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Thesis Title : STUDENTS' AND TEACHERS' UNDERSTANDING OF THE APPLICABILITY OF CLASSROOM SCIENCE IN EVERYDAY EXPERIENCES.

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STUDENTS' AND TEACHERS' UNDERSTANDING OF THE APPLICABILITY OF CLASSROOM SCIENCE IN EVERYDAY EXPERIENCES

by

Kelesi Loga Sale-Whippy

A thesis submitted in fulfillment of the
requirements for the degree of
Master of Education

School of Education
Faculty of Arts and Law
The University of the South Pacific

March 2010

DECLARATION

Statement by Author

I, Kelesi Loga Sale-Whippy, declare that this thesis is my own work and that, to the best of my knowledge, it contains no material previously published, or substantially overlapping with material submitted for the award of any other degree at any institution, except where due acknowledgement is made in the text.

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Statement by Supervisor

The research in this thesis was performed under my supervision and to my knowledge is the sole work of Kelesi Loga Sale-Whippy.

Signature……………………

Date..23/3/2010…………

Name..Vilimaka Foliaki…

Designation….Supervisor……

DEDICATION

I dedicate this writing to my husband, Peter and our four children, Emma, Nathan, Moanalei and Amon for their generous support in taking care of things at home while I am engrossed in my work. In addition, I dedicate this writing to my mother, Siteri Lalaciwa Sale, my sisters, Emma Bitu Sale-Mario and Salaseini Finau Sale-Cabebula, and their respective families who have taught me so much in providing the resources and motivational elements during the challenging times in research work.

ACKNOWLEDGEMENT

First, I would like to thank Our Almighty God for giving the very breath, power, strength and endurance in enabling me to complete such a task.

Second, I thank my sponsors the Australian Agency for International Development (AusAid) and the Faculty of Arts and Law (FAL) for the tremendous support in providing the necessary resources during the challenging periods of study.

Third, I take my hat off to my supervisors, Dr Srinivasiah Muralidhar for his comments and advice during the preliminary stages of my writing and Mr.Vilimaka Foliaki whose encouragement, support and patience had significantly contributed to compiling this writing. Also, at this point I would like to acknowledge the services of Dr. Mesake Rawaikela whose comments at the final stages of this writing effected confidence and boosted self-esteem during this critical stage.

Fourth, I thank the Head Teacher, Teachers, Students and Stakeholders that participated in this project for their cooperation and willingness, and making necessary adjustments to their teaching and learning schedules to accommodate me during my fieldwork.

Finally, I thank my good friend, Venina Martin, who has supported me in typing and editing work during my undergraduate and post-graduate years. Without her devotedness, I would not have been able to meet deadlines.

ABSTRACT

Students' and teachers' perceptions of their experiences of school science have been extensively examined at primary, secondary and tertiary levels in Fiji. The aim of this research study is to explore students' and teachers' understanding of the applicability of classroom science in everyday life in a co-educational ethnic Fijian primary school. As such, the research aims to articulate their views as a contribution to the debate about the future form and function of the primary school science curriculum in Fiji. The method used to elicit their views is Phenomenology- a methodology that continues to gain recognition in science education research. In obtaining data, questionnaires and semi-structured interviews were administered to 40 students and five teachers of the target school in a period of seven weeks. The findings of this research offer a window into students' and teachers' perspectives of experiences of school science and everyday situations. On the negative side, students reveal limited knowledge on how scientific concepts and processes are involved in everyday phenomenon and vice-versa. The teachers' views are closely aligned with that of the students. From a more positive perspective, students and teachers see the study of science as important and should be relevant to everyday living though the nature of their responses reveal otherwise. The implications of these findings and the insights they provide could be used extensively to assist at the Curriculum Development Unit in Fiji.

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CHAPTER 1
INTRODUCTION

Am I?

I sit and listen to the squeaky sound of the machine

the laughter, recitations and the soft giggles …

"*Well, um, er, it's like a potato."*

"Oh! What was that? What did you say?"

"Hmm…it's not like dalo or tavioka, like we have here."

"Yes, yes go on."

"Cause it's hard to swallow."

"Do you take time to chew, keep it in your mouth for some time?"

"*No, cause I worry sick and I don't like the taste."*

"It's good for your health and it helps you do better."

"If only I am told I would not be feeling like an alien or am I?"

Familiar statements such as those shown above do not reflect lazy students; they are statements of facts. The above reflection is a lament of a student participant in this study as she approximates the frustrations commonly felt during science classes. A general picture that emerges from this expression is that the way science is taught at school, has given it a foreign image. The Fiji Islands Education Commission Report (2000) also highlights that the way science is taught in Fiji schools is located within, and exclusively derived from western contexts This study maintains that such sentiments may be related to the belief that science is 'culture free' and is a discipline that comprises of a set of objectives and universal facts, rules and procedures.

Numerous studies in the science classroom also suggest that girls' participation and enthusiasm in science are influenced to a great extent by whether they identify themselves as people who can or cannot do science (Brickhouse, Lowery, & Shultz, 2000). Unfortunately, science as is traditionally taught in schools has little resemblance of how scientists work. In such classrooms, there is only one 'right' answer, and one 'right' process to find that answer. Further, scepticism and debates are discouraged, and uncertainty and controversy are not a part of the daily classroom discourse or the science textbooks and laboratory exercises in which students use to approximate the 'right' answer.

Moreover, science subjects appear to be only for an elite group of students - the 'science students' or the 'top students'. Those who are not as 'good' as these top students are encouraged to pursue careers in other disciplines such as Literature or History. In other words, this elitist view portrays science as a difficult subject that is accessible only to selected students with natural aptitudes for science, or who could somehow decode the complicated terrain of science (Lemke, 1990). Unfortunately, these erroneous beliefs do not give students any insight into the ways in which scientific knowledge is actually constructed (Schwab, 1966). Such perception created what Lemke (1990, p. 8) calls a 'mystique of science', where science becomes something that seems inherently complex and unobtainable.

The Phenomenon

The central role of one's prior knowledge in teaching and learning is widely reported (Osborne & Freyberg, 1985; Bell, 1993; Cobern, 1996). These research studies on children's learning in science, which are later discussed in detail, emphasise the need to begin teaching from the children's prior knowledge, and to build from that base their understanding of the world. Before they enter the formal science classroom, children have already had prior experiences with natural phenomena in real-world contexts of their homes and communities. In Fiji, for example, by the time children enter primary schools, they already have experiences with making *lovo* (baking in an earth-oven) or preserving fish by drying, smoking or salting. By this time, many children would have already started enquiring about various natural phenomena such as the metamorphosis of a caterpillar into a butterfly and the changing phases of the moon. In this study, it is maintained that integrating 'real-life' or 'everyday' situations such as these into the existing science curriculum would help make classroom science more meaningful and worthwhile.

My experiences in teaching science in Fiji mainly involved teacher-centred instructions. Due to numerous reasons such as the lack of resources and time, I, as well as many other teachers, generally expect students to write in their books only the questions and ready-made answers that are provided on the chalkboard. In such classrooms, the teacher is a dominant figure who provides to a group of passively listening students, the instructions about how to re-produce science facts and theories that are in the textbook. Although this type of instruction may still have a place in the contemporary Pacific Island classroom, its value in promoting a meaningful understanding and appreciation of science, especially if used day after day, is questionable.

Interestingly, there is a general perception that students who do not score high marks in science are not scientifically oriented and therefore do not have the intellectual competence to do well in this subject area. Some local studies (Dakuidreketi, 2006; Muralidhar, 1989; Singh, 1992) had revealed that the teaching and learning of science in many Fiji classrooms are far-removed from students' daily experiences in the home and community.

To understand how students and teachers relate classroom science to everyday knowledge and practices, an investigation was carried out at a primary school situated in one of the suburbs of Suva, Fiji. Specifically, this study aims to find out how well students and teachers draw on their everyday experiences to better understand classroom science. Everyday experiences and cultural experiences are interchangeably used in this writing, as it is believed that culture forms a significant part of one's everyday life practices.

Why the phenomenon is a concern

Rosenthal (1996) contends that culture is an important force that helps to shape and define the education system. As seen in the previous paragraph, one's culture is an important factor, which can influence learning in general, and science teaching and learning in particular. In essence, every human being uses science to understand the natural world. As a human enterprise, science is meaningful only in the context of a specific culture, in which its practitioners (scientists, teachers, and students) are the product of that culture.

In a comparative study of ethnic Fijian and Indo-Fijian communities, Dakuidreketi (2006) argues that the cultural contexts of the two main ethnic groups in Fiji (Indigenous Fijians and Indo-Fijians) bear significant implications for the construction of meaningful understanding of science concepts and processes. The author further states that every indigenous culture has a unique orientation to learning. In its most fundamental sense, science is a 'process of enquiry' by which we try to understand how the natural world works and how it came to be the way it is. Science is, therefore, an inseparable element of any human culture. This shows that culture, science, and learning are intricately interrelated as we dwell on the many ways in which science contributes to everyday life.

In this study, there is a special focus on the need for science teachers, particularly at the primary level, to have a meaningful understanding of science as a process through which humans, regardless of their cultural context, make sense of their world. For students to be able to develop this understanding, teachers must first understand the basic processes of science and how these can be used in everyday inquiries to make sense of events and phenomena

This above problem is not restricted only to Fiji as it has also been highlighted in many studies in other parts of the world. For example, Stake and Easley (1978) reports that many science teachers focus their teaching on the memorisation of facts rather than on higher-order thinking skills and the applications of science to daily life. A similar trend has also been observed in many Australian schools (Gallagher & Tobin, 1987). From my experiences as a classroom teacher, these problems are exacerbated by an examination-oriented curriculum, which constrains teachers to limit their lessons to only what is in the textbook and 'teach to the test'. A closer look at the examination systems in Fiji are provided in a later section in this chapter.

As mentioned earlier, this study explores students' and teachers' understanding of the relationships between classroom science and their everyday experiences. Based on the problems discussed above, the importance of this research is discussed in the next section to provide the grounds for and to consolidate the significance of this research project.

The Significance of the Study

This research project is significant for the following specific reasons:

1. The study may suggest ways for reform of the science curriculum to improve perceptions of science and everyday applications of science;

2. The analysis of the research information could indicate potential areas for improving policies and decision-making in science education in Fiji;

3. This study may also assist to identify important areas of misconceptions specific to Primary Science.

This study is a significant contributor to a worthy cause. It is believed that all efforts to ensure that classroom science is relevant and meaningful to the lives of the people of Fiji must be supported and encouraged.

As mentioned in previous sections, the heart of the problem is that many students fail to understand science in a meaningful way because they are unable to relate new science concepts and skills to the experiences, knowledge and skills they already have. Therefore, ideas from this study may enhance recent efforts to nurture experts in science who are adept at exploring the interactions between scientific skills and concepts, and the natural environment. It is believed that science programmes in which children learn about their local ecological systems, such as vegetation, rivers, farming, fishing, and food preservation methods, would build learners’ confidence and enhance their participation in the science classroom.

Moreover, most developed and developing countries in the world today rely on science and technology to improve their economy. For Fiji to fully benefit from this development, it will have to rely on information gathered from researches such as this study to equip more of its people with the necessary knowledge and skills to participate in implementing new scientific approaches. In addition, findings from this research study would help teachers and policy makers find a way to make science more relevant and meaningful to students as well as teachers.

The Research and its Scope

Objectives of this research study

The objectives of this research project are to:

1. draw upon students' and teachers' classroom science knowledge and everyday life experiences thus accessing different ways of thinking about how science could be best taught and learnt in the target school and hopefully in the Fiji science classroom;

2. bridge the gap between traditional knowledge and modern science;

3. improve students' and teachers' personal theories about the world and classroom science learning.

Research Questions

To ensure that the above objectives are attained, this study explores ideas that would help answer the following questions:

1. How well do students and teachers understand the relevance of classroom science in their everyday lives?;

2. How well do students and teachers draw on common everyday experiences to understand classroom science?;

3. Are there areas in classroom science in which local knowledge and skills are of comparative advantage?

To fully understand the implications of these questions, it is important to have some understanding of the education system in Fiji and the organisation of its science curricula. These are discussed in the next section.

The Education System in Fiji

For many years, Fiji's education system has been closely linked to that in the United Kingdom and, more recently, to that in New Zealand. It was only in 1988 that the final two New Zealand-based national examinations, the *New Zealand School Certificate* (NZSC) and the *New Zealand University Entrance* (NZUE) for forms five and six, respectively, were administered in Fiji secondary schools (Fiji Islands Education Commission Report, 2000). In 1989, the NZUE was replaced by the local examination known as the *Fiji School Leaving Certificate* (FSLC). The NZSC examination was replaced by ongoing internal assessment methods developed by the Fiji Curriculum Development Unit (CDU) to prepare a standard platform for admission to form six.

Formal education is offered at pre-school (ages three to five years old) followed by primary (Classes one to eight), and secondary (forms three to seven). At the primary levels, there are two examinations offered: The *Fiji Intermediate Examination* (FIE) and the *Fiji Eighth Year Examination* (FEYE) and these are administered at classes six and eight respectively. The FIE is an entry examination to class seven and the FEYE qualifies students to enter form three. Recently, an assessment strategy, the *Fiji Islands Literacy and Numeracy Assessment* (FILNA), which is administered at classes four and six, has been piloted in a number of primary schools in Fiji to replace the FIE. It is understood that the phasing out of the FIE is the result of the continuing public pressure placed on the *Fiji Ministry of Education* (MOE) regarding the validity of examining students at that stage (Fiji Islands Education Commission Report, 2000).

A summary of the present school structure in Fiji is shown in Table 1 below. This table shows the three major school levels, age group, class or forms and the predominant nation-wide assessment method used at each level.

Table 1: Present School Structure

School level	Age (yrs)	Form or Class	Common nation-wide Assessment
Pre-school	3-5		No common nation-wide assessment
Primary	6	Class 1	No common nation-wide assessment
	7	Class 2	No common nation-wide assessment
	8	Class 3	No common nation-wide assessment
	9	Class 4	Fiji Islands Literacy/Numeracy Assessment
	10	Class 5	No common nation-wide assessment
	11	Class 6	Fiji Intermediate Examination or Fiji Islands Literacy/Numeracy Assessment
	12	Class 7	No common nation-wide assessment
	13	Class 8	Fiji Eight Year Examination
Secondary	14	Form 3	Internal Assessment
	15	Form 4	Fiji Junior Certificate Examination
	16	Form 5	Internal Assessment
	17	Form 6	Fiji School Leaving Certificate Examination
	18	Form 7	Fiji Seventh Form Certificate Examination

Organisation of Science Curricula

The teaching of science in Fiji begins at class one, although children at pre-school level are exposed to basic features of the natural environment, in particular the different colours, shapes and textures of plants and leaves (refer to Table 2). A second science-related subject, Health Education, is introduced at class five. This means that all students of classes five and six take both Health Science and Elementary Science. Both classes seven and eight take Basic Science, which comprises of Health and Environmental Education. The subject Basic Science is taught up to form four, and at form five, students have their choice of whether to focus their studies in either one of three streams: science, social science (which includes the art subjects such as Commerce, Literature, Language, History, and Geography), and vocational studies (which include Agricultural Science, Technical Drawing, Food Technology, Woodwork, Metalwork and Engineering). Table 2 illustrates the structure of the science curricula from the primary level up to the secondary level.

Table 2: Organisation of Science Curricula from Primary to Secondary Education

Level	**Form/Class**	**Science curriculum**
Primary (Lower)	Class 1 Class 2 Class 3 Class 4	Elementary Science – Natural/Life experience
	Class 5 Class 6	Health Science, Elementary Science
Primary (Upper)	Class 7 Class 8	Basic Science – compulsory for all students
Secondary (Lower)	Form 3 Form 4	Basic Science – compulsory for all students
Secondary (Upper)	Form 5 (Science) Form 6 (Science) Form 7 (Science)	English Physics Chemistry Biology Mathematics

(Source: Adapted from the Fiji Ministry of Education Annual Report, 1999 - 2004)

The Basic Science Curricula

During the past decade, the Basic Education Management Training and Upgrading Project (BEMTUP), funded by the Australian Aid Agency (AusAid), revised the science curricula at the upper primary levels, classes seven and eight. This work, which included a critical examination of the content of the Basic Science curricula from a number of teacher participants, revealed that most of the topics contained material that were out of touch with students experiences (Ravana, personal communication, September 28, 2006). Ravana, a teacher participant, adds that most of the topics and concepts were totally irrelevant to the students' and teachers' immediate experiences. Further, Ravana argues that the prescribed textbook contained a linear, simplistic, fact-filled body of knowledge. She further elaborates that as a result, in 1995, the Basic Science curricula were revised and improved with the aim of providing more experiences that best suited students' needs, as summarised in Tables 3 below.

