially when our collaborative planning needed to address the dilemma of assessment and the link that can be made between understanding goals and standards.

The key element outcome gives examples of performances teachers could include in their planning for each of the standards. Some examples of performances from the Essential Learnings Framework 2 (2003), which could relate to our planning of, Reduce, Reuse, Recycle, Rethink could include:

- Plan and undertake civic action to improve the lives of themselves and others.

- In class meetings clarify group problems, offer solutions and use established democratic decision-making processes.

- Understand and participate in events of civic and community significance.

- Increasingly act ethically in decision-making processes e.g. respect the views of others, act honestly, and negotiate solutions. (p. 13)

Using the information contained in the Essential Learnings Framework 2, unit long understanding goals could now include:

1. How can we as a group of citizens manage waste?
2. Where is the local waste and what actions do we need to do to minimise this waste?
3. How can we maintain this improvement?

The activities designed throughout the unit should then link to the understanding goals. Many of the suggested activities would be suitable with minor modifications for example, in the brainstorm activity a question could be asked, how can we make a difference to the problem of waste? Learning journals that ask students to comment on how can we manage waste and maintain improvements and the participation in the class mural where students draw the local community and the location of waste. Throughout the unit students would add art ideas such as, collage or drawing to show how the problem of waste can be improved.

Conclusions reached in both previous professional learning programs and our own planning methodologies were realised in early April 2005 at a professional learning program titled, *Essentials for All, Maintaining Wellbeing*. The facilitators in this program stressed the importance of linking the language within a standard to match understanding goals. In previous

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professional learning programs this emphasis of language relationship had not been stressed. Understanding goals in the past were usually understandings teachers felt students should achieve during a unit of work therefore incorporating specific language that could expose elements of assessment was a challenging exercise.

It also became apparent that planning should be critiqued using reflective practices, which has the potential to challenge our activity choices. An improved activity choice would hopefully transfer to an improvement in student learning outcomes. The following chapter contains a critique of past planning practices and has a preferred future planning vision.

CHAPTER 17

PLANNING CRITIQUE AND VISION

My planning in 2004 underwent two distinct collaborations. The first collaboration involved a critical friend who had expertise in planning and therefore provided valuable input into my planning. The second collaboration involved a colleague teacher who helped plan a unit about waste and recycling. In the first collaboration, I was able to plan according to what I felt students should know and what my planning should look like. In the second collaboration, I was able to utilise the experiences and past planning methodologies of a colleague teacher who provided valuable input into alternative activity choices such as, a class mural and a sculpture made from recycled materials.

Planning with the support of colleagues where sharing of planning methodologies becomes the norm presupposes social constructivism. Social constructivism places constructivism in the realm of developing understanding through the influences of others, where individuals are not acting independently. Tobin and Tippins (1993) believed "the social component of constructivism has been so important to us that we gave greater emphasis to it, the individual and social components being parts of a dialectical relationship where knowing is seen dualistically as both individual and social, never one alone, but always both" (p. 20).

In the first collaboration the essence of my planning was done individually in my own time. This meant the activity choices and assessments were from my own bank of resources and deemed suitable for the required unit and student age group. When the unit had been detailed sufficiently my critical friend was able to critique the unit and provide valuable insights into alternative activity and assessment choices. The potential of including different intelligences such as, music, visual arts, poetry or written products and assessments associated with these choices was not realised at the time. My critical friend was also able

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to identify a mismatch of activities in the phases of my planning, the omission of adequate ongoing authentic assessments and the importance of mentioning the purpose of an activity to my students.

The second 2004 collaboration involved a colleague teacher from my own school. During this collaboration my 2003 unit was reinvented to become, Reduce, Reuse, Recycle, Rethink. A proforma adapted from the *Planning Learning Sequence booklet* (2004) was used to document our planning. The 6 phases used in the Sun Safety unit were narrowed to 3 phases in the Reduce, Reuse, Recycle, Rethink unit. This made the unit succinct, easier to read and manageable. After two planning sessions our unit was submitted to the Essential Learnings Coordinator who identified deficiencies in our planning.