Table 3: Basic Science curricula for classes seven and eight

Class	**Topic**	**Subtopic**
Class 8	Weather	What causes weather? Air and wind movements How air pressure influences weather Thunderstorms and tropical cyclones Heat energy from the sun How is rain formed? Weather prediction

	The Land, Environment and Us	Where organisms live? Why organisms live in certain places? Feeding patterns and how man changes the ecosystem
	Food and Nutrition	Our bodies need food. What happens to food inside us? The growth of our bodies and nutritional problems.
	Separating Mixtures	Pure substances and mixtures. Separating with a sieve. Separating heavy grains. Separating by spinning. Some special separations.
	Energy	Energy Transformation. Technology and the demand for energy. Using energy wisely.
	Floating and Sinking	The up-thrust force in liquids Liquids have densities. Putting solids in order. Floating and sinking.

	Rocks and Soil	Inside the earth. Looking at rocks. From rocks to soil. Good soil. Acids and soils. Soil and minerals.
Class 7	Introduction to Science	Know your science laboratory. Our senses. Measuring in science. What is scientific investigation?
	Matter	What is matter? States of matter. Solutions and pure liquids. The water cycle.
	Living Things	Features of living things. Natural habitat. Upsetting and restoring natural habitats. Conditions for good plant growth. Carbon cycle and minerals cycle.

	The Environment and our Health	The physical environment and our health. The social environment and our health.
	Sounds we hear	Vibration and sound. Sound, matter and vacuum. The voice box and the ear. Let's make music.
	Pressure Force	What is force? Force at work. Can the pressure change? Air pressure. Comparing and expanding air.
	Energy	Exploring energy concepts. Energy source. Renewal and non-renewable energy. Uses of energy. Energy saving.
	Space Technology	The solar system. Space technology. Space technology spin-offs.

Scope and Limitations

Instead of seeking to ensure representativeness of the data by extending the breadth of the investigation to involve a range of schools, this study however, focuses on understanding the dynamics of science experiences of children of one ethnic Fijian primary school referred to in this study as, the target school. This research explores the range of views held by students and teachers of the applicability of classroom science in everyday life. Since it was not practical to involve all the students in the school at the time of this research, the data was collected from a ‘target group’ which consisted of five teachers and 40 students from classes seven and eight**.**

The main constraint of this research was time limitation at the target school. As researcher, an ideal setting would be an isolated place with little or no disruptions at all during the interviews. It was not so in this case. There were continuous announcements made by the head teacher and teachers on duty over the loud speaker, which had a negative effect on the interview process. The student participants had to stop for a while in their responses to listen to the announcements before continuing. In certain instances, I had to re-ask or re-frame the questions to establish a fresh start.

Summary

As already mentioned, this study explores students’ and teachers’ understanding of the applicability of classroom science in everyday life and vice-versa. To some extent, students as well as teachers in this study revealed limited understanding of how scientific concepts and processes are involved in everyday phenomenon. From a more positive perspective, students and teachers saw the study of science as important and should be relevant to everyday living though the nature of their responses revealed otherwise. This is discussed in my findings in a later chapter.

The next chapter covers a study of parallel literature on concepts and ideas related to this study. Chapter 3 consists of an in-depth discussion of the methodology I had chosen to adopt in this research. My interpretations of the data collected and deliberations are highlighted in Chapter 4, and a set of reflections that includes implications and afterthoughts are discussed in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

Introduction

This review of the literature is an exploration of relevant theories and concepts that have informed this research and provided insights into the connections between children's everyday experiences and school science. Initial deliberations on the philosophy of science and what science is, are followed by a series of discussions of learning theories in particular on a constructivist approach to learning. A section on science and context is included, followed by a discussion highlighting perceptions of science for social relevance. The chapter is wrapped up with critical discussions on science teaching and learning from a multicultural perspective.

The Nature of Science: understanding what science is

Understanding what science really is, is an important precondition to a meaningful understanding of the world that we live in. Understanding the nature of science shapes the way one learns (or teaches science), and allows one to easily distinguish between science and other practices or knowledge that are not science. Misunderstanding the nature of science is a major cause of confusion in the science classroom, which, in turn causes many students to hate science. Science is traditionally perceived as a special body of knowledge and skills associated with the world in which we live. Another popular conception that people have about science is that it is a disciplinary field or area of specialisation such as physics, chemistry, biology, or astronomy to name a few. It is also been referred to as an occupational role of professionals, called scientists, who have a characteristic attitude of mind and way of working (Hacking, 1999). Old scholars in the history of science such as Aristotle and Isaac Newton were famous scientists. However, many of their ideas which were considered as science in their time are now seen as non-scientific or myths.

Debates are not new to science. The above information shows that the nature of science, and issues such as what constitutes science, the work of scientists, interpretations of scientific data, are, and will be controversial. Science progresses because of doubts and controversies; it thrives on diversity of ideas and interpretations. The literature contains numerous and on-going debates over issues of this nature. A simple example would be the argument between scientists about global warming or the cause of AIDS or evolution.

Other debates may be over more abstract philosophical assumptions pertaining to the nature of science itself. In 1962, for example, Thomas S. Kuhn (see Chalmers, 1976), brought in much controversy to science when he put forward the idea that science does not progress via a linear accumulation of new knowledge, but undergoes periodic revolutions (or paradigm shifts). He called such events paradigm shifts or scientific revolutions. According to Kuhn, science evolves and is typically practiced within an established way of doing things (a framework or paradigm).

In a nutshell, science is an on-going process of solving problems. Therefore, rather than allowing ourselves to be drawn into these on-going and never-ending debates, it would be more valuable, in my opinion, to shift the focus to the aspects of science that the majority appear to agree with. Hence, before advancing any further, of particular importance is to understand that the nature of science refers to the characteristics of science as a way of knowing, or the values and beliefs innate in the development of scientific knowledge. Eight characteristics of science that makes the subject unique from other disciplines are listed as follows:

1. Scientific knowledge is based on empirical evidence.
2. Scientific knowledge is a product of both observation and inference.
3. Scientific knowledge is tentative.
4. Scientific knowledge is a product of creativity and imagination.
5. Scientific knowledge is subjective.

6. Science is skeptical and rejects the notion that it is possible to attain absolute truth.

7. Science rejects supernatural explanations for observed phenomena.

8. Scientific knowledge is socially and culturally embedded.

(ED316 Science and Social Studies III, Unit 1: The Nature of Science)

These characteristics are interrelated and overlap to some extent but they summarise much of the literature surrounding the nature of science. However, in my opinion, it is worthwhile to focus on three characteristics that appear to be in parallel with this study. Thus, for the purpose of this writing, the changing nature of science (that is, its tentativeness), scientific knowledge being a product of creativity and imagination, and the diverse 'traditional' perceptions of the natural world and how it operates (that is, its cultural-embeddedness), are discussed in alignment with the phenomenon understudied.

Battiste and Henderson (2000) contend that the changing nature of science affects knowledge and practice in each generation. The authors reaffirm that individuals make observations, compare their experiences with what they have been told by their teachers, conduct experiments to test reliability of their knowledge, and exchange their findings with others. The implications of this dynamic cycle, in my view, is that everything pertaining to culture and tradition is continually being revised at the individual and community levels.

Interestingly, Battiste and Henderson (ibid) further imply that for indigenous people, the 'particulars come to be understood in relation to the whole' and the laws are continually tested in the context of everyday living practices. For instance, during the interviews with the students, responses to the question concerning survival techniques on an uninhabited island revealed knowledge and practices tested out in the daily living of personal experiences of the participants. Specific references to the question varied from how people lived in the Pre-European Contact Era would have survived, for example, "Living off green coconuts" to vague explanations suggesting the processes of distillation (the basic process of obtaining fresh water from sea water). These recounts were an indication that survival of individuals and communities, over time, depends on their dynamic knowledge base.

Consequently, while scientific theories are substantiated by considerable evidence, all these are considered provisional and subject to change or refinement (Chiappetta & Koballa, 2004). The authors argue that theories are inferred explanations and science even as a way of knowing is not a representative of absolute truth. In turn, this way of thinking removes science from being an all-knowing human enterprise. Thus, it can be respectively mentioned at this point that scientists rely heavily on their imagination in carrying out their work. This brings to attention the second key characteristics of science parallel to this study, the assumption that scientific knowledge is a product of creativity and imagination.

According to Chiappetta and Koballa (ibid), scientists draw upon their imagination and creativity to visualize how nature works, using analogies, metaphors, and mathematics. By contrast, a stereotyped image of scientists being bespectacled, serious-looking individuals in lab coats, conducting laboratory experiments that require superior intellect to be understood often diminishes a liking towards this discipline. As a result, according to Buxton and Provenzo, the processes in science are perceived to include a relatively fixed body of knowledge that requires rigid specifications and systematic inquiries (Buxton & Provenzo, 2007).

Children tend to be naturally creative, but creativity may be dampened before they leave school if teachers have not sought and kindled creative potential. In association, Sahu (2006) articulates that there is empirical evidence to show schools can play a major role in encouraging creative development in science. The author reasons that scientific knowledge which is developed due to the curious inventive attitude of human thinking generally is, the study of scientific concepts including observations, experimenting, hypothesis, materials and methods, results and conclusions, is nothing but the creation of human spirit, just as much as religion, art or literature, and is an essential part of humanities.

Likewise, in this study, the participants are involved in identifying and classifying their thoughts and confirming their knowledge with their experiences. Specifically, the participants are engaged in a confrontation of what they know about formal and informal science. As the process of interviewing continued, an unfolding, unraveling technique was noted. Furthermore, it is evident that the whole experience require being imaginative and creative. As students (and teachers) relive certain experiences, for instance, food preservative measures, there is a conscious effort on the participants to relate to their experiences to the (science) concepts learned at school and vice-versa.

However, a notable number of the participants have a view of science that is far removed from the real world practice of science. It appears that students are unmotivated to explore their ideas nor is there display of interest to solve problems in a scientifically acceptable manner. It can be deduced, from the evidence as discussed in chapter 4, that these students, more often than not, are not provided with opportunities to think independently and be introduced to problem-solving situations in negotiations during science learning.

In response to this claim, the teacher participants rest on the excuse that the pressures of an 'exam-oriented' curriculum give little room to developing creative scientific abilities. The resultant, as confirmed by the Fiji Islands Education Commission Report (2000), is that teachers feel obligated to rush through units of study in an effort to cover the materials. In addition, the report reveals that science instructions mainly include basic information about a topic, consisting of a typically overemphasised vocabulary and factual information in preparation for tests and examinations.

Nonetheless, teachers of science need to develop ways of enhancing creativity development in science. As science educators, the situation warrants the need to be confident and the ability to, as argued by Buxton and Provenzo (2007), 'break away from formalized texts as too much structure kills creativity' (p. 138). The authors had supported, Carin and Sund (1970) suggestions that 'teachers must be prepared to move away from commercially prepared materials when the situation warrants it and supplement these with what they have devised themselves' (p. 272). Scheele (1979) had also agreed that teachers could 'bring textbooks to life' by developing an activity on any topic to complement a textbook-based activity, that is, to include fun and games to the printed material.

In other words, a science teacher should be able to innovatively create their own activities and, due to this involvement, is more likely to nurture creativity in students. In turn, during engagement in science, one should find enjoyment and understanding, and is able to convey what it means to have fun with (and in) science. Furthermore, Aikenhead and Ogawa (2007) report several case studies that have shown how intuitive imagination propels science and improve understanding of scientific concepts and skills.

This tacit or implied knowledge leads to what Kuhn describes as dependent upon 'scientists' prior experiences and training' (Kuhn, 1970, p. 198). The degree to which this knowledge is shared often reflects the strength of a group commitment to a paradigm. Along with Kuhn, Bauer describes science in terms of working within a community of scientists that is, professionalised science (Bauer, 1992). Thus, for the purpose of this writing, the way of knowing as described, in brief, comes by consensus-making within a community of practitioners. Simultaneously, this writing is a documentation of students and teachers views of what constitutes science.

More so, what is considered as science in the participants' everyday life practices are determined by what they personally perceive as scientifically oriented. My purpose is not to review this expansive literature and the intellectual disagreements therein; instead I aim to highlight what Kuhn demonstrated that science does not proceed in a purely logical and impersonal way. More discussions on the notions of science and culture are included in a later section. Before advancing any further, it is worthwhile to highlight specific learning theories referred to by education psychologists in order to draw upon a particular learning theory that is associated with the nature of this study.

Theories of learning

In view of the vast literature surrounding the scientific study of psychology in education regarding the learner and the learning process, this section is an elaboration of a learning theory that has stemmed from one of many learning theories. However, before detailing how the approach relates well to this study, it is appropriate to include a brief explanation of four major learning theories that are widely accepted and understood.

An overview of the literature depicts how learning occurs along a continuum. On one extreme lies the Behaviourist Learning Theory instigated in the early twentieth century by behavioural scientists namely Pavlov (1849-1936), Watson (1878-1958) and Thorndike (1874-1949) (see McInerney and McInerney, 1998, p. 109). Accordingly, McInerney and McInerney contended that this view of learning was based on observable forms of behaviour referred to as the observable mechanisms of learning (ibid, p. 108). Specifically, as stated by Mageean (1991) that in the classical behavioural theory, the center of attention is the teacher and the materials, with the student being a passive recipient of teacher management responding to environmental stimuli.

The essence of this theory is for teachers to identify what children find rewarding and then to structure the teaching environment so as to make such rewards dependent on both the social and academic behaviour that need to be enhanced (Merret & Tang, 1994). In contrast, Wheldall (1987) mentions that because teachers have a great deal of control in this model, little opportunity is given for students to construct their own meaning.

The webpage *Learning Theory.com* (http//www.learningtheories.com/humanism.html) outlines a second theory of learning, the Humanistic view, which appears to have emerged in the 1960s. This webpage quotes Huitt's (2001) interpretation that 'people act with intentionality and values'. On this webpage, Huit makes a contrast between the behaviourist notion of operant conditioning, which argues that all behaviour (including learning) is the result of the application of consequences, and the cognitive psychologist belief that learning is the result of a process of mental construction. The humanistic theory of learning, according to Huit, puts forward the idea that to understand learning, one has to study the person as a whole, especially as an individual grows and develops over his or her lifespan. Thus, in Humanism, learning is student centered and personalised, and the educator's role is that of an observer and facilitator of that learning.

Learning Theory.com also outlines Bandura's Social Learning Theory (1962-1977) which promotes the central argument that, in addition to the ideas of behaviorism, learning also requires the learner to interact with others. In line with Bandura's theory, McInerney and McInerney (1998) cite that recent efforts that have also been made to incorporate cognitive elements to behaviourism and that have led to the emergence of the idea of Social Cognitive Theory. The literature reveals that social cognitive theorists dwell on the belief that much complex human behaviour, such as the acquisition of language, social behaviour and attitudes can only be explained through modelled learning and is governed by four processes: attention, retention, reproduction, motivation (Bandura, 1986). In addition, Bandura further argues that if an individual pays attention to a particular behaviour in another, then the capacity to perform similar behaviour is enhanced.

Moreover, Bandura's Social Theory emphasises the importance of cooperative learning in a social context, based on imitation and practice. While research in this area is inconclusive, it does appear as depicted by the literature that learning is shaped by modelled behaviour. In a nutshell, there is a rich research base that illustrates the effect of modeling in shaping student academic, emotional and effective behaviour (Copeland & Weissbrod, 1980; Deutsch, 1979; Gresham, 1981; King, Ollendick & Gullone, 1990; Shrunk, 1987; Stoneman & Brody, 1981). However, the effect of this aspect of learning to enhance understanding remains questionable as there is great diversity in the way individuals relate to models (symbolic or verbal discourse), and incorporate features of the modelled behaviour into their own behavioural repertoire (McInerney and McInerney, 1998).

Towards the end of the continuum lies Constructivism, a fourth alternative learning theory which is derived from cognitive psychology. This theory has become very important in helping to explain *effective learning*. Implicit in this cognitive view of learning is the notion that effective learning occurs when individuals construct their own understandings. Poplin (1988) contends that there is an emphasis in cognitive theories on the active role of the learner in building personal meaning and in making sense of information. A key element of constructivism is the centrality of the learner, as an active agent, in the learning process. This theory also shifts the focus from what the teacher models to what the learner does. These important elements of constructivism are at the heart of this study.