A limitation of time unfortunately precluded us from an effective evaluation of activity choices and assessment tasks. The issue of planning time was also raised by the Education Union in July 2004. The Education Union found the most frequently cited issue for teachers when planning was time to come to terms with the Essential Learnings, time to discuss the framework and plan collaboratively during the school day. The collective time allocation for our collaborative planning consisted of only 2 and a 1/2 hours. For a more satisfactory time allowance we would need a further 2 hours to peruse what we had already planned, make adjustments, plan appropriate assessment tasks and include activities designed to incorporate thinking strategies. Some collaborative teams had been provided with a full day for their planning, others had elected to spread their planning time over 3 half days, whilst some teachers have been given no time. This disparity in planning time allocation would need to be addressed where all teachers are given a fair and equitable portion of time especially within the context of my own school. Other problems facing school collaborative planning groups are the fusion of personalities, expertise in planning and time management. Among the teachers within my current school few would have the expertise required to plan a unit of study in the limited time frame given my colleague teacher and myself.

Although individual teachers bring to the planning process their past understandings, they also waste time trying to understand the language and concepts contained within the Essential Learnings, to incorporate levels of thinking, include appropriate assessment tasks and reach a consensus on activity choices. My preference after scrutinising the collaborative planning options favours the utilisation of a critical friend in the first instance. A person who already possesses a level of competency in planning and who is able to inform the planning process of discrepancies, alternatives, or omissions. The critique would include, unpacking new procedures for example, assessment tasks, detect omissions in the planning and the inclusion of meaningful activities that directly relate to understanding goals and the guided question/s. Using a critical friend provided time, albeit my own time, where planning can be analysed and concerns addressed.

I felt the critical friend collaborative planning option enables teachers to read, re-read, make mistakes, research and fine-tune their planning and therefore engage in deeper levels of understanding. If teachers engage like my critical friend and I have in their own personal understanding of the planning process, then it could be argued strong pedagogical constructivism has prevailed. When teachers have developed their own level of competency in the planning process using the critical friend planning option then they can engage in meaningful group collaborations. This would hopefully address the issue of time constraints, as teachers should now understand how to plan more effectively.

Given the different types of collaborative planning options used from 2000-2004, I therefore propose a succinct future planning vision that would incorporate:

- Common understandings of planning methodologies. Reference pages: 110, 195, 240-4
- The inclusion in the first instance of a critical friend with expertise in planning methodologies to assist in the collaborative planning process. Pages: 201-5, 210, 216, 239-40

- Equity of time for planning or adequate time where planning could be done satisfactorily. Page: 223, 238
- The use of easy to use proformas, which link to accessible printers and can be transported from school computers to home computers. Pages: 217-8, 224, 228, 230-32
- A common understanding of assessment and proven assessment tasks that could be used in most units of study and be able to link to the standards. Pages: 110, 134, 139-40, 162, 172, 181, 197, 200, 208, 213, 216, 228, 233-5, 241-4,
- The inclusion of students in the planning and assessment process. Pages: 221-2, 243, 251
- The inclusion of reflective practices built into the planning process where units of work can be adequately analysed and adjustments made accordingly. Pages: 107-8,118,170

The succinct planning vision can be supported through various professional learning programs, which continue to add to our understanding of improved planning methodologies. One such professional learning program occurred in early April 2005. The 2-day professional learning program linked to the key element, maintaining wellbeing through the Essential Learnings of personal futures.

The program consisted of elements described in the future planning vision, which I had compiled approximately 1 year prior to these professional learning days. On day 1 of the program, facilitators asked participants to unpack the important concepts contained within each of the key elements of personal futures using a place mat activity. This process illustrated the importance concepts have in the design of the Essential Learnings and the need to use concepts as a motivating influence in our units of study. I had used this procedure in the unit Sun Safety. Participants also engaged in a rigorous examination of the language and expectations contained in the standards.