The common misunderstanding regarding constructivism is that instructors should never tell students anything directly. Instead, they should always allow students to construct knowledge for themselves. This is actually confusing a theory of pedagogy (teaching) with a theory of knowing. Constructivism assumes that all knowledge is constructed from the learner's previous knowledge, regardless of how one is taught. McInerney and McInerney (1998) report Vygotsky's Social Development Theory as one of the foundations for constructivism. For Vygotsky, therefore, cognitive development is not so much the unfolding of mental schemas within the individual but the unfolding of cognitive understandings of social beings within social contexts. In a sense, we become part of the community and the community becomes part of us in the sharing of knowledge.

In this study, Vygotsky's ideas regarding the relationship between the social environment and the child's learning are very important. Within the traditional oral cultures of ethnic Fijians, for example, the ideas that a child adopts are derived from their relationships with other people in the home and community. In the Fiji context, Vygotsky's ideas are worth exploring as it promises richer experiences that could be used as a platform for meaningful science negotiations in the classroom. Hence, it is this view of learning that proves adamant for this study.

A constructivist perspective

As previously discussed, the key tenet of a constructivist approach to learning is a view of learning that sees the individual not as a passive recipient of knowledge, but as an active constructor of meaning. Jenkins (2001) and Bennett (2003) contend that this view of learning is well known, in the simple sense that each of us can only learn by making sense of what happens to us through actively constructing a world for ourselves. This process of construction, often made internally, personally and unconsciously, consists largely of reinterpreting bits and pieces of knowledge to build a satisfactory and coherent picture of the world.

Despite the abundant research in science education based on this assumption, we know little about the nature and processes about the person's active efforts to construct meaning while learning. Most studies have focused upon students' prior knowledge and post-instructional knowledge, and not on what occurs during classroom interactions. The analysis of classroom discourse, however, is a means of providing useful insights. In a study using dialogue samples, Munby (1982) analysed how approaches to teacher-student conversation can promote intellectual dependence on the teacher. As a result, he describes these approaches to encourage greater independence of thought.

Essentially, Selley (1999) describes that a constructivist view of learning holds that people construct their own meanings from what they experience, rather than acquiring knowledge from other sources. In a similar thought, Dakuidreketi (2006) advocates that learning is not viewed as transfer of knowledge but rather as the learner actively constructing knowledge that is independent of the teacher.

Further, Osborne and Freyberg's (1985) research on children's science using a range of studies including their own work on the 'Learning in Science Project in New Zealand' showed that children acquire many of their ideas prior to their formal learning in science. These pre-existing ideas are what Bell (1993) refers to as 'student's prior knowledge'. Cobern (1996) labels this same idea as 'world view' because children's meanings are more sensible and more meaningful to them than the ones presented to them by teachers. This implies that children enter the school already equipped with many concepts, skills and beliefs previously acquired. Osborne and Freyberg (1985) affirm that children are like scientists for they are always curious to find things out for themselves. The authors further mention that children naturally attempt to make sense of the world in which they live in, in terms of their experiences, their current knowledge and their use of language.

Three important ideas about children's science that are pertinent to this study as outlined by Osborne and Freyberg (ibid) are discussed accordingly. Firstly, as previously discussed, is the importance of considering students' prior knowledge when teaching new concepts and skills in science. Secondly, as the writers reveal, that the ideas or views of children are usually strongly held by them and are often significantly different from the views held by scientists. Thirdly, that the ideas held by children are sensible in their point of view and they can either be influenced by science teaching or remain as they are.

The implications for these to teaching science is for teachers to know what prior knowledge children have of the new concepts during science lessons at school and try to relate the ideas or views of children to the new scientific concepts that formal science has to offer. Without knowing the children's worldview or pre-existing ideas, it will be difficult for the teacher to try and change or be influential to favour the new scientific concepts. This is called conceptual change, whereby students "preconceived ideas are "built on", and to some extent restructured by the correct science view (Osborne, Bell and Gilbert, 1983; Hewson & Hewson, 1988; Osborne, 1982). Conceptual change approaches implies that the aim of science instruction is not to replace everyday views but to make students aware that in certain contexts, science conceptions are much more fruitful than their own conceptions. This is a relevant aspect of my research in which I attempt to draw upon the views of students and teachers of the relationship between classroom science and everyday concepts and skills.

As previously mentioned, this view of learning is already well known, in the sense that each of us can only learn by making sense of what happens to us through actively constructing a world for ourselves (Wertsch, 1997). In doing so, the crucial statement that underlies the essence of the notion of constructivism in science orientations is articulated by Koballa, Kemp and Evans (1997, p. 27) that, "all students must become scientifically literate if they are to function in tomorrow's society." He contends that we must teach so that our students become literate in science. However, scientific literacy has a complex and dynamic nature, and it is not easily defined or mastered. Many discussions of scientific literacy tacitly suggest that it is a continuous process. Pella (1976) in a strong statement had said that not all individuals could understand science and technology at the same level. The author writes that some will understand only concrete experiences, while others will be able to rely on theoretical and quantitative positions in explaining natural phenomena. Showalter (1974, p. 1) had added that the dimensions and associated factors should be viewed as a specific continuum along which an individual can make progress.

Ideally, the revelation of the findings constitutes an ‘over-reliance’ on the teacher for the ‘right answer’. In this case, science educators could use the detailed revelation of the children’s prior knowledge (including errors, misconceptions and half-formed ideas) as a basis during the implementation process. This way, the pitfalls of assuming any prerequisite knowledge is minimised (just because the class has ‘done it last year’). In turn, there is something real to build on by finding out in advance what is it that children know. In addition to these ‘private’ elicitation strategies with one’s own class, as argued by Selley (1999), teachers could draw upon published material on laboratory experiences and the use of science equipment to effect science teaching and learning. It is deduced that teachers will find the kind of alternative conceptions found among children which could be useful for diagnosing individual children’s ideas towards what is termed as ‘accepted scientific knowledge’ in any given situation.

Science and context

The Fiji Islands Education Commission Report (2000) highlights the need for relevant and appropriate science curriculum. This document put forward the idea that prior knowledge and experiences, when relevantly and appropriately structured, should enable students to process science comprehensively in the classroom and its applicability outside the classroom. In addition, our ability to use knowledge appears to depend on the context in which the knowledge was acquired (Bell, et al., 1984). The author contends that the context of learning and the students’ existing knowledge will influence what links will or will not be made. In parallel, Dakuidreketi affirms that this may involve the incorporation of indigenous knowledge systems and how these might be used to understand modern ways of doing things (Dakuidreketi, 2006). For example, the author illustrates astronomy may be linked to the navigation methods of their ancestors; studying chemical products used in modern medicine may be linked to the use of traditional medicine derived from herbs or plants which are well known to cure diseases;

studying the use of fertilizers to retain soil nutrients may be linked to the traditional method of fallow system where planting is done in one area for one year and left vacant for several years, to retain soil nutrients, until planting is shifted back to the same area. Evidently, this involvement could capitalise on the importance and usefulness of classroom science experiences for productivity and sustainable living in the community.

The central role of context in learning is well documented in the literature. For instance, Driver (1983) maintains that the context in which science is learned influences the learning outcomes. However, contexts that help students in learning science may differ between ethnic groups. Thus, students of the Pacific may relate better to contexts, which acknowledge and give value to their own experiences and culture. Accordingly, the settings are those relating to the student themselves, their home life, and the world of leisure, work and the wider environment (Dakuidreketi, 2006). Interestingly, Dakuidreketi explains the studying of forces in an Ethnic Fijian classroom may be learnt in the context of digging using the *'i sau ni lalau'* or 'digging stick', or moving a heavy load using an inclined plane or stick. The author mentions that contexts act as a way to link the sciences (forces) with the world of the students (their own experiences and prior knowledge of digging or moving a heavy load) (ibid). So it is very important that the curriculum contains some connection to students' experiences as it adds meaning and interest to the life at home and community thus links the school with the home.

In essence, Rabuka (1994) advocates the changes that are occurring in the Pacific societies are the resultant of European or Western influences. An area of concern, according to him, in education is the development of knowledge in areas that are considered important in coping with modern life. As a result, very little traditional scientific and technical knowledge is currently being passed to the young people through the formal educational system. Finally, Rabuka mentions that this issue requires further consideration as to whether we should teach traditional scientific knowledge, what should be taught, and at what point in the system this should be introduced.

In summary, Fensham, Gunstone and White (1994) suggest that curriculum content should include the following characteristics:

- science curriculum need to begin as an extension of what the learners already know from their experience prior to schooling;
- the learning objectives, that is, practical skills and knowledge, should have criteria of achievement that most learners can realise at some level; and
- pedagogical skills should use the demonstration and practical modes that are inbuilt to science and also the cultural learning that occurs prior to and outside formal schooling.

The authors further state that science content should be made up of a number of different types of learning such as of, according to them, theoretical knowledge, application of such knowledge, intellectual skills, practical skills, problem-solving, science traits and attitudes, impact of science and technology, personal and social needs, the evolution of scientific knowledge, and, boundaries and limitations of science. A suggested selection criteria towards a relevant and meaningful science material is discussed in the final chapter.

In conclusion, Hodson and Reid (1988) in supporting these ideas argue that the content selected needed to be relevant to the students and negotiated. They advocate that the content should be selected on the basis of what motivates students; relating content to real life situations, emphasising humanitarian considerations, using children's knowledge, experiences and interests.

Culture and learning science

If science is regarded as a form of discourse that has evolved as a relatively recent activity of humankind, then the goal of science is to make sense of a universe of phenomena in terms of knowledge that is viable (Ogawa, 1997). Ogawa writes that to be accepted as scientific, knowledge must meet several tests. First, it must be coherent with other viable knowledge claims. Second, it must be accepted by members of the scientific academy through a process of peer review. Third, it must withstand conceptual and empirical challenges in repeated attempts to refute its viability. In the event that knowledge withstands those tests, the activity of gaining acceptance becomes increasingly social as attempts are made to convince others of the acceptability of what is claimed.

As used in a cultural setting, co-participation implies the presence of a shared language that can be accessed by all participants to communicate with one another such that meaningful learning occurs. The shared language must be negotiated and would enable all participants in a community to engage in the activities at hand. Students receive opportunities to practice and observe others practice such that, at any time, a person might be both a teacher and a learner with respect to others in the community. Hence, in participating in the communal activities, respect would be shown for the knowledge of others and efforts would be made to find out why particular claims were regarded as viable.

Ravuvu (1983) relates that in a Fijian village setting, cultural learning occurs in the specific context to which learning relates. He reports that children learn hunting techniques during food gathering expeditions. In addition, they learn songs and dances during community celebrations. The author mentions that children learn kinship laws during interaction with relatives. Similarly, Lemke (1985, p. 8) argues that if students are to learn science as a form of discourse, 'a social activity of making meanings with language and other symbolic systems in some particular kind of situation or setting' seems imperative. Consequently, learners are able to practice science in a setting in which others who know science assist them to learn by engaging activities in which co-participation occurs (Schon, 1983).

In relation to learning science as a collective, social activity instilling a group effort, a particular theme that had emerged from the findings of this study is students' attitudes to science are relational to performance and achievement in science. To this effect, as suggested by Craven (1996) teachers can encourage students' achievements through simple strategies such as acting positively, smiling regularly at the children, warmly welcoming them to class, and building self-esteem through positive reinforcement. According to Craven, the Pacific students are more person-oriented than information-oriented. Therefore he discusses that students, who feel a personal connection with the teacher will be more co-operative, interested in learning, willing to take risks and attempt new tasks. Consequently, teachers who take a personal interest in their students' culture and life outside school will establish a more positive rapport and, hence, a more favourable learning environment.

From this perspective, learning is a social process of making sense of experience in terms of what is already known. Accordingly, teachers should be on the lookout for misconceptions or incorrect knowledge held by students. The teacher, representing society, has an obligation to educate students, to assist them to learn what is currently regarded by society as viable knowledge. Hence, the implications of cultural orientations to science learning is the restructuring of learning environments to facilitate the process of learning to what society regards as appropriate at that particular time.

Science for social relevance

It has been widely recognised by science educators that it is important to link science concepts to those aspects of the everyday world to which those concepts relate. Over four decades ago, Shamos (1966) reasoned that social aspects of science are easier to learn, as students are motivated to demonstrate how science functions in their world. Traditionally, classroom teachers are described as spending too much time on the study of science 'for its own sake' and not enough time on socially relevant themes. In turn, science educators have had such a difficult time convincing classroom teachers of the merits of a socially relevant approach. Does this mean that it is time to abandon disciplinary science study? This is an important question, one that needs to be answered comprehensively. Virtually everyone accepts some form of social relevance in the science curriculum as long as it does not threaten long-held traditional values about the integrity of the science disciplines themselves.

The United Nations Educational Scientific and Cultural Organization Report (UNESCO, 1980) advocate that students should study science of an integrated nature to help them understand the possibilities and limitations of science and the effects it can and will have on them and the community in which they are a part of. The report includes a belief that all of education should relate to the present lives of students. In particular, it reads, students are constantly reminded that the processes and products of scientific inquiry that they learn are about the world around them. Included here is the ability to function as a citizen in a democratic society and to contribute to discussions on issues related to science to name a few. As such, there would be frequent discussions about the relationships between the principles of science for social responsibility. Hence, students would be alerted to read about issues that concern them in magazines, newspapers and other related media, and discuss them with family and friends.

The approach one assumes in any science class need to focus on maintaining interests and performance as learners' progress in their class levels. It is disheartening to gather from this research that performance and interests wane or decrease as students advance in their science classes. Holistically, the implications of science for social relevance in science learning, command empowerment for individuals to think and to act. It should give students and teachers, new ideas and investigative skills that contribute to self-regulation, personal satisfaction, and social responsibility from as young as pre-school years.

There is however, no one best curriculum as students, teachers and communities differ but the most important aspect is that we understand why we do what we do and the likely consequences of that particular approach. Nuclear power plants and recycling, birth control to name a few of society's pressing issues, become part of the daily interaction between student and teacher; and between student and student. This way, knowledge is richly interconnected, intellectual skills will allow individuals to work with what is known, and awareness is developed in the context within which that knowledge and those skills apply.

Summary

The literature is a highlight of various researches that are in line with this particular study. The discussions are based on educational psychology learning theories and the importance of incorporating everyday skills, knowledge and experiences to science learning. Additionally, teachers with good understanding of children's psychology (the development stages in growth and their thinking abilities), background and interest are better equipped to provide the necessary opportunities which allow students to make connections between scientific ideas learned in the classroom that are relevant in the communities. In turn, students should see the value and significance of what is delivered in the science classroom to their everyday life situations. The next set of writing consists of how this research was conducted. This covers the methodological approach and administration procedures carried out in this study.

CHAPTER 3

METHODOLOGY

Introduction

In this chapter, I first provide an overview of how I use Moustakas' (1994) phenomenological methodology blended with ideas from Guba and Lincoln (1989) to explore and understand experiences in science learning both in and out of the school. In the following sections, I provide a thorough overview of the applicability and relevance of the phenomenological approach to my study. There are discussions of the research tools, administration procedures, and data collection techniques. These are then followed by a brief description of the participants and the setting of this study, and how I had recorded and analysed my data. Finally, there is also a discussion of the trustworthiness of the phenomenological approach, and ethical aspects that are associated with this form of inquiry.

Why Phenomenology?

Phenomenology, simply put, is the study of phenomena; the way the world appears to the human experience. Max van Manen (as cited in Laverty, 2003, p. 4) sees phenomenology as "essentially the study of lived experience or life-world". The main aim of any phenomenological study, therefore, is to identify or comprehend meanings of human experience as it is lived by the participants (Polkinghorne, 1989). Further, this type of study is also centered on how people methodically construct their experiences and their worlds that inform and shape their perceptions and ways of life. It is the desire to understand human experience that motivates a phenomenological researcher.

As my research project developed, I realised that this phenomenological quest was in tune with my own desire to understand not only my perceptions of science, but also my roles in the Fiji education circle, my school, and community. As I started to understand more about research, and started to think more seriously about the most appropriate research approach to use, I then saw phenomenology as most appealing to the inherent and unavoidable subjectivity of my judgments and my shifting engagement with the study as a whole.

The use of the first narrative person (the pronoun *I*), beginning from this chapter, is a reflection of my ever-growing critical understanding of the research process. It is also an attempt to give my engagement in the research process personal meaning. It was at the stages of reading about research methods, and writing this chapter, that I learnt about the central role that I play in this research. Therefore, the use of the first narrative person is also an attempt to reflect my frustrations with the research process; my struggles to be allowed to tell about the phenomenon of interest from its core.