On day 2 participants were asked in the second half of the day to plan a unit of work they could take back to their schools using the key element, maintaining wellbeing. The information gained in day 1 about concepts and the standards would be incorporated into our unit. Participants formed collaborative grade group partnerships and were explicitly taken through the planning process using the latest Education Department documents as references.

In the explicit explanation of planning procedures participants were firstly asked to choose a concept, which would direct their planning. My colleague and I chose the concept of *choice*. Participants were asked to read the standard their students would aspire to and carefully word the understanding goals to match that standard. The activity selection would then match the understanding goals and link to the chosen concept. Throughout the planning process the facilitators guided participants to the key departmental references of, the Essential Learnings Framework 1 and 2, the Essential Learnings Assessing Guide and the Planning Learning Sequences documents.

Participants brainstormed during the planning process a list of assessments that could be utilised. Important books were referenced to assist in this process, which included, Bennett and Rolheiser's book *Beyond Monet*, a paper titled, *Assessment as learning* by Earl and the Essential Learnings Assessing Guide. The assessment ideas generated by participants were scribed and later emailed to all participants to use in their future planning. Participants were also alerted to the inclusion of thinking within their unit of study with reference to the Essential Learnings Framework 1. Missing from these professional learning sessions however, was the mention of including the students' voice in both the design of units or in the assessment procedures.

My collaborative partner and I decided on the topic, *Food*, which would be suitable for students aged between 5-6 years. The topic also had the potential to engage in problem solving, connect with other Essentials and cater for a range of learning outcomes. The standard used to underpin our understanding goals was upper standard 1, in the Essential Learnings Framework 2 (2003).

Standard 1 upper stated, "Students understand different ways in which their behaviour has both positive and negative effects on their own wellbeing and that of others close to them. They use this knowledge to suggest simple solutions in given situations" (p. 8).

Our understanding goals took a great deal of deliberation before we decided on 4, which best represented our topic, concept and standard. The understanding goals included:

1. What makes a healthy food choice?
2. What are some of the foods that will affect my wellbeing? (positive and negative affects)
3. How can I collect data and make conclusions?
4. How can I improve my wellbeing?

Our activities needed to reflect our understanding goals and also the concept of choice. The tuning in activities included, brainstorming the word choice (good and bad choices), visual art products to show food that makes us feel good and draw on a small piece of paper one food you like to eat for breakfast. This information would be used in a graph where results would be discussed, questions formulated and also used as an assessment.

Guided inquiry was directed mostly by the inclusion of information through videos, books and a guest speaker, a dental therapist whose brief would be to talk about sugar contained in breakfast cereals and breakfast choices. Students would also ask older students what they had for breakfast plus any other pertinent questions. From previous information students would then draw on another small piece of paper a breakfast food choice. This illustration would become a component of graph number 2. Comparisons would be made with graph number 1. Discussions would evolve with these comparisons. The illustrations from both graphs would be used as an assessment and link students' prior understandings to current understandings.

The final phase, performances of understanding, required students to design a breakfast for the class. From the breakfast designs extensive discussions would emanate whereby the most popular breakfast design would then become the class breakfast. The class breakfast design may also include negative choices if students chose these foods. Another activity included the introduction of a food pyramid template where students would select from a magazine two pictures, one food they thought bad and the other good. These foods would then be pasted onto the template. This activity could be done in a cooperative group situation whereby discussions could reveal levels of understanding and also indicate students' understanding of positive and negative food choices. Unfortunately due to time constraints further activity choices were not developed. Having fewer activities however, could prove beneficial, as the unit would not become unwieldy as happened in previous planning sessions where only a fraction of the listed activities were completed.