Being ethnic Fijian through maternal descent, I was interested in drawing upon perceptions, particularly from an ethnic Fijian standpoint, of the connections between science, as a subject studied in school and science, as practiced in everyday life. However, my growing awareness of the inevitable effects of my own world-views and prejudices on the phenomenon under study further prompted a phenomenological approach. My awareness of the traditional research issue of objectivity provided the motivation to use a research method that would most assuredly give some credibility and trustworthiness to my findings.

Phenomenological studies employ a variety of research instruments. In this particular study, however, questionnaires, in conjunction with in-depth interviews (Moustakas, 1994), were used to collect the data. I believe that it is only through this form of information gathering that we can truly hope to arrive at an understanding of the essence of the phenomenon of interest. The following paragraphs present in detail the research setting, the participants, the research instruments and how these were used in this study.

Setting and Participants

The School

My love for this school, being a past student had greatly contributed to the reason why it was selected as the target institution for this study. Also, as I have mentioned at the outset of this chapter that having strong ethnic-Fijian connections through maternal descends, I was very curious about finding out if students and teachers at this school can realise meaningful connections between school science and common daily practices. This curiosity drove me to undertake this investigation.

The school is co-educational in nature and is predominantly attended by ethnic Fijian students. The teachers are also predominantly ethnic Fijians. It is situated on the southern part of Suva, about a quarter of a kilometer from the vicinity of the city. The school was established in 1944 to cater not only for the primary education of ethnic Fijian children whose parents were civil servants and living in Suva at the time, but also for the children of an increasing number of ethnic Fijian families who had moved to Suva and other nearby suburbs in search of a better life.

The history of this school has it that it was once a prestigious school. The combination of ethnic Fijian children from the two extremes of the socioeconomic continuum, and their realisation of the importance of education in modern living, made this school an excellent arena for academic excellence. In addition, the extent to which science and culture could be explored along this continuum was affluent. The implications include the conclusion that teaching and learning placements in such settings contribute to meaningful understanding regarding cultural (everyday) issues.

However, time has changed, and the quality of educational experiences provided at this school, in my opinion, is not as good as it once was. Since the school is one of the oldest establishments in the Suva area, most of the buildings are in terrible need of maintenance work. Currently, the degraded infrastructure, the lack of a proper science laboratory, the demands of a new hands-on science curriculum, and the effects of all these on the practices of both teachers and students, are calling for attention from all stakeholders.

The Students

The participants were students in classes 7 and 8 during the 2007 school year. Based on these students' previous achievements in science, their respective teachers selected 40 students to participate in this study. There were a balanced number of participants from each gender. All except 3 were ethnic-Fijians: 2 *Ni-Vanuatus* and 1 *I-Kiribati*. The ages of these students ranged between 12 and 14 years. Further, all except two students began their formal education at the school and the majority of the student participants lived within the Suva city limits and neighbouring suburbs.

The Teachers

Five teachers were involved in this study. Four of these were the teachers of the participant students, and the remaining participant was the Head Teacher of the school. They were of ethnic-Fijians and were over 30 years of age. Although the Head Teacher was not directly involved in teaching the student participants, he provided useful information from an administrative perspective. The other four teachers had dual roles as they had responsibilities as teachers and as parents of the school. Thus overall, there were 45 participants as summarized in Table 4 below.

Table 4: The Participants

	Number of Participants		
	Students	**Teachers**	**Head Teacher**
Class 7A	10	1	1
Class 7B	10	1	
Class 8A	10	1	
Class 8B	10	1	
Total	40	4	1
	45		

Research Instruments

The Questionnaires

The questionnaire is one of the most commonly used research instruments in educational research. It consists of a list of carefully-constructed questions that aim at obtaining useful information from research participants. The participants were required to record their answers in spaces on the questionnaire and they were given adequate time to record their answers.

From a phenomenological standpoint, I believe that the questionnaire had allowed me to get closer to the meanings of the experiences of the student and teacher participants. Due to the fact that enough time was given to the filling of the questionnaires, as well as the absence of the intimidating effect of my presence when the questionnaires were being filled, I believe, the respondents had the freedom to express their true opinions.

Ideally, two sets of questionnaires were constructed and used to gather information about how students and teachers related classroom science to common everyday experiences in the community such as food preservation. The following factors were considered when the questionnaires were constructed:

1. The responses and ideas of the respondents were to be kept confidential;
2. That the respondents understood what the questions meant. Students with limited English proficiency were assisted with elaborations and clarifications;
3. That each statement or question was to express only one idea; and
4. That the time for administering the questionnaire was to be convenient to all participants.

Students' Questionnaire

In considering the above factors, the first questionnaire (refer to Appendix 2) included 22 questions: 21 closed response-type-questions and 1 open-ended question. The first 10 questions required students to state whether they 'Agree' or 'Disagree' with statements about commonly used methods of preserving food. These questions were also given to the participating teachers, to compare their views with those of the children's opinions. Question 11 includes five statements which explore students' opinions about what they considered important or unimportant in science learning. The next three questions, Questions 12 - 14 targeted the students' attitude towards learning science. These questions were categorised using a three-point rating scale: happy, sad, neutral (is not concerned). Finally, the latter three questions (Questions 15 – 17) included personal details of the participants.

Teachers' Questionnaire

In addition, a separate questionnaire (refer to Appendix 3) was designed for teachers use only. It had 23 closed-response questions that probed opinions on:

1. The nature of science and;
2. Classroom science practice.

In this questionnaire, the participant teachers were also requested to provide additional information about themselves such as the number of years of teaching experiences they have had and the highest qualification attained. These sources of information were useful particularly, in determining the extent of teachers' views of science in relation to everyday interactions. For example, a teacher graduate with a good number of years of teaching experience, deliberated meaningfully on aspects of science outside the classroom. The background check was addend information, particularly when I did a pilot study concerning two teachers and two students in the suburb where I live. Ideally, this exercise was of great help as it gave me an opportunity to improve and/or delete some of the questions. In addition, it helped me generate new questions.

The Interviews

An interview, as defined by Cohen and Manion, is "a two-person conversation initiated by the interviewer for the specific purpose of obtaining research-relevant information"

(Cohen & Manion, 1994, p. 271). Accordingly, as suggested by Kerlinger (1986), the interview can be used to follow up unexpected results, or to validate other methods or to go deeper into the motivations of respondents and their reasons for responding as they do.

Consequently, in this study, a semi-structured interview (Cohen & Manion, ibid) was used to check on the dependability of the data collected in the questionnaire. This type of interview appeared to be most appropriate for the purpose of my research as it allowed me to be more in control of the data collection process as the questions were open-ended in nature This interview approach allowed me to be always in a position to guide the conversation around issues pertinent to the study. Respondents were prompted with further questions or direct quotations from their responses to either confirm or clarify important ideas. This technique assisted me to get close to the respondents' basic perceptions of, and experiences, with formal and informal science.

Students' and Teachers' Interviews

The students' interview questions (Appendix 9) were constructed mainly around issues that emerged from responses to the questionnaires. These issues included:

1. Opinions about the nature of science and what science is;
2. Interests in science;
3. Attitudes towards learning science;
4. Experiences in science lesson and;
5. Applicability and relevance of school science learning to everyday experiences.

In addition, the teacher participants were also interviewed (Appendix 10) on their perceptions of:

1. The nature of science;
2. The strategies that they use to teach science concepts, skills and processes;

3. What should be valued and emphasised in the science curriculum;
4. The place of cultural/traditional practices in the science curriculum;
5. The extent to which they incorporate everyday knowledge and skills in school science;
6. The influences of everyday experiences on how they teach concepts and skills in science.

Data collection and recording

The questionnaires were administered prior to the interviews as I felt that the responses from the questionnaire would assist me re-formulate the interview questions. Ultimately, the responses indicated the extent to which participants understood or misunderstood aspects relating to this study. All student interviews were conducted at the school staff room. They were mainly conducted in the morning between 8am and 9am, as classes did not formally begin until 9 o'clock every morning. However, due to time constraints, some students gave up their free time, recess and lunch times, to be interviewed. I am greatly indebted to the participants and to the school as a whole, for making such allowances.

The interviews were informal to allow for dialogue to occur naturally. As I became a more confident interviewer, I grew flexible about moving to certain issues that the participants indicated to talk more on. This growing confidence also enabled me to relax and enjoy the interviews, particularly with the students.

At this stage of the study, I was someone familiar as I had taught with some of the teacher participants. However, I was very much aware that this familiarity could be a source of bias during the data collection process (Tilley, 1998). Moustakas (1994) idea of *epoche* (which is defined later in this section) provided guidance thorough out the research process and ensured an appreciable level of objectivity.

The interviews were audio recorded and the tapes were later transcribed. Although the interviews were conducted in the English language, the participants, both students and teachers, from time to time offered explanations in the Fijian language. Due to the relaxed and informal nature of the interview, I was not paying too much attention to the language the students and teachers were using. However, this was another cause for concern as I struggled to transcribe accurately what the participants said. In addition, although I transcribed what was actually said, I was aware that my translation may not have truly represented what the respondents actually meant.

Due to issues of anonymity and confidentiality, a coding system was developed to describe the participants through their assigned roles. Instead of using the participants' real names on interview excerpts, the letters S and T are used for students and teachers respectively. In addition, the letters M and F indicate whether the participant was a male or female. Numerals that indicated the order in which the participants were interviewed, also accompany the letters. For example, T2F meant the second female teacher that was interviewed, and S1M meant the first male student that was interviewed.

Although much of the fieldwork was carried out at the target school, a lot of useful data were also gathered from other places such as The University of the South Pacific (USP) library, The (Fiji) Ministry of Education (MOE) office downtown Suva, the Curriculum Development Unit (CDU) office, and the Fiji National Archives. In addition, the pilot study also involved three students in my home area who were not part of the target school.

Analysis of data

My growing awareness of the impacts of my own personal biases on the collected data, and genuine concern for authenticity in the same data, were two competing issues that remained paramount during the whole research process. 'How could I ensure that I remained objective and at the same time close to the participants?' or 'How could I interpret what the participants said and at the same time claimed that the data was free of biases?' were examples of questions that I often asked myself. These concerns led to the ideas of *epoche* (Moustakas, 1994) and *bracketing*.

Epoche

Epoch is a Greek word, which means "to refrain from judgment" (Bednall, 2006, p. 123). This label, as Moustakas (1994) explains, refers to the phenomenological process of setting aside prejudgments and maintaining an unbiased, receptive presence. This idea demanded that the analysis and interpretation of data be ongoing. Thus, throughout the analysis stage, and even during the interview process, I was aware of my own prejudices and perceptions of the target phenomenon. This awareness ensured that I maintained an open mind to all responses that I heard, transcribed, or interpreted.

Bracketing

Bracketing involves thoroughly examining and then suspending one's beliefs so that a description about the phenomenon is not contaminated with the researcher's bias. In other words, Murray and Mensch (2008), in a study towards exploring perceptions for potential athletes, state that the aim of bracketing is to free ourselves from our own thinking and seeing things, as undisturbed as possible by our own knowing. Therefore, bracketing the question involves a specific setting aside of prejudgments for the phenomenon understudied.

At this particular stage, subsequent questions were structured around the foci of this research which was, to draw meaningful connections between classroom science and everyday life. The specific question asked was "Can you think of ways in which this idea (or process) of science is practiced elsewhere?" The question was very open in nature, with follow up discussions led by the participants themselves. Openness was critical and the exchange was entirely open, with few direct questions asked. Geertz (1973) had described this process as an attempt to get at what participants really experienced, from the inside out, and not simulations of what they thought they experienced. Therefore, it was important not to look for only what was 'said', but also what was said 'between the lines'. Hence, verbatim did not necessarily capture all of what was 'really said' during the interviews. As well, I agree with van Manen (1997) in his support for the importance of paying attention to silence, the long [...] and short pauses [er, um], as it is herein that one may find the taken for granted or the self-evident. Each interview was tape recorded and transcribed.

Once this was complete, I then compared the meanings of each text and isolated the shared themes, which are discussed in the following chapter. Tesch (1987) described this as clustering similar statements together to form initial shared themes. I struggled to sort those themes that overlapped and those that were variations of other emerging themes by reading and rereading the texts, as well as by writing and rewriting the theme names to ensure that they clearly and accurately described the responses. The work on reviewing included revisits to the participants in order to clarify their meanings and intentions.

The description of the method, the specific steps of data gathering and analysis, and Moustakas' (1994) suggestions regarding the style of the research report were all elements that attracted me to this method. Phenomenology's emphasis on the human aspect of research, as well as the strong interpersonal nature of the data collection, suggested an autobiographical approach to the description of the research study and to the report (Moustakas, ibid, p. 104-105, 183). The phenomenological concept of bracketing, or consciously setting aside one's prejudices and preconceptions, was also a definite prelude to an autobiographical component of the research report. "In phenomenological research, the question grows out of an intense interest in a particular problem or topic. The researcher's excitement and curiosity inspire the search. Personal history brings the core of the problem into focus" (Moustakas, 1994, p. 104)

Furthermore, with the help of my supervisor, we analysed certain data quantitatively so that readers could be instantly provided with quantifiable evidence to substantiate discussions that were significant to my reasoning during interpretation. My hope in confronting the data collected had been to find out the extent to which students and teachers realised that their everyday experiences (out-of-school contexts) were very much a part of the science that was taught and learnt in school. Consequently, I attempted to formulate discussions in a way that depicted a true and clear representation of my findings.

I started by comparing the data from the interviews (what was said) with the Agree/Disagree responses on the questionnaires (what was written). This way, it was easier to compile a holistic analysis as the basis for my interpretations. Once the data was bracketed, it was, according to Patton, "horizontalized", that is, all aspects were considered important at this stage (Patton, 1980, p. 408). Data was then examined, organized and grouped into meaningful clusters called Themes.

After the process of sorting out these themes, I followed what is described as Phenomenological Reduction (Moustakas, 1994, p. 120-121).

In summary, the following steps were undertaken for each set of data:

1. Listing and Preliminary Grouping (Horizontalization)

2. Reduction and Elimination: To determine the Invariant Constituents

3. Clustering and Thematising the Invariant Constituents

4. Final Identification of the Invariant Constituents and Themes by Application: Validation

Prior to the reduction process, I visited and re-visited the themes that have emerged to ensure that all that were said and written and most of what was not said was captured in those themes. After this long and tiring process, I then eliminated data that were not related to the phenomenon understudied, repetitive or overlapping. Then, I was able to identify the invariant themes within the data in order to perform as Moustakas calls it an "imaginative variation" on each theme (Moustakas, 1994, p. 102). This was done in order to see an idea from different perspectives. In doing so, I was able to develop, enhance or expand versions of the themes.

Using these enhanced or expanded versions, I then moved on to what Moustakas referred to as the textural portrayal of each theme. This was a description of an experience; an abstraction of the experience that provided content and illustration but not yet essence. The final step in this phenomenological analysis was the development of a "structural synthesis" (ibid. p. 142). This synthesis formed the fundamental basis of the experience. The true meanings of the experiences (hidden and the obvious) of the students and teachers were described in the form of an interpretation. Overall, in the structural synthesis, at this particular stage, I had to search beneath the affect inherent in the experience to deeper meanings for the individual, which became the essence of the phenomenon.

Ethical Considerations

The nature of such a study required appropriate correspondence (Appendix 11) to various institutions and personnels beforehand. A letter was sent to the MOE giving a brief explanation of the research details. The content of the letter included the intention of engaging teachers and students from the target school in talking about their perceptions of science and the relationship of their home activities and practices in science learning.

To gain access to the school, a letter of information and consent was sent to the Head Teacher. He was asked to arrange for twenty students in classes seven and eight, from a range of ability in science, to take a letter of information and consent for caregivers of children who could be involved in this research study. In addition, five teachers comprising of the head teacher, and the respective teachers of classes seven and eight were interviewed and given questionnaires. After the transcribing process, there was a debriefing exercise as I discussed some preliminary findings with the teachers during their staff meeting at the end of Term One in the 2007 school year.

The school was visited after the MOE officials and the Head Teacher of the target school granted approval. Every effort was made to minimise the disruption to the children's schoolwork. For example, visits to the school were made during the most convenient time to the participants. Each interview lasted about 30-35 minutes and four to five students were interviewed in a day. I spent seven weeks at the school conducting my fieldwork. The interviews were recorded on audiotape with prior consent from the participants. Not all participants wanted to hear their interviews re-played. For those who wanted to, however, I replayed the tapes for them. During such time, the students were encouraged to identify the parts they wanted to be disregarded. Conveniently, the research processes operated within an environment of safety and trust that was established at the outset and maintained throughout the study. The interactions during the fieldwork took place within the target school and it is within the embodied relationship that the data was generated and interpreted.

Summary

As pointed out in this section, for such a phenomenological project, the multiple stages of interpretation that allow patterns to emerge, the discussion of how interpretations arise from the data and the interpretive process itself are seen as critical. The bracketing which intentionally focused the interpretation on the experiences of participants was a factor that was central to the rigor of the study. Furthermore, in an attempt to bring together focused and reflective considerations, the last chapter includes a tabulated outline of my initial intentions and the implications of the outcomes of this study.

The next set of writing, Chapter 4 includes my interpretations and deliberations of the findings of this study.

CHAPTER 4

INTERPRETATION OF DATA

Introduction

This research offers an important window into students' and teachers' perspectives of the connections between classroom science and everyday experiences. Emerging clearly from the study is the widespread discontent among both students and teachers at the way science had been taught and learnt in the primary school classroom. Dominant amongst these is a feeling that, whilst science is considered to be an important subject, it had little relevance to what students and teachers do outside the school, at home and in the community. Although this concern has been highlighted by other studies (Aikenhead & Jegede, 1999; Fisher & Waldrip, 1999; Osborne & Collins, 2000) the context and background of the target school and participants make this study unique and therefore necessitate serious consideration. Thus the value of this research rests not so much in its originality, but in its potential to bring to the foreground the unique experiences of a special group of students and teachers whose concerns are often lost in the complexity of classroom routine.

Themes

The information from both research instruments had informed one another about the range of views held by the participants of their understanding of the relationships between classroom science and everyday experiences. In using phenomenological interpretation of what the participants said and wrote, I was able to dwell deeper into, and gained insights about their views and experiences. It was an enlightening exercise drawing comparisons and contradictions between the responses as the true meanings of the experiences (hidden and the obvious) of the students and teachers were described in the form of an interpretation.

During the analysis process, the following themes were identified and are explained in detail in the consecutive paragraphs:

- Science deals with abstract or difficult ideas;
- Influences of the ‘exam-oriented’ curricular on perceptions of science;
- Science should deal with experiments and practical work;
- Teachers’ practice is constrained by traditional classroom routine and protocol;
- Over-reliance on the teacher for the ‘right answer’;
- Interests and performance in science decrease as students progress up the class levels.
- Attitude to science is related to performance or achievement in science;
- Lab and science equipment are important for effective science teaching and learning;
- Classroom science is important and useful for productivity and sustainable living in the community;
- Limited understanding of the scientific bases of everyday practices;

Science deals with abstract or difficult ideas

A general consideration of science that has emerged is that science is all about the natural environment, if not, a subject to be learned and later examined. One could note a cosmetic view of what constitutes science, in most of the views obtained. Missing from these views is the realisation that science is a discipline that involves everyday processes for instance, measuring, estimating, making deductions and hypothesising.

In particular, the successive responses reveal that science is perceived to be a subject that is 'out there' to be studied. As a result, there seems to be a misconception that, involvement in science through abstract learning is what science education is all about. It is also important to note that a significant proportion of students, (15 out of 40 or 37.5%) associate science as a subject that deals with abstract ideas.

Question: *Do you see science anywhere around you? (Please elaborate)*

S4M: Yes. The picture of a forest on the wall. The patterns on the charts.

S6M: Charts and drawings.

S8M: No response. *(Is seen to be searching around the room)*

S10M: No, only in the classroom.

S35F: Yes, er, the pictures on the wall.

Question: *If you were going to tell someone about what science is, what would you say to him or her?*

S4M: Science is the study of the things around us, what we couldn't see.

S18F: Science is where you start using your knowledge to answer the questions the teacher asks.

In addition, there seems to be limited knowledge of what the nature of science is, as revealed by the following (teachers') responses:

Question:	*What is science?*
T1M:	The study of our surrounding, our environment.
T2F:	Everything around us and in us.
T3F:	The study of weather, environment and living things.
T4F:	The study of the earth, the rocks, the management of the earth.
T5M:	The study of living things and non-living things.

The marginalised view that science is something 'out there' to be studied, arbitrarily I believe, hamper meaningful appreciation of the fact that students could be tasked to engage in scientific sense-making practices at classroom level. It can be strongly argued, as confirmed by the following remarks that teachers' understanding of the nature of science determines students' perceptions to a great extent.

Question:	*Is learning science meaningful to you? How?*
S35F:	Yes. When I write the right answers.
S39F:	Yes. When I write the correct answer in my test papers.

In the literature review, a meaningful understanding of the nature of science by students is always accompanied by effective changes in teachers' beliefs and pedagogy. In this study, however, the effectiveness of teaching the nature of science appeared to be related to how teachers' view their roles in science lessons. In particular, the existence of too many external examinations (two at primary and three at secondary level) as discussed in chapter 1, is a contributing factor to the 'examination-focused' teaching styles adopted at class levels which is discussed in detail in the next theme.

Influences of the 'exam-oriented' curricula on perceptions of science

Interestingly, a handful of the students acknowledge that school science should be made meaningful to them for reasons such as:

Question:	*Can we learn science anywhere else? Why do you say that?*
S3F:	Yes, because something we are doing in science that we also do at home.
S4M:	Yes, um [Pause] because the science that we learn happens to us.
S7F:	Yes [Pause] we learn some of our culture. (What do you mean?) (Seems hesitant and confused and could not elaborate further).
S26M:	Yes, because it shows us interesting things we do not know the environment and other things.

However, a significant proportion of the students stipulate science as irrelevant elsewhere rather than in the classroom; an indication that students' perceptions of science are still influenced by the exam-oriented curriculum and teaching methods.

S8M:	Yes […] so that we will pass our exams.
S9F:	Yes we have to er, [Pause] um mm [Pause] know science in the classroom. *(Only in the classroom?)* Yeah!
S21F:	Yes, um, […] because without science we wouldn't understand what the teacher says about the past [S/Sc]. In Basic Science, we need to understand things for the exams.

On one hand, the purpose of learning science, according to the nature of these responses, is mostly for study to pass examinations. On the other hand, students could identify the relevance of science in their everyday life as confirmed by the next set of responses:

Question:	*Are you aware that most of the things you do outside your classroom (or as part of your culture) is science or related to science? Can you give some examples?*
S5F:	Yes, when we go camping billy boiling, we heat the water.
S25M:	Yes. Cleaning the classroom, keeping, preserving, conserving of resources.
S26M:	Yes. Playing rugby, force is used.
S27F:	Yes, when you try to destroy trees, if you are staying on a hill, it can cause soil erosion. You can't get more oxygen. You can't have places to rest when the sun is hot.
S39M:	Yes, maybe. You know, mixing '*yaqona*' to make a solution. When we play outside, it strengthens the body.

The views expressed here show that students' have some ideas of the meaningfulness of science. Specifically, the perceptions are from the everyday concepts of science students bring to school and the language they use to describe them. These experiences could be made valuable in terms of drawing upon science-related connections that are relevant and meaningful during science interactions at school, in order to deviate from examination-driven instructions.

Further, it needs to be noted that though certain concepts may not be suitable in some contexts, science teachers still deliver content as it is from the book. For instance, in terms of the topics found in the present lower Primary science syllabus, are either in part or in general foreign to the experiences of many rural ethnic-Fijian students.

A teacher participant in a description of a worst-ever science lesson lamented an example.

> T4F: The students were doing an experiment on heating. They had different objects to heat – a nail, a piece of chalk, wood, etc. They were working in groups and I noticed that this particular child was still holding on to a heated nail even after everybody else had completed the task. The rest of the students had returned to their places and have begun writing their observations but this child was still holding onto the nail and the nail was still being heated. In my haste, I grabbed the nail and exclaimed in agony as my hands got terribly scorched by the heat. I turned around and started to growl at her for taking far too long in her experiment and that the nail (being a metal) should have been too hot for her to handle in minutes, like the rest of the students. Well, I looked twice at the sheepish grin and to my amazement; it hit me on the head…this child is from '*Beqa* Island' – an island people famous for fire walking displays. From then on, I believed the myth surrounding the people of that particular island to have been given the '*mana'* or 'state of perseverance' to endure heat or burning things…

In this case, the objective of the lesson is to determine which objects are good or bad conductors of heat. As revealed by the data, the general notion that metallic objects are supposedly good conductors of heat will continue to be rejected by the people of Beqa Island; a group of island people who are renown for enduring heat and are commonly known in Fiji as the 'firewalkers'. In conflict, students have been taught over the years to accept the information in view of the fact that it is for passing examinations. In other words, the island people of Beqa are forced to accept a science concept for the purpose of writing the desired response in an examination that is practically meaningless and irrelevant to their village and community life practices.

An ideal science curriculum should include provisions for science teachers to localise content so as to 'build-in' flexibility to accommodate the conditions of the students. In doing so, it is believed that perceptions of science could be diverted from an examination formation to a more meaningful and relevant orientation. As a result, teachers would be at liberty to teach concepts that best suit the contexts of the learners. In part, the solution here lies in asking teachers to think more carefully about relating aspects of a science topic to students' lived experiences. For a start, in the case of the island people of Beqa, teachers could use the illustration on good and bad conductors of heat, to reconcile students' experiences with the appropriate science facts. In other words, the 'unusual' experience should not make the concept of heat conductors irrelevant and, students should not be denied the fact that, though they are learning a science fact, the circumstances surrounding their identity may prove to challenge the fact.

Science should deal with experiments and practical work

In this study, there is a consensus by the students and teachers that scientific concepts are more accessible and more easily retained when supported by practical involvement.

The student participants had a great deal of appreciation for doing experiments in their science classes, as indicated by the following responses:

Question: *Can you name some things that you like about your science class?*

S3F: Doing, er […] experiments.

26M: Going out into the environment, observing, doing experiments, er, knowing the organisms in the environment, what they are capable of, what they do for a living e.g. their daily work, how they find food.

38M: When I do experiments.

Question: Do you teach science the same way as you teach other subjects? How is it different/same?

T4F: Not really. In science, the children have to do a lot more research in addition to the work we do together. A lot of discussions take place, more activities and experiments. I don't expect them to get all the knowledge from me like in the other subjects. As for science, they've got to create their own knowledge.

T5M: It's a bit different. In the other subject areas, the teachers have to be in control of the class. In science, there are a lot of activities involved so students are engaged more in the teaching and learning process.

This finding is supported by Rudduck et al. (1996) who emphasised the fact that practical work offer students a greater sense of ownership. In addition, as Garson confirms, 'curiosity aroused by investigations can lead pupils to realise that the science they are doing has applications to their own lives' (Garson, 1988, p. 5). This realisation is an important aspect of scientific education.

However, on a contradictory note, though a quantitative analysis indicate that 72.5% of the students like science because of experiments, 27.5% express a dislike for science as, according to them, the teacher 'does the experiments' or 'the teacher writes experiments on the blackboard'.

Question: Is there anything that you don't like about your science class?

S3F: Mmm, we don't do experiments. I don't like it when the teachers do the experiments themselves.

S38M: When the teacher talks all the time or write experiments on the blackboard.

There is a widespread agreement by these students that there are too few opportunities for them to engage in practical work. This point, which is also highlighted by a number of other students, confirms that whilst practical work has been an integral part of science, the classes seven and eight students at the target school have had fewer opportunities and exposure. As a consequence the subject matter becomes less accessible and interests wane. Prior to this, as is discussed in a later section, science largely holds students' interests and attention.

However, students have indicated that to be engaged in doing practical work make science concepts easier to understand. In considering the preceding statements, it is obvious that students associate science learning with experimental (practical) strategies. Surprisingly, the teachers also consider practical work an important component in teaching science concepts. However, due to traditional classroom routine and the obligations of keeping up with lesson times, most often teachers find themselves in very 'tight spots'.

Question: *What's your favourite subject to teach? Why?*

T1M: I like Maths. I like teaching English and Social Science and Health, and Fijian but not Elementary Science. [Why don't you like to teach E/Sc?] Well… er… teaching Science, you need to er… well you need to know how to deal with materials and apparatus and everything but…er with all that, still sometimes I feel that science is not as important as other subjects and so I tend to er… have all the other subjects up to par but science seems to be the one … well … right now, right now, I am have all the other subjects up to date, but not science, you know, doing experiments and all that, because all those things need a lot of time to do.

A common justification that most science teachers fall back on is the insufficient time allocated for science in the school pragramme. The truth of the matter is, as teachers rush through the curriculum, the tendency to appropriately talk about a concept in a science lesson become indistinct due to the rigid structure in the lesson timetable. Consequently, it is evident that to some extent, experiments and practical involvement, at the target school though considered important, are not fully realised. As indicated by the above reaction, science is not often given much consideration due to classroom obligations such as time limitations, which teachers continue to face in the science classroom.

Teachers' practice is constrained by traditional classroom routine and protocol

In considering the following opinions about science teaching being a challenge, it is evident that teachers at the target school, amongst the constraints that have been previously mentioned, struggle to teach certain concepts in the prescriptions.

Question: *In your opinion, do you consider science teaching a challenge? If so, how is it a challenge? If not, why is it not?*

T3F: Oh, yes very challenging. Firstly, I am weak in Science and Maths. As a student I did not have any interest in these two subjects at all. Secondly, as a teacher of science, the unavailability of resources such as science equipment continues to put pressure on my work. In addition, the concepts are sometimes hard so if we have the apparatus maybe it will help to teach science better.

T5M: Yes, I could say that it is indeed very challenging because in most cases I really have to struggle with certain terms and concepts, which I find quite confusing.

These statements sound almost like confessions unraveling an unfortunate reality of classroom routine. In the lower classes, students are encouraged to manipulate things with their hands and senses. As students progress in their science classes, they are introduced to ideas that they must simply accept, whether they understand the concepts or not. The scenario is no different than the situation that those of the island people of *Beqa* are experiencing in their science lessons. In addition, during the early years of schooling, according to the following descriptions, students interpret their science learning experiences as a positive adventure. This may be partly due to the ways in which science was conveyed in class.

Question; *Have you always been good in science?*

S3F: No. I am good in classes 1-6 but poor now in class 7 because I didn't revise.

S22M: No. In the lower classes I was good, but in class 8 I do not study hard that's why I'm poor.

S26M: No. I was really good in science in the lower classes but I did not study/work hard in science now and I did not know what to do.

S36M: No, because in the lower classes, I was good because I always have high marks.

An interesting logic given below as counter-act to the concerns given above relays the discomforts and pressures a teacher endures when teaching science particularly if aspects of the contents are unfamiliar.

Question: *What do you think of the science curriculum?*

T3F: The content is too much. For example, there are far too many activities for each unit. It becomes too much for the examination classes given the restricted time frame.

The teacher further explained that in an attempt to complete the content, the curriculum would usually be taught in a rush to finish the book at the expense of depth and understanding. In turn, the teaching and learning scope became very narrow with over-reliance on teacher-centred pedagogies thus there was very little room for self-exploratory and self-motivated teaching and learning styles.

Over-reliance on teacher for the 'right answer'

Question: *What do you think is the essence of science teaching and learning?*

T2F: Engage the children in their learning. Make them discover for themselves.

T4F: Making students take responsibilities for their own learning. Make them discover for themselves. Help them create new knowledge by providing the resources necessary for them.

Although two out of the five teachers emphasised the need for self-exploration in science, as shown in the above conversation, they appeared to have contradicted themselves and do not freely allow their students to undergo trial-and-error learning opportunities; to learn to be independent thinkers and effective problem solvers.

Question: *What do you do if the outcome of an experiment does not turn out the way you had planned?*

T2F: Well, let me tell you this. I try out the experiments myself before the children do to ensure that when they actually do the experiments they will be doing the correct things. Therefore, during the activities I will advise them, "you're not doing this right, you need to do it this way", that's why I need to do the experiments first so that the results of the experiments turn out the way the prescriptions say.

T4F: I always try to maintain that not all experiments will result in the way the books says so it is all right if we make a mistake, we can always redo the activities until we get the correct answers.

This is first hand experience to what researches have talked about in past studies concerning effective teaching and learning strategies. A documentation of a number of similar instances (Muralidhar, 1989) where drilling and coaching are the routine of science teachers I believe, is the result of lack of appropriate knowledge and expertise to handle concepts and skills in these situations particularly, as science advances in class levels.

Muralidhar further mentions that one cannot entirely put the blame on practicing teachers for reasons such as, the narrow structure of Fiji education system with its centrally developed curricula. The scenario at the target school is that teachers, who are not in a position to alter the curriculum as set by the Ministry of Education, receive prescribed materials from the curriculum developers, without being given the chance to check for integrity and credibility of the nature of the prescriptions. Therefore, it is at this implementation stage, when teachers and students are expected to negotiate meanings from the prescribed texts that the real problem of misrepresentation (and misconception) of science concepts and skills exists.