The information gained through this professional learning program was later disseminated to the staff at my school, by way of succinct notes and discussion. Many teachers were grateful for this succinct information with reference to a clear proforma format where links were visible on 1 page outlining understanding goals, performances of understanding and assessments. The proforma outlined during this professional learning session was also introduced in other professional learning sessions held during 2005. A sample of this proforma outline included:

Key Concept: Healthy Choices.
Guiding Question: What makes a healthy food choice?
Focus Essential: Personal Futures.
Focus Key Element: Maintaining Wellbeing
Supporting Essentials: Thinking - reflective
Key Element Outcome/Upper Standard 1, Essential Learnings Framework 2, (2003): "Students understand different ways in which their behaviour has both positive and negative effects on their own wellbeing and that of others close to them. They use this knowledge to suggest simple solutions in given situations" (p. 8).

Understanding Goals	Performances of	Assessment
What will students come to understand?	**Understanding**. *What will students do to build and demonstrate their understanding?*	*How will you and the students know that they understand?*
Example: 1. What foods make a healthy choice?	*Example*: <u>Tuning In</u>: Brainstorm the question of 'What is choice'?	*Example*: Drawings Written information.

Chapter 18, the final chapter, summarises the understanding I have acquired in planning methodology up until 2005. This chapter mentioned the inclusion of constructivist theory, which provided a lens to critique my planning and activity choices and has the potential to optimise learning opportunities for the students.

CHAPTER 18

CONCLUSIONS

As a result of this thesis study I have been able to reflect as a learner and researcher. A part of my reflective learning journey included the theory of constructivism. I first discovered this word in the Tasmanian Department of Education's document, Our Children: The Future. Teaching and Learning (1991). This document mentioned constructivism as, the current theoretical stance of the Tasmanian Department of Education on how we acquire knowledge. Due to this revelation it became apparent an examination of constructivism would be needed to ascertain whether I used this theory in my pedagogy.

In the combined role of researcher and learner I examined a variety of papers on constructivism, which disclosed the origin, popular types, unifying characteristics, principles and their differences, the use of metaphors, pedagogical implications and students and teachers co-constructing their learning environment. Constructivism in Mathematics Education, by Noddings (1984), mentioned constructivism could be a powerful theory to develop alternative pedagogies where reflection forms a critical component in changing unsatisfactory teaching practices. Taylor (1996) added a critical lens to constructivism especially in the social and cultural constraints that can work in opposition to constructivism as seen through the influence of modernism. Airasian and Walsh (1997) however, added caution to the euphoria surrounding constructivism and argued, "constructivism is an epistemology, a philosophical explanation about the nature of knowledge" (p.444). Consequently it does not always translate into classroom practice by specifying the detailed craft of teaching that enables students to become constructors of their own knowledge.

The need for caution from Airasian and Walsh (1997) regarding the euphoria surrounding constructivism implied a critique of my planning was required to

ascertain if this theory was visible. The critiques included my planning methodologies and an analysis of activities to ascertain whether they achieved maximum learning opportunities for my students. Activities providing maximum learning opportunities would suggest a descriptor of constructivism. The critiques resembled similar principles of an action research model, that is, deconstructing my planning, implementing perceived positive changes and reflecting on the outcome.

During these critiques questions were raised such as, did my classroom practice include elements of constructivism? Did the critique uncover activities that have a multi-faceted dimension or provide optimum learning opportunities? Was the order and choice of activities appropriate? Could the reflective analysis provide improved alternative activity choices or planning models?

To ascertain whether elements of constructivism were visible in my classroom practice I used the Constructivist Learning Environment Survey (CLES) in 2000 and again in 2003. The CLES represented the students' perspective on whether constructivist ideals had been implemented. Tobin and Tippins (1993) however, cautioned:

> The collection of data is essentially an objectivist idea that implies that data are out there to be gathered up. As is often the case, the use of the collection metaphor can constrain thinking about actions associated with the process of data creation. From a constructivist perspective data are not collected, but are constructed from experience using personal theoretical frameworks that have greatest salience to the goals of the individual conducting the research (p. 15).

Although Tobin and Tippins (1993) believed data collection to be an objectivist manifestation, I felt the scales within the CLES represented constructivist ideals that could be implemented into classroom practice. It

should then follow the detailed art of teaching would be achievable according to these scales.