Interests and Performance in science decreases as students' progress up the class levels

As previously mentioned a consequence of the decline in practical work is that the subject matter becomes less accessible and interests wane. In turn, a fundamental factor of waning interests and performance could be attributed to the fact that science concepts and skills become more sophisticated and too advanced to negotiate, as students progress in class levels, particularly if teachers and learners do not relate well to the material understudied.

Question:	*Is there anything that you don't like about your science class?*
S9F:	Hard to understand science.
S12M:	Writing long notes.
S13F:	Teacher giving me a lot of hard words that I don't know.
S38M:	When the teacher talks all the time or write experiments on the blackboard.
S20M:	I like it when we were in lower classes, but now the teacher hardly did any experiments and we didn't understand what was going on.
S31F:	I don't like doing the experiments myself because I find it hard to follow the instructions. I need someone to supervise so that nothing will go wrong.

Another causal aspect to students' lack of interest in science, which I suspect, is the lack of realisation that most of the experiences that students are engaged in outside the confinements of their classroom (as part of their culture) is also science or related to school science. Interestingly, these responses confirm my suspicion.

Question:	*Are you aware that most of the things you do outside your classroom (or as part of your culture) is science or related to science? Can you give some examples?*
S22M:	Now *(after being given few examples)* I am aware of some things like I do in class I can also do it at home.
S18M:	No, I did not know but now, during this interview, I know some things are related to science.

S20M: Some, yes. Like what I learnt in Social Science – the grog session. *(No further elaboration).*

It is appalling to note the devastating experiences students go through during science lessons given the expressions at hand. A lot could be said about the circumstances surrounding situations as such. In a report, Muralidhar (1989) had argued that science textbooks, teaching and assessment practice emphasise learning of answers more than the exploration of questions. As a result, teachers continue to be encumbered with an overstuffed curriculum as they struggle daily in their work, thus contributing to an over riding effect on students' interests, achievements, and performance in science.

Question: *In your opinion, do you consider science teaching a challenge? If so, how is it a challenge? If not, how is it not?*

T4F: Yes, it is a challenge. First of all I have to be informative myself. I have to do a lot of research before I teach a new concept.

T5M: Yes, I could say that it is indeed very challenging because in most cases I really have to struggle with certain terms and concepts which I find quite confusing.

Question: *Do you think science is supposed to make sense? Why do you say that?*

S29F: Yes, […] er, so that I know the answers to write in the exam.

S11M: Yes, because when we grow up we have to learn about it and if we have a job we will know what to do.

S33F: Yes, science should be meaningful to me so that I score good marks and get a good job.

Comments as these are reflections of the limited realisations of the usefulness of science in aspects of life other than an acquisition of knowledge to be tested or evaluated at the end of instructions. Most of these attitudes could be attributed to how science had been taught at classroom level; a hard subject that could only be memorised for assessment purposes. It is objectionable to see the effect of such teachings on attitudes, particularly if orchestrated intentionally by teachers and science educators. As an outcome, as cited in the literature, learning becomes fragmented as science concepts and skills are understood in isolation rather than holistically. It is believed that in turn, developing relational links between classroom science and everyday experiences would not be fully maximised.

Attitude to science is related to performance or achievement in science

Allied to feelings of personal fulfillment, students express the views that their level of interests in science is related to how well they perform in tests and exams. Students' perceptions center on the premise that, if they are 'good at science' and 'achieve high marks in tests', their confidence is greatly improved and the subject is of greater interest to them. When questioned how they rate themselves in science, students revealed the following responses:

Question: *How are you at science? Poor, average or good? How can you tell?*

S12F: Good. All my subjects are poor, only in science it's good – I score good marks.

S26M: Average. I gain more marks in science than in any other subjects.

S33F: Average. By looking at my marks. When I score low marks, I am poor, but when I score high marks, I am good in science.

These views are understandable for the simple fact that students have been taught from the early stages of schooling to strive for maximum marks. Achieving high marks is an indication that concepts are well understood and internalised. Within these comments also, one can find an evaluation of the teachers' roles in their success with the subject—an aspect that increasingly dominates children's thinking as public examinations loom into view. This finding has confirmed that over-reliance on performance and achievement has taken away the essence of sense-making in science lessons.

Some of the responses of students with the inclusion of a teacher to the question about why science should make sense and meaningful reveal similar sentiments:

> S29F: So that I know the answers to the exams.
>
> S21F: We need to understand things for the exams.
>
> S8M: So that we will pass our exams.
>
> T2F: I do not have any choice but to teach according to what is being examined. If I don't then my supervisor will mark me down resulting in no-salary incentive. We are always reminded in staff meetings to cover the entire syllabus that will be asked in the external examinations.

A further analysis of the science curriculum revealed that little regard is given to inculcating life-long skills. By this, I mean that teaching for understanding of the applications of what students learn at school in their real life situations in their homes and communities, is lacking. Through discussions with teachers, it was evident that teaching is directed towards the main (examinable) subjects and that the focus has been on facts and figures, and memorised processes and skills. When students are seen that they can recall facts on paper, learning is assumed to have been effective.

Lab and science equipment are important for effective science teaching and learning

The unavailability of science apparatus such as test tubes, flasks and tongs to hold 'heated' objects has been an on-going problem in the teaching and learning of science at the target school.

> *Question:* *In your opinion, do you consider science teaching a challenge? If so, how is it a challenge? If not, why is it not?*
>
> T3F: Oh, yes very challenging. Firstly, I am weak in science and maths. As a student I did not have any interest in these two subjects at all. Secondly, as a teacher of science, the unavailability of resources such as science equipment continues to put pressure on my work. In addition, the concepts are sometimes hard so if we have the apparatus maybe it will help to teach science better.

Teachers at the target school suggested that it should be enlightening to have a science laboratory as some topics in the science textbooks require related lab-work. But as indicated by the above statement, science teaching has been affected by the lack of such science teaching resources. It is believed that if concepts in science are taught using the desired apparatus, teacher will be able to teach science better. However, due to the unavailability of proper science equipment, the experiments and lessons are put up on the chalkboard, for the purpose of avoiding students' misconceptions.

An alternative teaching method which is rapidly becoming a trend involves students doing laboratory work and science projects that are forced to result in ready-made conclusions within a very short time frame. Teachers, more often than not, avoid involving inquiry work in science as it often includes long-term explorations resulting in more questions. However, it needs to be clearly defined at this point, that, when students attain the ability to inquire into complex issues that are relevant and interesting to them, they will be able to navigate toward a deeper understanding of science concepts. The results will allow students to see themselves in a world filled with science, both as content and as process.

Question:	*Can you name some things that you like about your science class?*
S1F:	Experiments, sometimes group work. I don't like doing work on my own because some other ideas might be good. Also, I don't like it when the teachers do the experiments because I love to do the experiments too.
S2M:	I love to do experiments on my own.
S3F:	Doing experiments. We don't do experiments. I don't like it when the teachers do the experiments themselves.
S15F:	Just doing experiments.
S16M:	Doing experiments.

Although, the use of laboratories and proper science equipment may be considered reliable tools for effective teaching and learning, the focus is on inquiry and critical thinking and has been the goal in science education for many years. Nonetheless, there is little evidence that a typical science class, as is the case in the target school, has been successful in moldings students towards this goal. It is through critical inquisition that students are trained to utilise the knowledge and skills they have acquired in their science classrooms to their immediate surroundings.

Classroom science is important and useful for productivity and sustainable living in the community

When teachers are asked about their views on the extent to which science can contribute to improvement in the quality of living standards in the community, the reactions disclose an interesting thread:

Question: *Is there any relevance of the science children learn at school for their daily life in the community? Please give an example for your answer.*

T4F: Yes, a lot of relevance as they (the students) are just beginning to realise the significance of formal schooling to community living. For example, studying plants, they learn about the usefulness of plants – giving out the desired oxygen for us to breathe in and making use of the carbon dioxide we breathe out. Hopefully, when they go back home, they are motivated to conserve plants, less cutting down trees and the like.

T5M: Of course, things that are learned in the classroom should have a lot of relevance outside the classroom. I believe that apart from the outcomes of tests and examinations, learning can be measured when students re-live their classroom experiences at home.

For the majority of the teachers' responses, as shown by the statements above, there is an indication that classroom science greatly contributes to improving life practices in the homes and communities of their students. In comparison, students expressed similar sentiments about the importance of learning science.

Question: *Do you think science is important? Why?*

S1M: Yes, because we learn a lot of things. *(When probed, what kind of things)*. Um, Measurements, weights of the subjects, we put it in a cup, and put it in a ruler balance and then we weigh it using a pin.

S6F: Yes, because sometimes, we, er, sit it for assessment.

S4M: Yes, because it will help us in our future for a good job. It will also help our life.

S21F: Yes, because if there wasn't any science, we wouldn't understand our surroundings.

Hence, what is articulated in these comments is recognition that learning science is important, and that science and scientific knowledge are important aspects of contemporary life. Those who could do science are seen to be intellectually able and enjoyed higher academic status. Conversely, the most common argument for the importance of science is its instrumental value for future careers.

S18M: It is important to learn science because many questions will be asked when you're working for an electric company like the FEA (Fiji Electricity Authority).

Predominantly, careers such as, electric works are traditionally associated with science. What these findings suggest is that science has a marketing problem. If the main value that pupils are placing on science is its instrumental value rather than its intrinsic interest, then science teachers should endeavour to make clear the wide range of occupations which scientific knowledge supports, how it might be used, and why it is useful.

Whilst there would appear to be a growing awareness amongst some students of the general career value of science, the lack of specific examples raised implies that little has been done to emphasise the value of science qualifications in a wide range of occupations—or alternatively that science has as much value as a cultural resource for any 'educated' individual. At the moment, the attitude of the students at the target school would appear to be summarised by the view that—yes, studying science is important in everyday life experiences but not for me. A closer examination of the many reasons given for the importance of science shows a marked difference between boys and girls in the nature of the statements offered.

Girls had little difficulty in offering explanations for the importance of science to themselves and to their everyday practices. A motivating example is shown in the following comment:

> *Question:* *Do you do things at home or at a function that might involve science? Can you tell me what these things are? (Probe: Can you tell me more about it?)*
>
> S23F: Yes. Making lei, it is like doing experiments – you make things with your hands.

To an extent, the view expressed here confirms what the literature surrounding children's science involves. Children love to manipulate objects using their hands, in other words, learning science become relevant and sensible if engagement is practiced. In the case of this participant, science learning is associated with plaiting (or weaving) as a resultant of experimenting with 'your hands'. In turn, teachers of science need to consider creating opportunities for student involvement in this direction; in particular, girls enjoy creating and re-creating material. It is common knowledgeable that science concepts that prove too difficult to comprehend at this level, would be manageable should teachers draw attention to such potential and strength as indicated above.

Boys, on the other hand, had little to say about the importance of science either to themselves or to their everyday lives. What they did say was very similar to the comments made by girls, although the common examples they offered depicted their traditional gender- related roles:

> S1M: Smoking fish, making *lovo* (hesitant to elaborate).
>
> S26M: Yes. Making *lovo* – the steam coming out when the *lovo* is cooked. Cutting coconut leaves.

Central to the differences in the above views are the traditional roles of males and females in the community. In Fijian communities, the women and girls are confined to traditionally feminine tasks such as cooking and washing, while the men and boys do masculine tasks such as carpentry work, making *lovo*, and cutting coconut leaves. Hence, it is clear that the responses above reflect the participants' roles and responsibilities in the homes.

Interestingly, the roles discussed could be an asset to learning science meaningfully in the sense that teachers could use students' experiences as support material to teaching certain concepts and skills. Realistically, some concepts can be challenging in nature, for instance, in questionnaire 1, <u>all</u> the participating teachers affirm that *'Different foods have different ways of preservation methods for example, foods that contain a lot of water take less time to preserve than foods that contain less water'.* For many, the nature of these responses is an oversight, too trivial to be a cause for concern.

As a researcher and a teacher of science, I am saddened by the thought that teachers could be very ignorant of the fact that, *foods that contain a lot of water take a longer time (not less time) to preserve than foods that contain less water'.* If teachers take the time and initiative to use children's knowledge and experiences, at least most of the discrepancies in conceptual understanding would be narrowed. It is likely that teachers are, not at all, concerned if they are contributing to widening the scope of misconception in their own science classes that can have a negative effect in sustainable living in the community.

Limited understanding of the scientific bases of everyday practices

Vital to any such course, as well, would be a component that allowed for the exploration of aspects of science in everyday situations. From the teachers' perspective such an element is essential to constructing a connecting thread between classroom science and the 'real' world of the students, endowing the subject with a relevance that no other mechanism can. Nevertheless, the strength of the views expressed here suggests that the link between science and everyday events is too often ignored. In considering these responses to determining the relevance of what is offered at classroom level to daily life practices are reflections of the extent to which science is taught using everyday experiences:

Question: *Do you relate to everyday experiences when teaching science concepts and skills? Can you tell more about how and when you do relate?*

T1M: Er…sometimes, not all the time because most of the time, the books think otherwise, we just go by the book.

Question: *When do you relate?*

T1M: Only when…in…lessons on the environment, when we go and look at the leaves, the plant that's when we talk about the plant that's when we talk about the medicines (herbal) and stuff e.g. the pawpaw plant, children come up with all sorts of medicinal aspects of the different parts of the pawpaw plant.

On one hand, the unspoken could mean that very little of what is in the prescription is related to everyday life, on the other hand, as previously mentioned, some concepts are often too hard to be understood for reasons such as lack of information and unrealistic science material for teachers. An example of an incomprehensible concept is included, when a term needs to be defined:

Question: *What are biodegradable foods? Do you have any idea? (Please explain your answer). Can you give some examples?*

S3F: (shrugs to indicate no idea)

Out of the forty-student participants, thirty-two or 80% indicated a *no-idea* response. At this level, students should have been able to approximate terminologies of such nature with the assumption that deliberations would have been undertaken in class. One of the traditional tools in science education, the science textbook, must be examined for its impact on everyday teaching and learning. However, given the nature of these responses, it was unfortunate that such a term sounds unfamiliar, if not alien.

Upon sighting the pupils' science textbook currently in use at the time of this writing, it is disheartening to note the absence of an index page to assist with the definitions of terms and concepts. Surprisingly, one of the main purposes of the textbook is to clarify and specify concepts and skills. On the contrary, the science textbooks contained foreign material and as Muralidhar confirms 'a mile wide and an inch deep' (Muralidhar, 1989); more material than necessary for a course of study. As a result, from my own experiences as science teacher, the norm for science teaching is to write on the chalkboard, copying directly from the textbooks without providing opportunities for students to do the experiment and to talk about the bits they don't understand in the experiments.

There was a 100% affirmation by teachers that classroom science concepts and skills are relevant to everyday practices. Interestingly, when students were asked if they could draw upon science-related experiences in their homes, the responses revealed very limited understanding.

Question:	*"Do you think it is possible to do science at home? Can you give examples?"*
S4M:	Yes, boiling tea, er, when tea is boiling and [Pause] the air is evaporating (Did not elaborate).
S5F:	Yeah. Cooking, um, um, [Pause] how you groom yourself.

Similarly, when students are probed, if they could recall some cultural practices that are similar to school science a degree of uncertainty is detected.

S18M:	Smoking fish, making lovo (hesitant to elaborate).
S20M:	When there is a *soqo* (gathering) in my house, I practice certain customs like manners.
S23F:	Yeah, the way we prepare food and like Indian ceremony, cutting of the hair and Indian wedding.

S24M: (Hesitant) Making a fire using two stones.

S25F: Yes. Like er, grog and water. It's like making a solution.

S34M: Digging a pit for lovo and rubbing two sticks together to get heat and then a fire will start. Cutting coconut leaves.

S39F: Yes. Cooking the Fijian way using hot stones for 'lovo'. Producing fire by rubbing two sticks together.

A strong finding from this research is that students draw very limited comparisons between school science practices and everyday phenomena. The basic simple connection, which fails to build and develop pupils' knowledge, and to make its new insights distinctive, has the potential to alienate many pupils from the subject. From a personal observation, it is apparent that due to lack of knowledgeable aspects of their own culture and traditional practices, teachers lack the confidence to deliver effectively and efficiently in science classrooms. In the short term, teachers need to be more aware that determining the nature of students' prior experiences with what they have to offer at classroom level is, therefore, an important process if misconceptions are to be avoided. In the majority of the comments, the emphasis is on the general value of science as a subject to be studied, often illustrated with examples of its instrumental value; and there is little recognition that one value of scientific knowledge is the ability to engage meaningfully in everyday issues.

Summary

This section includes a documentation of the range of views held by the participating students and teachers of the target school of the nature of science and the connections between formal science learning and everyday experiences. It is imperative that the links between the two phenomena need to be recognised primarily for potential contribution to alternative ways of knowing, particularly western type of scientific knowledge. In summary, learning science involves coming to understand and being able to use the knowledge, concepts, skills and processes of science meaningfully and relevantly in everyday living. In this process, the learner is engaged in making sense of the scientific ways of interpreting and explaining phenomena. In turn, there is a need for consideration of children's knowledge and experiences as support material for meaningful negotiations in science classes.

The final section of this writing consists of reflections that include the implications of my findings and, an afterthought that is generated from my experiences as a researcher undertaking this phenomenological study in science education.

CHAPTER 5

REFLECTIONS

Introduction

In this chapter, I intend to discuss the implications of my key findings before ending with an afterthought. It is not my intention to draw any definite conclusions as I whole-heartedly believe that my work into researching the phenomena of school science and everyday experiences is not complete as I surely will use aspects of this writing as basis for further investigations towards a higher degree. In turn, I leave with an afterthought to create motivation for practicing teachers (particularly at primary level) to pursue similar studies.

Implications of my findings

As mentioned at the outset of this writing, my experiences as a teacher of science mainly involved teacher-centred instructions. My concern was whether it would lead to real understanding and appreciation of science if I continued to teach that way. As this research unfolded, a dawning realisation hovered in my conscience as to how I can contribute to creating awareness in fostering a thirst for science and its relevance to everyday practices. The thought made me pursue this investigation as I was determined to explore the nature and range of views that students and teachers held about the phenomena of science and everyday living.

My research findings have fashioned my own perspectives as a teacher and student of science. During the course of my study, a lot has been revealed about the characteristics of the present education system, classroom science practices and, the different views about what needed to be valued and emphasised in classroom science. Hence, after conducting my research and analyzing the findings, I am determined to highlight three main areas that I believe would assist policy- makers develop a science curriculum that is more relevant to the students' everyday life practices. Before I discuss any further, I aim to align three implications alongside the research questions mentioned in Chapter 1 to establish a consolidated purpose for this concluding chapter.

Table 5: Implications of my Findings

Research Questions	**Implications**
How well do students and teachers of the target school understand the relevance of classroom science in their everyday lives?	Developing classroom science for relevance in everyday experiences.
How well do students and teachers of the target school draw on common everyday experiences to understand classroom science?	Establishing meaningful connections between classroom science and everyday practices.
Are there areas in classroom science in which local knowledge and skills are of comparative advantage?	Redefining students' and teachers' views of the nature of science.

Developing classroom science for relevance in everyday experiences.

Science embodies a critical perspective that must examine deeper and broader issues. This research is an exploration of students' and teachers' views about everyday experiences in relation to scientific phenomena in an attempt to assist teachers build on the everyday ideas about science that students bring into their classrooms. Pertinent to this study, are these questions that may be important in the process of curriculum design: What effects would interactions between classroom science and everyday practices have on the understanding of science concepts and skills? Who has access to the benefits of the science knowledge? Who does not? What local sources of science knowledge are being ignored or eliminated?

For classroom science to be meaningful to students, the curriculum must move beyond the conventional science domain to include the social and cultural domains. With more access to meaningful science experiences, I believe that conceptual understanding can be strengthened so the learner can see the value of their prior knowledge and experiences in making additional and new connections. It is evident from the findings of my study, that the way science is currently taught and learnt, lost to the children are the opportunities to learn science in a cultural and integrated context. Thaman (2001) emphasises the importance of securing a curriculum that is inclusive of our ways of living. Thus, it is recommended that science curriculum include traditional ideologies such as the processes involved in meat and crop production or, how the older generations cleaned their clothes. Other important questions which need to be considered for a science curriculum that is relevant to everyday life include:

- How were native plants used in the past and how are they used at present?
- How did our ancestors navigate their ways around our islands?
- How did they determine weather patterns?
- What environmental changes have occurred over time in the community?
- What about the traditional methods of preserving food items in Fiji and in the Oceania for that matter?
- How did the people in the olden days store food and water?
- What were some traditional ways of preserving and conserving food and water?

From a personal standpoint, the above are some examples to form the basis on which an inclusive curriculum, as Thaman recommends, can be built. Apparently, this calls for a science curriculum that includes authentic representations of students' and teachers' experiences. I believe that such a curriculum which breeds learning experiences that are rooted in students' everyday experiences not only will add meaning to the life at home, but, will also provide meaningful links and interest between what is done at home and that is done at school.

To push for a non-natural perpetuation of status quo science that is recreated in the image of a dominant perspective makes science lose its natural identity. Policy-makers in government have the power to design the curriculum provided to the students. Those who have this responsibility must consider the ethical implications of the task and approach it with modesty. The curriculum in an education system is established for nothing less than to alter the mind of the learner. Educators and policy-makers who have control over the curriculum have the overwhelming power to determine what curriculum will be accessible to which learner.

The way the curriculum shapes the learners, as Eisner (1994) confirms, will also shape the culture in which they live. The science curriculum, to a large extent, determines more than students success in school. It also opens or closes doors to students' future aspirations. Inevitably, the foundational beliefs of policy-makers and curriculum developers will permeate the decisions made about the science curriculum. Thus, it is important to realise that we cannot allow our students to give up their ways of life in order to conform to a science curriculum that is a hindrance to students' accessing quality avenues such as their very own potential experiences

Establishing meaningful connections between classroom science and everyday practices

As stated in the review of the literature, Thomas Kuhn identifies a 'paradigm' as a constructed world of perception and conception (Chalmers, 1976). He further elaborates that paradigms are assumptions about reality that provide the foundation for our reasoning, feelings, values and actions. A shift in paradigm then, is a change of consciousness, a change in one's capacity to be aware, to pay attention (Dudley, 1987). The paradigm that has dominated science teaching and learning, in Fiji, in general and the target school in particular, has been marked by a focus on scientific mechanisms, which has led to a separation of theory from students and teachers lived experiences.

Missing from this paradigm is the context of experience and a developmental understanding of life processes. Basically, this call advocates a move from a marginalised way of thinking to a relational way of perceiving the world. As a matter of fact, much has been written of the importance of placing learning into a suitable and relevant context. In recent times, schoolwork has been criticised as being out of touch with students' lives in the home life. It appears that indigenous ways of knowing have been largely supplanted by western science perspectives. More often than not, teachers are placed in a position of uncertainty that they are reluctant to work towards reconciling conflicting concepts. In this respect, teachers need to draw upon everyday examples to stimulate interest and discussions about the concepts they wish to explore.

Simultaneously, it is important that pupils are aware that the scientific issues that are relevant today have their roots in earlier discoveries, which has led us to our present state of understanding about a particular concept. Pupils should also be made aware that future discoveries may take our understanding further forward and may change the currently held views of a particular concept or idea. In considering the role of science in everyday issues, we engage pupils in the thought process, which has engaged scientists through the ages. This, in turn, enables them to question the scientific information presented to them (sometimes as apparent scientific fact) and to make their own judgment about its worth.

Concurrently, teaching science is about identifying the science, which is apparent in everyday life, rather than simply considering new examples of the application of the concept or idea. In essence, the aim should be to enable pupils to recognise the science that is all around them, in their locality, at school, at home, and encourage them to engage with it. Teaching using everyday issues should enable students to build their own conceptual applications to examples offered in class.

In addition, the notion of what is culturally relevant and appropriate in the science classroom is complex, however, this becomes all the more complicated if the teaching of science continues to ignore the students' culture and traditions. Accordingly, science applications in the family and community are denied entrance into classrooms where students are drilled on test-specific content. Consequently, learning becomes a procedural exercise whereby learners commit facts and concepts to memory very thoroughly that they can recall facts whether or not they understand the processes involved.

The main concern underlying the above principles has to do with the construction of meaning in science classrooms. That is, a teacher's main task is to create a context for understanding lesson content, making ideas less ambiguous and comprehensible to the learner. In connection to these suggestions, the issue of cultural transmission as advocated by the Fiji Islands Education Commission Report (2000) should be key instruments in strengthening the respective cultural traditions of the different populations that makes up Fiji. Specifically, schools should operate to mainstream the collaboration between traditional ways of life that have an impact on formal education. Moreover, Wells (1981) relates that relevant scientific knowledge, skills and processes would develop with the use of such interactive teaching methods as discussed, thus allowing what is being taught and learned to be meaningful.

In doing so, science educators hope to foster more opportunities to use the knowledge that children have and the practices that are familiar to them, as resources for science teaching and learning. In this study, for instance, the Fijian earth-oven, or *lovo,* is an emerging positive resource for instruction in teaching the concepts of 'convection current' and 'energy transfer'.

In summary, as discussed in the preceding section, Thaman (2001) maintains that inclusive curriculum has the potential to develop more democratic procedures in science education. Thaman retains that a democratically designed curriculum promotes democratic procedures in the sense that there is room for negotiations during the teaching and learning process. As most science teachers in Fiji are well aware that learning science often creates difficulties, the notion of a culturally inclusive science curriculum, as Thaman reasons, should open up new possibilities in enhancing science teaching and learning, particularly at primary schools. Hence, teachers and students need to be given the opportunity to develop the necessary links between classroom science and everyday experiences in order to make sense of the concepts and processes that are often meaningless and purposeless in their contexts.

Redefining students' and teachers' views of the nature of science

Thus far, theories previously held about the nature of science are culturally westernised, and, in turn, render it unattractive.

T5M: The study of living things and non-living things.

As mentioned in the prior chapter, the findings of this research shows the marginalised view that science is something 'out there' to be studied, arbitrarily I believe, hamper meaningful appreciation of the fact that students could be tasked to engage in scientific sense-making practices at classroom level. This study contends that if science is acknowledged as a human activity, that involves the processes of inquiry, then the focus on purpose, content, methods and evaluation procedures will present a more humanistic orientation.

As discussed in the review of the literature, understanding what science really is, is an important precondition to a meaningful understanding of the world that we live in. In addition, the exploration of three characteristics of science which makes the subject unique from the other disciplines that are pertinent to this study are; the changing nature of science (that is, its tentativeness), scientific knowledge being a product of creativity and imagination, and the diverse 'traditional' perceptions of the natural world and its cultural-embeddedness. The impact of understanding the nature of science from such a standpoint, should improve teachers' as well as students' belief systems on the complex issues surrounding the nature of science.

On one hand, misunderstanding the nature of science is a major cause of confusion in the science classroom, which, in turn causes many students not to enjoy science. Obviously, present in this study is a degree of inadequate understanding of the nature of science. For most of the teachers, as shown by the data, the views highlighted in regards to the nature of science, are subjective and technical in nature. Although, the teachers talk in terms of science being an evolving discipline with opportunities for hands-on explorations, their classroom actions, as confirmed by the students' responses, are not congruent with such views. The data show that teachers' actions are dominated not only by their own limited views of the nature of learning but also by the requirements of the syllabus. The teachers' main goal is to help students pass the examinations and test with good marks. To an end, their teaching methods reflected science as being a 'catalogue of facts' that the students had to remember and repeat in examinations.

On the other hand, understanding the nature of science shapes the way one learns (or teaches science), and allows one to easily distinguish between science and other practices or knowledge that are not science. Adequate understanding of the nature of science is vital for effective implementation of any science curriculum. In particular, the influences of professional development may be effective for enhancing the ability to connect classroom science to everyday life practices in assisting teachers at the target school. Moreover, such explicit teaching on the nature of science is a first step toward developing an improved understanding of how science is viewed.

In this research, alternative perceptions of the nature of science are common among teachers and students. The teachers' views are closely aligned with that of the students' in the sense that the explanations they offer depict simplistic conceptions. Certainly, a deeper understanding of the nature of science by all science teachers is required to address this concern. Eick (2000) in a similar study on pre-service teachers' views of inquiry and the nature of science conclude that continued exploration of this phenomenon will generate influences that could guide perceptions towards consolidated conceptual change approaches in this area of science education.

In considering everyday issues, pupils are enabled to check their application of knowledge and understanding in new contexts. Hence, teachers need to reinforce the relevance of science that they teach in contexts that would excite and motivate inquiry and further questioning. This can only be realised if there is extended understanding of the nature of science and its philosophical underpinnings so that students are provided with the skills they need to be able to meaningfully explore the information presented to them. Ideally, everyday practices not only become more than, but builds upon, classroom science.

In core, students bring their everyday experience of life to lessons that include examples of scientific applications and widely held views and explanations of some aspects of science that are only partially understood or even may be incomplete and hence apparently incorrect. Discussion of these experiences can be used as a way to find out what level of understanding a pupil holds. Having found out what the pupils know and have experienced, there is a need to build on this. In some cases this may involve planning suitable activities to enable pupils to clarify their understanding of an aspect of the topic, without having to teach the whole of that aspect of the topic as advised in the prescriptions. In other cases, it may involve remembering who has experience of what and making use of them as a resource to help other pupils understand particular aspects. It may be that the experiences shared by the students at the start of the topic can be used as lead-on, in which the specific learning of a lesson can be related during general activities.

Afterthoughts

It is inevitable that a curriculum that acknowledges and encourages a wide variety of cultural perspectives of science education will generate learning opportunities outside the restricted context of the school. It follows that we can re-orient prescriptions away from the pursuit of facts and memorised knowledge and procedures towards more humanitarian ends that take into account the learners everyday experiences as backdrop for the process of discovering scientific notions.

The final piece consists of my personal reflections before, during and after compiling this writing.

The Write- up

> *My experiences during the writing of this thesis were indeed very challenging. At first, I was unsure of what my role as researcher was, in terms of analyzing data collected from this phenomenological research. I panicked from thinking about what I would do with all the information I had gathered and I did not know a thing about thematising nor categorising responses. In fact, even before conducting the fieldwork, I had drawn predetermined 'themes' from the questions I was going to ask my participants. After much discussion (actually sitting down and going through the responses) with my supervisor, my data began to inform me of my findings. It should be noted at this point that when I decided to undertake this research, I did not, at any time, think about how I was going to analyse the data I would collect nor did I take into account, seriously, the method(s) I would use.*

> *My initial supervisor would constantly remind me to stay focused on 'what I wanted to do', 'how would I do it', and 'why I wanted to do it'. Even then, I was writing bits and pieces of information that seemed out of place with my intentions. Being a teacher by profession with a postgraduate diploma qualification, I thought it would be a 'piece of cake' carrying out the tasks of interviewing and administering questionnaires. However, during the fieldwork, when I saw the amount of data, panic struck in, as I had very little research experience. I asked myself, "What am I going to do with all this information?", "I don't know how to go about analysing*

these things!" All sorts of thought were zigzagging in my head. I knew I was totally lost.

Fortunately, (and thankfully) I was blessed with a patient and encouraging guide who took extra time and effort and directed me to comprehensively placing the missing pieces to my writing. At times, I felt like 'throwing in the towel' and quit because it was just too hard and confusing (not to mention chaotic!). I thought that most probably the demands of a large family (according to my initial supervisor) had a lot to do with my distractions. Honestly, I was not distracted in any way; but merely being lost in the process of research work (although I must admit that the supervisor had a point, as I had just gone through my fourth and final round of motherhood!). However, I remained determined to complete this writing because, firstly, I owed it to my sponsors, initially the Australian Agency for International Development (AusAID) and, during the latter part of this writing, the Faculty of Arts and Law. Hence, after four and a half academic years (9 semesters!), I could confidently put the last piece of the puzzle in place.

Towards the end, the whole experience was an enriching exercise as I began to see my work take effect not only physically, but emotionally as well. I have learned to be very patient and to accept criticism constructively (two very unpopular values on my list). It is overwhelming to actually internalise that I could possibly contribute to the body of knowledge in science education. Somewhere deep inside something was swelling up ready to overflow. I could only describe it as joy. It gives one a feeling of accomplishment and satisfaction to finally draw conclusions to an intention. For me it was excitement as, to some extent, I could claim ownership to this contribution of the literature surrounding science discourse in my home country.

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APPENDICES

Appendix 1: Definition of Terms/Concepts

The following terms and concepts are defined for the purpose of this study.

Co-educational school – an educational institution attended by the genders, boys and girls/males and females

Contextualised learning – studying content in reality (actual environment).

Cultural practices - traditional activities, belief systems and norms related to a particular ethnic group.

Ethnic-Fijian – of the Fijian culture; a native of the Republic of the Fiji Islands.

Everyday (life) experiences - all knowledge, skills, processes and activities related to the survival of a person in and out of school.