The CLES came in 2 versions, preferred and actual. The preferred CLES was given at the start of a unit of work and provided an insight into the implementation of constructivist ideals. After a period of time, usually at the end of the unit, the actual CLES was given to the same group of students to ascertain whether the scales had been achieved from their perspective. An analysis of the actual CLES revealed I needed to put into practice scales I had briefly or neglected to cover. The analysis identified the following areas that required attention, students to discuss their problems often, students to help plan their own activities, student questions to be supported more frequently, students to help decide time spent on activities, students to share their ideas and to re-evaluate their written or art products when engaged in self or peer evaluations.

Limitations, however, existed when using the CLES. The first was the age cohort of the students in both the 2000 and 2003 studies. Due to the age of these students their understanding was limited on some items, especially where ambiguities existed. This was evident in their scoring and verbal responses. Some students gave multiple responses or copied the responses of other students. I felt before younger students undertake surveys such as, the CLES, the language in items is modified, item responses are limited to 3, the number of items reduced and clear explanations given to items. The question of validity could also be an issue when the teacher is also the researcher. Younger students may be inclined to create a more positive outcome when working directly with the teacher researcher. Although I stipulated before students commenced the questionnaire that these were their own views, there could have been an element of compliance.

The timing of the CLES's introduction was another important factor. This was evident in the 2003 study when the survey was given later in the year after students had acquired basic literacy skills. In the 2000 study basic literacy skills had been established in prior years and therefore the CLES was given

earlier in the year. In both studies I orally dictated each item to the whole class. This was to avoid difficult sentence structures or difficult words such as, solve, interesting, perfect and problems. In the 2003 study I dictated the CLES at the commencement of the school day to small groups of students, as this reduced disruptions to class routines. I could also gauge in this small group situation whether students responded appropriately to each item. Given the literacy skills of both groups of students and their level of understanding in using surveys, I felt more reliable results would be achieved with older students where their understanding and maturity was better established.

Another limitation was the class structure or the perceptions of a particular age cohort of students. This limitation was a major issue in Dawson's 1994 action research study. Dawson used the CLES to ascertain her students' perceptions of attempts to introduce a constructivist reform agenda into her high school science classes. Conclusions drawn from Dawson's action research study indicated class A was more in favour of the change in pedagogy than was class B. In class B some students did not appreciate the relevance of the activities and were more focused on factual content.

Another limitation is school or collaborative planning preferences. During the course of school collaborative planning sessions and in most professional learning programs held between 2003-5 teachers were not encouraged to include students as part of the planning process. The inclusion of the student voice therefore would be silenced if teachers were to adopt unquestionably the methodology prescribed by their school or facilitators at various professional learning programs. An exception to this planning ethos was my critical friend who recommended the inclusion of students in the planning and assessment process and the practices of Reggio Emilia.

Using colleagues in a collaborative planning process either as a critical friend or in conjunction with clusters of teachers has the potential to unpack the complexities of pedagogy, planning and in particular the choice of activities associated with a unit of study. Erickson (2002) acknowledged that advances in brain research and knowledge on how students learn supports the belief that

students should be actively engaged in learning. Erickson stipulated if knowledge is to be retained then it should be used in a demonstration of complex performances. By using constructivism as a referent and Erickson's brain research information, activities should therefore include, choice, engagement with understanding, different thinking modes, values and purposes.

The choice of activities described in the two units of study in 2000 and 2003 endeavoured to include deeper levels of understanding. Blythe (1998) however, argued, "nurturing understanding is one of the loftiest aspirations of education and also one of the most elusive" (p.xi). Although Blythe alluded to the nurturing of understanding as difficult, teachers should therefore be vigilant and reflective in the choice of activities they provide for their students. Their reflective practice should ascertain whether activities are capable of changing students' misconceptions, provide thinking opportunities, include a purpose, include the student's voice and have multiple entry points by using different intelligences. The utilisation of authentic, informative assessment tasks undertaken at intervals throughout the unit can highlight misconceptions and ascertain levels of understanding thus substantiating the acceptability of those activity choices.