Indigenous knowledge - also known as traditional knowledge, it is the wisdom held and shared by the people in the community, and passed down from generation to generation.

Research instruments - the tools used to obtain data. In this case, the questionnaires and interview schedules.

Phenomenon (plural = phenomena) - happenings or an interesting occurrence acquiring attention.

Phenomenology - a research methodology that commands interpretation of data using the experiences of the researched party and the researcher.

Multiracial school – a school that accommodates student of all/any ethnic group.

Prior knowledge – existing ideas, ideas that have already been formed.

Respondents- students and teachers who are the participants in the interviews and surveys.

School science - also referred to as formal science. The science content taught and learned at classroom level

Scientific literate - being able to use scientific knowledge and ways of being thinking for individual and social purposes.

Science-related subjects- mathematics, health education, environmental education, general subjects, accounting, economics and physical education.

Target school- the school comprising of teachers and students who are the participants in this research study.

Appendix 2: Questionnaire 1

Students' and Teachers Views about science-related concepts of Food Preservation

For each of the statement below, please tick the box that best represents what you think:

A	***D***
Agree	*Disagree*

	Preserving food	**S**	**T**
1.	Salt can be used to preserve food so that it lasts and is good enough to eat.		
2.	When salt is used at home to preserve food, science is actually being practiced.		
3.	Biodegradable foods are foods that can keep for some time.		
4.	Our forefathers had their own ways of preparing and keeping food safe to eat for many days.		
5.	Smoked fish (Fish that has been cooked over smoke from a fire) is a delicacy in the villages. The practice of smoking fish is a primitive practice and not really science-related.		
6.	Pasteurization and sterilization are two processes used to preserve milk. These are modern processes that do not relate to our village practices.		
7.	Cultural practices such, as food preservation is no longer useful as we have refrigerators.		
8.	Traditional practices such, as "lovo" making is not related to science.		
9.	Drying food is not part of the Fijian way of preserving food.		
10.	Different foods have different ways of preservation methods. For example, foods that contain a lot of water take less time to preserve than foods that contain less water.		

Students Views (only)

11. How important are the following things in science? (Put: **I** for Important; **N** for Not important).
   a) Parents should help us study and learn at home.
   b) Learning of science should also be done outside the classroom.
   c) Laboratory experiments should be done only in the labs.
   d) We should do a lot of science ourselves with little help from the teacher.
   e) What we do in our culture should also be done in science lessons.

(Three point rating scale with happy, sad, neutral)

HAPPY	SAD	NEUTRAL
☺	☹	😐

12. Which face matches how you feel about science?
13. Are you happy, sad or in-between?
14. How come you chose that [Say: happy, sad, or middle] face?

Circle the number beside your answer.

15. Class

    1. Seven
    2. Eight

16. Gender

    1. Male
    2. Female

17. Age:
    1. 11-13
    2. Above 13

Thank you for your participation

Appendix 3: Questionnaire 2 (teachers only)

Teachers' Views about the Nature of Science and Classroom Science Practices.
For each of the statement below, please tick the box that best represents what you think:

A	**D**
Agree	Disagree

#	**Views on the Nature of Science**	**A**	**D**
1	Science is mostly theoretical.		
2	Science is useful in everyday life.		
3	Science textbooks contain some elements of everyday life experiences.		
4.	There are very few connections between culture and classroom science.		
5.	Science should not be taught using vernacular language.		
6.	I like doing science myself.		
#	**Classroom Science Practices**	**A**	**D**
7.	Science facts and processes are only to be taught, as this is important for exams.		
8.	A motivated science teacher encourages students to think about their experiences.		
9.	Before introducing a topic it is wise try to find out what students already know about it.		
10.	Relying on the textbook for information is good practice.		
11.	It is time-consuming to use everyday knowledge and experiences to teach science.		
12.	Science and culture need to go hand-in-hand during teaching and learning.		
13.	Cultural practices have an insignificant place in the science curriculum.		
14.	Teachers must not let students relate to their experiences when learning science.		
15.	It is time-consuming to relate to use prior knowledge in science lessons.		
16.	Some science concepts are just too hard to explain because students are unfamiliar with the processes involved.		
17.	Students should, from time to time, include in their science books diagrams and other recording methods, which represent their thinking, as it is time-consuming.		
18.	Students should be put in groups, according to their abilities in science.		
19.	The main concepts in science are to put on the chalkboard for all to see.		
20.	It is more appropriate to conduct whole class teaching for science.		
21.	There are some common cultural practices that could be used to teach science effectively.		
22.	Teaching science is quite enjoyable, yet confusing because the textbooks do not provide the answers.		
23	The diversity of students, in terms of culture and language, is not to be considered in science teaching and learning, as it has nothing to do with science.		

TEACHING QUALIFICATIONS and SCIENCE BACKGROUND

24. Years of teaching altogether…………..
25. Years of teaching at primary level (years 1-8)
26. Highest science qualification at Secondary School… (E.g. University Entrance – pass in Biology, etc.)

27. Highest science qualification at a tertiary institution…. (E.g. Bed Primary – ED 216 & ED 316 Science Education).

Thank you for your assistance

Appendix 4: Students Interview Questions

Theme Area of Interview: **A. Students' Perceptions of the Teaching and Learning of Science**

The following questions are to examine the role of teachers and the expectations of students and about this role. For example: Is this role directive? Is the teacher seen that as authoritative and restrictive or is seen as a facilitator and uses effective teaching strategies in teaching new science concepts and skills? Does the teacher allow students to construct meaning for any given concept or skill?

---

1. How are you at science? Poor, Average or Good.

2. How can you tell?

3. Have you always been that poor/average/good in science? Why do you say that?

4. Is learning science meaningful to you? How?

5. What happens when the science you are doing doesn't <u>make sense</u> to you? What do you do then?

6. Can we learn science anywhere else? Why do you say that?

7. View and attitude towards the subject

8. Can someone who is really bad at science – could they get to be really good at it? How?

9. Do you like the way your teachers teach science? Is the way s/he teaches easier or more confusing?

10. Can you name some things that you like about your science class? Is there anything thing that you don't like about your science class?

11. If you were going to tell someone about what science is, what would you say to him or her?]

12. (a) If science were a food what food would it be?
    (b) Why did you choose that food?

Theme Area of Interview: B. Students' Perceptions of their Everyday Experiences in Science Learning

The following questions are to examine how well students could relate their everyday experiences to formal science learning, and in regards to the concepts of food preservation.

---

1. Do you think science is important? Why?

2. Do you see science anywhere around you? If yes, please elaborate.

3. Food preservation
   (a) What are biodegradable foods? Do you have any idea? (Please explain your answer).
   (b) Can you give some examples?

4. If we want to keep these foods good enough to eat for some time what can we do? Can you explain a bit more?

5. Do you think that the process is related to science? How?

Theme Area of Interview: C. Students' Perceptions of their Formal and Informal Science Learning

The following questions are to examine how well students could apply classroom scientific knowledge to everyday practices.

---

1. Do you think it is possible to do science at home? Can you give examples?

2. Do you do things at home or at a function that might involve science? Can you tell me what these things are? (Probe: Can you tell me more about it?)

3. Are you aware that most of the things you do outside your classroom (or as part of your culture) is science or related to science? Can you give some examples?

Thank you for your participation

Appendix 5: Teachers Interview Questions

Theme Area of Interview: **A. Teachers' Perceptions of the Teaching and Learning of Science**

The following questions are to examine the role and expectations of teachers about in science learning. For example: Is this role dictative? Is the teacher seen that as authoritative and restrictive or is seen as a facilitator and uses effective teaching strategies in teaching new science concepts and skills? Does the teacher allow students to construct meaning for any given concept or skill?

---

1. How long have you been teaching?
2. What do you teach?
3. What's your favourite subject to teach? Why?
4. What do you value in science teaching and learning?
5. In your opinion, do you consider science teaching a challenge? If so, how is it a challenge? If not, how is it not?
6. What is science?
7. Do you teach science the same way as you teach other subjects? How is different/same?
8. What things do you do as a teacher of science that you can remember your teachers were doing?
9. What things do you do as a teacher of science that your teachers never did?
10. What do you think is the essence of science teaching and learning?
11. What do you think of the science curriculum?

Theme Area of Interview: **B. Teachers' Perceptions of their Everyday Experiences in Science Teaching and Learning.**

The following questions were raised to examine the extent to which teachers incorporate everyday knowledge and experiences in classroom science deliberations.

---

1. Do you relate to everyday experiences when teaching science concepts and skills? Can you tell more about how and when you do relate?

2. What do you do if the outcome of an experiment does not turn out the way you had planned?

3. Please describe your favourite science lesson? What did you do when you gave this lesson? What do the children do when you give this lesson? Was the teaching effective for the understanding of the subject? How do you know if your teaching was effective?

4. Please imagine a worst-ever science lesson, maybe one you actually experience as a child, maybe one you gave and everything went wrong. In any case, please imagine for a moment a teacher giving a worst-ever science lesson? What is bad the lesson you are imagining? In this lesson, what does the teacher do? What do the children do?

5. With reference to the worst-experience, what is the best way you think your students should be taught in order to understand the topic well and why do you think that? Do you use the same approach in teaching science? If yes or no, why?

Theme Area of Interview: C. Teachers view on schooling versus cultural experience and the practicality of science learned at school to everyday living.

This section attempted to draw upon views concerning the relationship between formal and informal science.

---

1. Do you value traditional practices and why?

2. Should we emphasise the relationship between science and culture? [Probe: why?]

3. Is there any relevance of the science children learned at school for their daily life in the community? Please give an example for your answer?

4. Are the concepts and skills of science learnt at school regarded as more or less productive in the community?

5. Does the science learnt at school lead to improvement in the quality of living?

6. In what way does science prepare children for life skills in their community or school?

Thank you for your participation.

Appendix 6: Correspondence

a) Letter to the Ministry of Education

132 Sawau Road
Bayview Heights
Suva

19th February 2007

Chief Executive Officer
Ministry of Education
Marela House
Suva

Attention: Principal Education Officer (Primary)

Dear Sir

Re: **REQUEST FOR SCHOOL VISITATION**

I am a research student doing a Masters of Education programme at the University of the South Pacific. As part of my thesis writing, I am required to conduct interviews from a certain school setting for data gathering purposes in order to complete my research titled **Students' and Teachers' Understanding of the Applicability of Classroom Science in Everyday Experiences.**

The focus of my research study is based on a predominantly ethnic Fijian primary school and I have targeted to conduct my research at an urban school in the Suva area.

I would appreciate if permission were granted soon as I intend to carry out my research during the month of March 2007.

Thanking you for your consideration.

Yours faithfully,

…………………
Kelesi Whippy
Student no. S99006548
EDP no. 55645

b) Introductory letter to the Head Teacher

132 Sawau Road
Bayview Heights
Suva
Date: _________________

The Head Teacher

Dear Sir/Madam

I am a Research student at the University of the South Pacific, enrolled in a Master of Education degree in the School of Education. I would like your help in fulfilling the research requirements for a Supervised Research Project (SRP), which forms a significant part of this degree. This thesis aims to explore Students' and Teachers' Understanding of the Applicability of Classroom Science in Everyday Life.

For this research, I would like to interview 25 participants from your school, that is, 40 students and five teachers. Preferably, I would like to choose students from classes seven and eight (ten from each level; five from each of the two streams, across a range of ability in science). The interviews are semi-structured, which will allow for a more informal discussion. In addition, there will be a two-page questionnaire for the students and a one-page questionnaire for the teachers. The questionnaires will take around 10-15 minutes to complete.
I would like to talk to children individually for about 30 minutes; at a time the teacher indicates will be least disruptive to their schoolwork. Participation will entirely be voluntary. The children may choose not to answer a question, or stop the interview at any time. The interview will be audio- taped with the child's consent. The child's name will not be used in the final research report and everything s/he tells us will remain confidential. The only people to have access to the tape will be my supervisor (Mr. Vilimaka Foliaki), University of the South Pacific, staff transcribing tapes and myself). When the research report is complete, I will forward a summary of the thesis to the school for staff and parents.

I would value your help in arranging for children to interview, if possible in March 2007. I enclose letters of information and consent forms for parents or caregivers of the children to be interviewed. A separate letter of information for teachers is also enclosed. If you need more clarification on the topic or more information on this research study, please contact me on 3377200 (evenings). 9400738 (mobile) or e-mail me at kelesiloga@yahoo.ca or S99006548@usp.ac.fj.

Yours sincerely,

____
Kelesi Whippy (Mrs.)

c) Informed Consent – Head Teacher

I give consent for the school to be interviewed in the research project, which looks at students' and teachers' views about their science learning. I understand that Kelesi Loga Whippy, who is the researcher, will interview the children. I realise that information will be used as part of a research report and other publications. The school's name and children's and teachers' identifies will not be disclosed.

Signed:……………………….
Name: ……………………….
School: ………………………
Date:………………………….

d) Student's Consent

It has been explained to me what we are going to do. I am happy for the tape recorder to be turned on. I understand that I can skip a question, or a stop talking whenever I want. I know that everything I say will be kept confidential, and that my name will not be used in the report.

Signed:………………………………………………
Name:……………………………………………….
School: ……………………………………………..
Room: ……………… Class: ……………………
Date of Birth:………… Age: …………………….

Date of Interview: ………………………………….

Gender:	Male	□	Female	□
Ethnicity:	Fijian	□		
	Indo-Fijian	□		
	Others	□		

How long have you been in this school? ……………………………
What was your last school? (if any) …………………………………….
Previous school (s) (if any):
………………………………………………………………………………..
Primary school……………………………….From………… To……….

Thank you.

e) Introductory letter to Parent/Care-giver

132 Sawau Road

Bayview Heights

Suva

Date: ……………………….

To the parent/caregiver of………………………………

Greetings,

I am a Research student at the University of the South Pacific, enrolled in a Master of Education degree in the School of Education. I am doing some research to find out about Students' and Teachers' Understanding of the Applicability of Classroom Science in Everyday Life. Therefore, I would like to give your child the opportunity to talk about what s/he thinks about this relationship and how it affects science learning.

Your child and I will have a chat. S/he may choose not to answer a question, or stop the interview at any time. The interview will be audio taped with your child's agreement. Your child's name won't be used in the final report and any other publications. I will forward a summary to the school for staff and parents.

It would really be appreciated if you would agree to your child taking part. If you are happy about this, please fill in the consent form below and return it to school with your child by………… If you have any questions or require further information, pleaser fee free to call me on 3377200 or 9400738 or email on kelesiloga@yahoo.ca or s99006548@usp.ac.fj.

Yours sincerely,

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Kelesi Loga Whippy

f) Parent/Caregiver Consent

I agree that my child (name)……………………………………….. be interviewed. I understand that the interviews will be audio taped with my child's agreement, and that all information will be kept private. I realise that my child's name will not be used in the report or any other publications so that s/he cannot be identified. I understand that my child can skip any question s/he chooses to, or stop the interview at any time.

Name: ………………………………..

Signed: ………………………………

Date:..……………

g) Introductory Letter to Class Teacher

132 Sawau Road
Bayview Heights
Suva
Date: …………………………
Dear Class Teacher,

Greetings,

I am a Research student at the University of the South Pacific, enrolled in a Master of Education degree in the School of Education. I would like your help in fulfilling the requirements of research for a Supervised Research Project (SRP), which forms a significant part of this degree. This thesis aims to explore Students' and Teachers' Understanding of the Applicability of Classroom Science in Everyday Life.

For this research, I would like to interview 45 participants from your school. That is, 40 students and five teachers. Preferably, I would like to choose students from classes seven and eight, (five from each of the two streams across a range of ability in science). The interviews are semi-structured, which will allow for a more informal discussion. The brief questionnaires will take around ten minutes to complete.

I would like to talk to children individually for about 30 minutes; at a time the teacher indicates will be least disruptive to their schoolwork. Participation will be entirely voluntary. The children may choose not to answer a question, or stop the interview at any time. The interview will be audio-shaped with the child's consent. The child's name will not be used in the final research report and everything s/he tells us will remain confidential. The only people to have access to the tape will be my supervisor (Mr. Vilimaka Foliaki), University of the South Pacific, staff transcribing tapes and myself. When the research report is complete, I will forward a summary to the staff and parents.

I would value your help in arranging for children to interview, if possible in March 2007. I enclose letters of information and consent forms for parents and caregivers of the children to the interviewed. A separate letter of information for the head teacher is also enclosed. If you need more clarification on the topic or more information on this research study, please contact me on 3377200 (evenings) 9400738 (mobile) or email me at kelesiloga@yahoo.ca or s99006548@usp.ac.fj.

Yours sincerely,

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Kelesi Whippy (Mrs).