The activities described in the 2 units were divided into stages or phases of understanding, each stage or phase built upon the preceding phase. The building of understanding through stages or phases would presume students are engaged in constructivism. Planning under the Essential Learnings incorporated a teaching for understanding planning framework adapted from the work of Blythe (1998) and Murdoch (1998). Often individual teachers modified the Blythe, Murdoch framework into their own personalised planning proforma. These planning proformas can be accessed through computers in either A4 or A3 format where sequences of activities are listed under various headings.

The reflective analysis of these 2 units identified areas of concern. One concern were the types of activities detailed in these units. Some activities did

not provide adequate choice, were not explicit, did not have a purpose, lacked adequate authentic assessments or were incorrectly placed in a phase. To rectify these deficiencies I redesigned these units using mostly a collaborative process. Due to these collaborations, professional learning programs, reflective thought and an improved understanding of the Essential Learnings my planning was transformed into more meaningful units. Some transformations included a rework of the Blythe (1998) and Murdoch (1998) phases, improved activity choices and the inclusion of a concept to underpin a unit.

The inclusion of the Reggio Emilia professional learning program effected the redesign of the 2003 unit. The appeal of this approach transferred into the 2004 planning with the inclusion of students' questions, which formed the basis of the unit, Reduce, Reuse, Recycle, Rethink. The Reggio Emilia approach placed students' interests and understanding at the heart of pedagogical practice. Classrooms are organised to support a collaborative problem-solving approach to learning where students assist in the planning and assume responsibilities for specific observations and information. Teacher's planning is also supported with parent input thereby transforming planning into a communal and collaborative activity.

Teachers' planning under the Reggio Emilia model involved rigorous documentation of student conversations. The analysis of these conversations often reflected student interests, preferences and ideas, which are later transformed into specific student centred projects. Students contribute to these projects from their own understandings, and suggest questions to ask and investigations to pursue. Planning therefore truly represents the interests and understanding of a particular cohort of students. Edwards (1998) appeared to endorse the type of procedures espoused by the Reggio Emilia approach and suggested, learning activities follow an open-ended spiral approach where they repeat key experiences, observe and re-observe, consider and reconsider, represent and re-represent. Learning therefore never becomes set and routine but instead is always undergoing re-examination and experimentation and therefore can be classified as thoroughly constructivist. Noddings (1984) stated:

the great strength of constructivism is that it leads us to think critically and imaginatively about the teaching-learning process. Believing the premises of constructivism, we no longer look for simple solutions, and we have a powerful set of criteria by which to judge our possible choices of teaching method (p. 18).

Using constructivism as a referent meant I was able to critique, modify or innovate on my planning. Activity choices deemed inappropriate could be transformed into more viable alternatives. Planning is also informed by the effective use of diagnostic assessments that disclose students' understandings or misconceptions. An informative assessment that allows teachers to uncover student's understandings is through overt thinking. Overt thinking encourages students to openly discuss procedures and discrepancies and provide support to correct those discrepancies. Ernest (1995) however, stipulated the implications for pedagogy is to be sensitive to individual constructions and facilitate a strong social basis within the classroom.

Noddings (1984) suggested another great strength of constructivism is the possibility of being able to think critically and imaginatively about the teaching-learning process. Pedagogy therefore has the potential to be influenced by many factors and can present in a variety of alternatives all showing evidence of a strong constructivist agenda. Visibility of constructivism would be students engaging in purposeful activities where it is presumed understanding occurs and where classroom practice can adjust according to student needs. The critical analysis of the 2000 and 2003 units indicated constructivism was visible in my practice according to Noddings. My planning was not rigidly conceived but open to divergent approaches informed through, professional learning programs either mandated or non-mandated, as part of a collaboration process, using ideas from recommended references, observations of exemplary teaching practice, reflective practice, videos and information acquired through the Essential Learnings.

Pedagogy could have the intent of a constructivist agenda however, some activities work well with some students and not with others. Some students may feel isolated or lonely and become detached from the classroom environment. The success of activities can often be determined by their introduction, classroom environment and the enthusiasm of the teacher. Taylor suggested a critical constructivist lens should therefore apply, which incorporates a social epistemology. Beck and Malley (2005) (*http://www.cvc-net.org/cvc-online/cvcol-0303-belonging.html)* highlighted the urgency of creating classroom environments that promote, care and that treat students with dignity and respect. The authors viewed education in the new millennium as:

> Education must focus on teaching all people how to live in an inclusive community where each person is treated with respect and dignity and enlisted to participate fully in the life of the community. A belonging pedagogy emphasises the democratic ideal in which caring, cooperating, and serving form the cornerstones of the learning process (p. 10).

Constructivist epistemology theory enables teachers to use the underlying principles, as a referent for their teaching and learning. A presumption of constructivism has been achieved in my pedagogy according to the literature and in the planning methodology used in both the 2000 and 2003 units. Using constructivism as a referent means planning models and activity choices will be continually under review and alter as I acquire further understandings about the desirability of those choices. Tobin and Tippins (1993) asserted, "constructivism acknowledges the impossibility of ever knowing the truth, it is possible to alter the metaphor of researcher as truth seeker to one of researcher as learner. That is, the role of the researcher is to make personal sense of experience and, in a socially mediated way, to build knowledge in a given field" (p. 15).

As a result of this thesis study I have achieved a greater understanding of the potential of constructivism and the Essential Learnings, which consequently has enhanced my planning methodology. This enhanced understanding can

also influence others. It is envisaged in future collaborative planning sessions or staff meeting agendas to have a more decisive and direct input into planning directions. Throughout 2005 this vision became a realisation.

In early 2005 I was originally a member of the Preparatory team of teachers. In our first collaborative planning meeting in February 2005 our team compiled an initial unit of study, titled, Who Am I? What Can I Do? This unit resembled my 2003 unit, Waste and Recycling, with a smorgasbord of activities listed under various phases. In one night I was able to recreate a more manageable unit, listing activities into appropriate phases and included tuning in activities to ascertain students' initial understandings. This revised unit was then circulated to all team members who were able to commence the unit within the first week of school.

In March 2005 I recommenced the Reading Recovery program thus reducing my on class time to half, sharing the Preparatory class with a teacher in her first year of teaching. Throughout 2005 I was a support person for my first year teacher colleague. This meant sharing my planning methodologies including daily planning book and unit planning methodologies. D. Foggo, my first year colleague teacher (personal communication, December, 2005) stated in an end of year note:

> *"Dear Lesley,*
> *Thank you for a wonderful introduction to teaching, thank you for your guidance, your knowledge, your willingness to share all this with me. Most of all thank you for your friendship".*

In April 2005 information gained through the wellbeing professional learning program was conveyed to my colleagues. This was done through staff meeting discussions and documentation I had compiled during this professional learning program. The documentation depicted a planning model using the unit, *Food,* which highlighted, the inclusion of a concept, appropriate activity choices and understanding goals that contained the language of the standards. Links were made between understanding goals, assessment and the inclusion

of a concept. Feedback from this planning documentation was positive and encouraging.

In October 2005 during a SARIS (Student Assessment and Reporting Information System) session I was able to provide the Preparatory team a succinct list of mathematical tasks undertaken during the year. A list of mathematical tasks was required for team members to enter into their reporting system. The Preparatory team had on several occasions tried to compile this list but had found it ominous.

In December 2005 I was presented with flowers and a note of gratitude from the Preparatory teaching team of, A. Brook, D. Foggo, B. Hudson, D. Jacques and H. Richardson (personal communication, December, 2005), which stated:

> "*Dear Lesley,*
> *Many thanks for the wonderful support you have given our team,*
> *especially during term 3 and SARIS*".

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APPENDIXES